Target Workforce State Report for

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BDO

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1 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 healthcare system through the creation of integrated delivery systems across the care continuum, support the transition to a value-based payment system, and facilitate workforce realignment and training to support system transformation, among other goals.

The Maimonides-led Performing Provider System (PPS), known as Community Care of Brooklyn (CCB), is one of twenty-five PPSs statewide working to implement the DSRIP program. Workforce development and training are key elements of the DSRIP program, and each PPS is required - among other workforce-related deliverables – to produce a report outlining the likely composition of its future workforce taking into consideration both demographic and other healthcare industry trends and the expected impact of DSRIP initiatives. This likely future state of the PPS workforce is referred to in the NYS guidelines for the DSRIP program as the "Target Workforce State." Maimonides Medical Center ("Maimonides") engaged BDO Consulting ("BDO"), in collaboration with IHS, Inc. ("IHS"), as its workforce vendor to document the factors impacting the target workforce state for the CCB network and to prepare this report on the anticipated future demand for healthcare services, professionals and workforce needs. Informed by an assessment of early DSRIP program planning, this assessment will serve as a framework for ongoing refinement of CCB's DSRIP program implementation plans, including plans for workforce development and training.

The Target Workforce State report identifies CCB's projected workforce needs by the end of the DSRIP program in 2020 and will be reviewed as against a baseline assessment of CCB's current workforce state to identify gaps and to inform the development of a workforce transition roadmap. The transition roadmap will be used by CCB to inform workforce planning and training to address any identified workforce gaps likely to result from implementation of or be required to ensure the success of the DSRIP program.

Development of CCB's target workforce state was conducted in collaboration with key PPS stakeholders as well as New York City-based Workforce Consortium members (OneCity Health PPS, NYU Lutheran PPS, and Bronx Partners for Health Communities PPS) to ensure that workforce needs and impacts of the DSRIP projects were being evaluated consistently across the PPSs in order to develop a comprehensive analysis of each PPS's target workforce state in its corresponding service area. CCB stakeholders, including DSRIP project managers and clinical leads, provided significant input into the DSRIP project impacts and assumptions made to inform the projection of CCB's target workforce state. Information from external databases including local, state and national surveys; medical claims databases; published literature; and IHS's Healthcare Demand Microsimulation Model ("HDMM") were leveraged to further inform the target workforce state projections.

CCB plans to implement ten DSRIP projects to support the development of an Integrated Delivery System ("IDS") through the coordination of high quality primary, specialty, behavioral, long-term and post-acute care services. The PPS-sponsored Community Needs Assessment ("CNA") was used to inform the selection of the ten projects which includes four system transformation projects ("Domain 2 Projects"), four clinical improvement projects ("Domain 3 Projects"), and two population-wide prevention projects ("Domain 4 Projects").

In modeling and projecting the estimated workforce impacts of the DSRIP projects on CCB's workforce, the following primary research questions were considered:

1. How many patients will be affected by this intervention?
2. What are the current healthcare 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 future patient demand for services?
4. Will the project, as designed, materially impact the region's healthcare delivery workforce?

Target Workforce State Summary Findings

As the DSRIP program progresses, the demand for healthcare workforce within CCB's 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 take shape. 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 intended to inform CCB's workforce planning. Workforce needs will be reevaluated as project impacts are realized over time.

Exhibit ES-1 below summarizes CCB's estimated target workforce state staffing impacts by 2020, taking into account the anticipated impact of the DSRIP program as well as anticipated demographic and healthcare coverage changes, independent of DSRIP, across the PPS' care settings and key job categories. In some cases, non-DSRIP impacts offset or moderate the effects of DSRIP, while in other cases they magnify DSRIP workforce impacts. Notable projected impacts for CCB include:

- By 2020, the combined impact of a growing and aging population, expanded medical insurance coverage under ACA, and DSRIP implementation will increase the modeled demand for health providers by approximately 773 FTEs:
    - Independent of DSRIP workforce, demand is projected to grow by approximately 525 FTEs.
    - The projected impact of DSRIP implementation alone is estimated to increase demand for health providers modeled by approximately 249 FTEs.
- The largest DSRIP-related increase is seen in demand for care coordinators/navigators/coaches (combined), which is projected to rise by approximately 409 FTEs.

- Also significant both in terms of projected workforce impacts related to DSRIP, and changes independent of DSRIP, are changes in registered nurses ("RNs") in the inpatient setting, non-nursing care coordinators/navigators and primary care providers and support staff in outpatient and community-based settings:
    - Net demand for registered nurses is estimated to decrease by approximately 177 FTEs, as DSRIP-related declines of approximately 337 FTEs, primarily in inpatient settings, are partially offset by increased demand for registered nurses due to non-DSRIP environmental factors (approximately 160 FTEs).
    - However it should be noted that RN vacancies were reported by CCB Partner's that completed the Current State Workforce Survey.
- An estimated additional 209 FTE administrative support staff and 170 FTE medical assistants are projected to be required in primary care settings to support primary care and other medical and behavioral health specialties to meet both DSRIP-related needs and those associated with population growth and aging.
- The need for Primary Care providers is estimated to increase by approximately 97 FTEs by 2020 due to both DSRIP and non-DSRIP factors.
- Approximately 81 FTE licensed clinical social workers are estimated to be required by 2020 to implement the DSRIP projects. This increase is driven by the integration of behavioral health into the primary care setting.

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

(DY2 to DY5)

Target State Analysis			
Setting and Job Category	Non-DSRIP Impacts	DSRIP-related Impacts	Total Impacts
Primary and Community-Based Settings			
Primary Care Providers	58.5	38	96.5
Cardiologists	10	6.5	16.5
Endocrinologists	3	0	3
Psychiatrists / Psychiatric Nurses	7.5	8	15.5
Psychologists	21.5	0	21.5
Licensed clinical Social Workers	0	80.5	80.5
Registered Nurses	27	25	52
Licensed Practical Nurses	8.5	0	8.5
Nurse Aides / Assistants	8.5	0	8.5
Medical Assistants	102	67.5	169.5
Administrative Support Staff	95	114	209
Emergency Department			
Emergency Physicians	1	-15	-14
Nurse Practitioners & Physician Assistants	0.5	-2.5	-2
Registered Nurses	6.5	-53	-46.5
Hospital Inpatient			
Hospitalists	3.5	-26	-22.5
Registered Nurses	126	-308.5	-182.5
Licensed Practical Nurses	16.5	-17	-0.5
Nurse Aides / Assistants	29	-78	-49
Care Managers / Coordinators / Navigators / Health Coaches/CHWs			
Transitional care nurses	0	21	21
Care coordinators, health coaches & transitional care managers (non-RN)	0	317	317
Palliative care health coach	0	10	10
Community health workers (asthma educators)	0	35.5	35.5
CVD Health coaches	0	17.5	17.5
Patient Navigator	0	8	8
Total FTEs	**524.5**	**248.5**	**773**

Target Workforce State Summary Conclusions

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

While this report serves to provide an estimation of CCB's target workforce state by the end of the DSRIP program to assist the PPS in the planning and implementation of DSRIP projects, the demand for healthcare services and providers within CCB's network will continue to evolve and is likely to change over time, independent of DSRIP impacts. It is anticipated that the demand for physicians in Brooklyn as well as in CCB's service area will likely continue to grow due to general population growth. As a result, the workforce projections stated within this report suggest that any DSRIP-related changes in workforce demand should be considered in the context of broader trends affecting the demand for healthcare services and providers within CCB's service area.

As a result of the DSRIP program, there is an anticipated increase in the numbers of care coordinators, and primary care providers and support staff which reflects the enhanced demand for these professions within a transformed delivery system. In addition to growth in the workforce, there may opportunities for retraining and movement across settings.

While the estimated workforce impacts for several of the PPS's DSRIP projects are not projected to have a significant impact on the workforce, the projections do indicate how DSRIP program goals, including reductions in avoidable utilization, might be achieved through counseling, improved access to primary and behavioral health services, and better care management for patients with chronic conditions.

Based on the available data as well as DSRIP project inputs and assumptions provided by key PPS stakeholders, the model suggest that the impact of the DSRIP program over the five years are unlikely to materially and/or negatively impact CCB's healthcare delivery workforce, especially when evaluated alongside the larger, projected workforce impacts of trends external to the DSRIP program.

2 Background and Purpose

CCB is comprised of a robust partnership network of a wide range of healthcare organizations and CBOs based within or serving the diverse communities of Brooklyn (and a small area of Queens that borders the PPS service area.)Maimonides Medical Center ("Maimonides") serves as PPS lead and fiduciary, and provides management support to the PPS through its Central Services Organization (CSO).

CCB is comprised of over 800 participant organizations ("PPS Participants") encompassing a broad range of specialties and care settings in Brooklyn. Included in the PPS are six hospitals (Interfaith Medical Center, Kingsbrook Jewish Medical Center, Maimonides Medical Center,

New York Community Hospital, New York Methodist Hospital, and Wyckoff Heights Medical Center), 8 federally-qualified health centers, and more than 3,700 clinical providers (of which 1,600 are primary care providers). CCB is the largest PPS in Brooklyn and one of the largest PPSs in New York State.

Maimonides engaged BDO, in collaboration with IHS, as its workforce vendor on behalf of CCB to define the target workforce state for CCB through the analysis of workforce impacts as a result of system transformation and implementation of clinically integrated programs. CCB's target workforce state was created in collaboration with the PPS's leadership and experts, and included input from CCB's Workforce governing body.

CCB is engaged in 10 DSRIP projects intended to address identified healthcare service gaps with a number of projects specifically addressing the provision of improved access to outpatient primary care and behavioral health providers, as well as substance abuse treatment programs, outside of the hospital setting. As a result, the target workforce state is expected to see an investment in and the expansion of resources and programs for the provision of primary care, behavioral health, and substance abuse services that will increase the number of physicians and staff needed to support the expanded care offerings.

The target workforce state for CCB, 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 healthcare services and providers in CCB's Brooklyn service area resulting from general population growth and aging over the next five years. The target workforce state will be used in a detailed gap analysis between CCB's identified current and target workforce state to inform development and implementation of the workforce transition roadmap. The approach used to define CCB's target workforce state as well as summary findings, observations, and considerations are detailed within the body of this report and the 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 healthcare 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 may 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 Brooklyn market is taken into consideration as well, it must be understood that the findings of this report are estimates that are subject to change and refinement.

3 Overview of Target Workforce State Modeling Approach

CCB's target workforce state was conducted in collaboration with key PPS stakeholders as well as Workforce Consortium members (OneCity Health PPS, NYU Lutheran PPS, and Bronx Partners for Health Communities PPS) to ensure that workforce needs and impacts of the DSRIP projects were being evaluated consistently across the PPSs in order to develop a comprehensive analysis of each PPS's target workforce state in its corresponding service area. The Workforce Consortium held in-person meetings attended by the respective PPS's DSRIP Project Managers and Clinical Leads to discuss the DSRIP project impacts and assumptions made to inform the projection of CCB's target workforce state.

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 healthcare use patterns within New York State and CCB's service 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 CCB'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 include:

1. **Healthcare services providers and support staff.** The right mix of healthcare providers and support staff is needed to ensure that patients have access to services and the efficient delivery of such services. Modeling the resulting workforce requires an understanding of 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 healthcare 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 Community Care of Brooklyn PPS, the relevant geographic area covers the population living in Brooklyn (with multiple PPS networks serving the Medicaid population in Brooklyn).

4. **Evolving needs.** Workforce needs will evolve over the study timeframe (2015 through 2020), as a result of general population growth and aging. Identifying how these needs

will evolve will help to inform the timing, emphasis and target settings for appropriate workforce-related initiatives.

While CCB's performance metrics are measured on services provided to the Medicaid population, CCB's partner network (e.g., hospitals, clinics, physicians, community based organizations, and others) 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 understanding how both DSRIP and non-DSRIP trends will affect the entire patient population.

The target workforce state modeling effort was conducted in collaboration with CCB's Workforce Governing Body, Project Leads, and Project Managers and included the review of supporting PPS literature, CCB's DSRIP Project and Organizational Applications, and quarterly implementation reports submitted to the NYS Department of Health. 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 CCB's stakeholders and refined based upon informed feedback.

The complexity of this modeling effort required the use of data from multiple sources and the use of advanced modeling tools. Data used in the analysis comes from local, state and national surveys, such as the Behavioral Risk Factor Surveillance System ("BRFSS"); medical claims databases such as New York's Statewide Planning and Research Cooperative System ("SPARCS") and Medicaid claims data made available to CCB through Salient Interactive Miner; published literature and IHS's Healthcare 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 the technical appendix.

3.1 Healthcare Demand Microsimulation Model

The workforce model described within this subsection is unique in its approach, breadth and complexity. Health workforce projection models have been used for decades to assist with workforce planning and to assess whether the workforce was sufficient to meet current and projected future demand (or need) at the local, regional, state, and national levels. 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] The model has been used by New York

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

and other states to assess the adequacy of provider supply at the state, regional, and county level.[2,3]

The model has also been used by professional associations and other organizations to analyze trends and policies with workforce implications.[4] 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 healthcare services and providers. Demand is defined as the healthcare services (and providers) 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, socioeconomic 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 Brooklyn).
2. Healthcare utilization patterns that reflect the relationship between patient characteristics and healthcare use.
3. Staffing patterns that convert estimates of healthcare service demand to estimates of provider demand.

[2] See, *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] Ongoing multi-year workforce study for NYS Department of Health (DOH)

[4] Examples include:

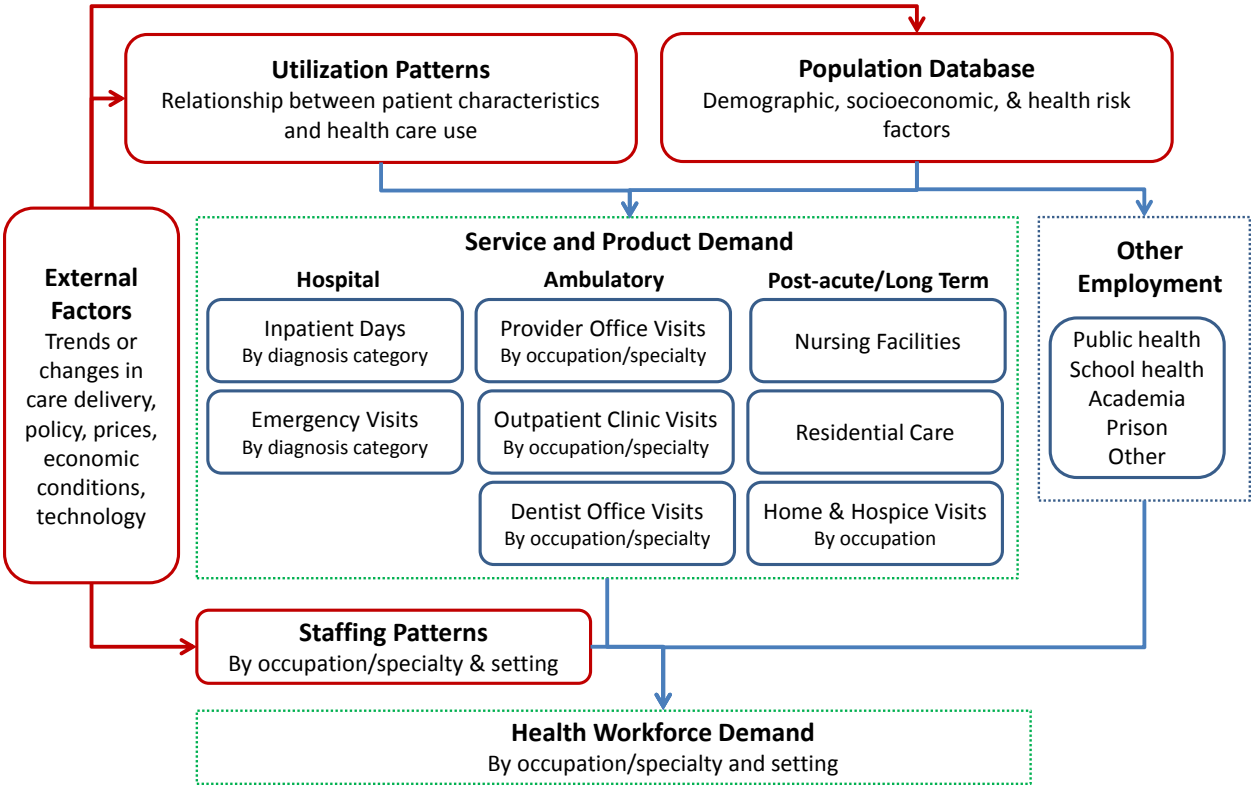
The Complexities of Physician Supply and Demand: Projections from 2013 to 2025. Prepared for the Association of American Medical Colleges. Washington, DC: Association of American Medical Colleges; 2015. https://www.aamc.org/download/426242/data/ihsreportdownload.pdf

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 Healthcare 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: Healthcare Demand Microsimulation Logic Model



3.1.1 Preparing the population database

The database prepared for the HDMM contains a representative sample of the population in each borough. The population profile in this representative sample is comprehensive of all insurance types (Medicare, Medicaid, commercial, and uninsured); population demographics (age, sex, race, and ethnicity); household income level; health risk factors including body weight status (normal, overweight, and obese); current smoker status; and presence or history of chronic disease (hypertension, coronary heart disease, diabetes, arthritis, asthma, history of heart attack, history of stroke, and history of cancer). For modeling purposes, estimates for the Medicaid population were scaled to the 477,612 Medicaid beneficiaries attributed to CCB. Estimates for the Medicare, commercially insured, and uninsured populations were scaled using estimates of CCB's market share for each payer type.

Information to create this database comes from both New York-specific sources such as SPARCS, EpiQuery: NYC Interactive Health Data, New York's Department of Health, and national sources such as the Center for Disease Control and Prevention's Behavioral Risk Factor Surveillance System[5] and the Census Bureau's American

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

Community Survey (ACS)[6]. 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 Brooklyn. Population projections (by county) through 2020 are from the Cornell Program on Applied Demographics in Ithaca, NY.[7]

3.1.2 Developing Healthcare Utilization Forecasting Equations

Patterns of healthcare 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 Healthcare Research and Quality's Medical Expenditure Panel Survey (MEPS). MEPS 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[8] 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 healthcare 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 Brooklyn produces estimates of the current and projected future demand for healthcare 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 healthcare services that would be used by a national peer group of the population in Brooklyn. Estimates of healthcare utilization from this national peer group were compared to actual healthcare use statistics to calibrate the model (reflecting that healthcare use patterns of people in Brooklyn can differ from national patterns, controlling for demographics, disease prevalence, and other health risk factors). Also, the population in Brooklyn might receive some care outside of Brooklyn, and some care provided in Brooklyn is for patients who reside outside of Brooklyn.

3.1.3 Modeling Full Time Equivalent (FTE) Staffing

The number and mix of healthcare professionals required to provide the level of healthcare 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

[6] https://www.census.gov/programs-surveys/acs/
[7] https://pad.human.cornell.edu/counties/projections.cfm
[8] 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).

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 for a similar patient mix. Staffing levels associated with individual DSRIP projects, described later, came from the published literature and CCB's specific models and assumptions.

3.2 Common Modeling Inputs and Assumptions across DSRIP Projects

While each DSRIP project has its unique modeling assumptions and data inputs, common modeling assumptions and inputs apply across some projects. These include parameters for identifying CCB'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 CCB's market share by payer type (Medicaid, Medicare, and other) in Brooklyn using inpatient discharge data from SPARCS. Exhibit 2 summarizes CCB's market share of Brooklyn 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).[9]

Exhibit 2: Estimated CCB Inpatient Market Share in Brooklyn (2014)

Payer	Market Share
Medicaid	42%
Medicare	50%
Other	52%
Total	47%

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 potential 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).

[9] 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 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	2,394*	3
Office-based nurse practitioner	2,038*	3
Office-based physician assistant	2,349*	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	1.75 x PCP	5
Direct admin support	1.25 x PCP + 0.75 x BHP	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 1200, reflecting average desired CCB panel size). [4] National healthcare use (visits, days) ÷ FTE providers in that setting, 2013. [5] Cherokee Health Systems. http://c.ymcdn.com/sites/www.tnpca.org/resource/resmgr/Leadership_Conference_2014/IntegrationofBehavioralHealt.pdf

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 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.[10] 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 CCB leadership suggested that the MGMA data might overstate the number of patient encounters in CCB for primary care providers. First, patients cared for by PPS providers might be 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 model the recommended panel size is 1,500-1,800. Hence, for modeling purposes we scaled the MGMA productivity numbers for CCB's desired panel size of 1,200.

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.

4 Impact of Changing Demographics and Expanded Medical Insurance Coverage on Provider Demand Independent of DSRIP

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

Using the HDMM, we simulated the projected change in demand for physician specialties and other health occupations based on projected population characteristics, independent of DSRIP across all patients and regardless of insurance status. These projections were then scaled to CCB based on its estimated market share of Brooklyn utilization by payer (Exhibit 4 and Exhibit 5). Much of the growth is driven by the growing and aging Medicare population. The projections illustrate that physician demand in Brooklyn is projected to grow approximately 4% between 2015 and 2020, independent of the effects of DSRIP (or by approximately 304 FTEs). Demand for primary care physicians in Brooklyn is projected to grow approximately 5% between 2015 and 2020, independent of the effects of DSRIP (or by approximately 90 FTEs). The CCB total physician growth is estimated to be approximately 154 FTEs of whom 45 FTEs are primary care physicians. These projections suggest that any DSRIP-related changes in

[10] Provider compensation: 2014 report based on 2013 data. Data extracted from MGMA DataDive.

demand need to be understood in the context of broader, complex trends affecting the demand for healthcare services and providers.

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

	Specialty	Brooklyn Total Growth		CCB PPS Impact
		FTE Growth	% Growth	FTE Growth
Primary Care	Total primary care	89.5	5%	45
	Family medicine	25.5	5%	13
	Internal medicine	54.5	6%	27.5
	Pediatrics	8.5	1%	4
	Geriatrics	1	4%	0.5
	Hospitalists (primary care trained)	7.5	3%	3.5
Medical Specialties	Allergy and immunology	3.5	8%	2
	Cardiology	20	6%	10
	Critical care/pulmonology	4	3%	2
	Dermatology	6	6%	3
	Endocrinology	5.5	6%	3
	Gastroenterology	9.5	6%	4.5
	Infectious disease	1.5	2%	1
	Hematology and oncology	9	6%	4.5
	Nephrology	8.5	7%	4.5
	Pediatric subspecialty	0	0%	0
	Rheumatology	3	6%	1.5
Surgery	General surgery	9	6%	4.5
	Colorectal surgery	0	2%	0
	Neurological surgery	2.5	5%	1.5
	Ophthalmology	11.5	6%	6
	Orthopedic surgery	10.5	6%	5.5
	Otolaryngology	5.5	6%	2.5
	Plastic surgery	3.5	5%	1.5
	Thoracic surgery	2.5	6%	1
	Urology	6	6%	3
	Vascular surgery	1.5	5%	1
	Obstetrics and gynecology	7	2%	3.5
Other	Anesthesiology	11.5	4%	6
	Emergency medicine	2	1%	1
	Neurology	7.5	5%	3.5
	Other medical specialties	9.5	4%	5
	Pathology	0	0%	0
	Physical med and rehab.	5.5	4%	3
	Psychiatry	15	3%	7.5
	Radiology	26	8%	13
	Total	304	4%	153.5

Exhibit 5 summarizes projected growth in Brooklyn's FTE demand between 2015 and 2020 for select health professions, as well as the growth in demand for providers in CCB's network. Similar to the approach for developing PPS-specific physician FTE demand projections, these estimates were also scaled to CCB based on its estimated market share.[11] Detailed information for Brooklyn by care setting is provided in the appendix.

Independent of the effects of DSRIP, demand for registered nurses in Brooklyn is projected to grow by approximately 424 FTEs between 2015 and 2020. Applying the CCB market share to applicable care settings, it is estimated that registered nurse demand will grow by approximately 176 FTEs. The growth in demand for nurses and other types of providers working in hospital settings may potentially be offset by reduced demand anticipated as DSRIP initiatives begin to reduce unnecessary hospital utilization.

[11] 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.

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

		CCB PPS Network				
Health Profession	Brooklyn Total	Inpatient	Emergency	Ambulatory	Health home	Total
Registered nurse	423.5	126	6.5	27	16	175.5
Licensed practical nurse	84.5	16.5	0	8.5	4	29
Nurse aide	136.5	29	0	8.5	3.5	40.5
Home health aide	96	0	0	0	46	46
Pharmacist	28	0	2	11	0	13.5
Pharmacy technician	36	0	2	15	0	17
Pharmacy aide	4.5	0	0	2	0	2.5
Psychologist	45	0	0	21.5	0	21.5
Chiropractor	7.5	0	0	3.5	0	3.5
Podiatrist	3.5	0	0	1.5	0	1.5
Dietitian	9	2	0	1	0	3
Optician	4.5	0	0	2	0	2
Optometrist	3	0	0	1.5	0	1.5
Occupational therapist	99	31	0	13	0.5	45
Occupational therapist aide	16.5	5	0	2.5	0	8
Occupational therapy assistant	28.5	5	0	8	0	13
Radiation therapist	4	1.5	0	0.5	0	2
Radiological technologist	15	0	0.5	7	0	7.5
Respiratory therapist	10.5	3	0	1.5	0	4.5
Respiratory therapy technician	1.5	0.5	0	0	0	0.5
Medical clinical technician	26	9.5	0.5	2.5	0	12.5
Medical clinical lab technologist	26.5	9.5	0	3	0	12.5
Medical sonographer	9.5	3	0	2	0	4.5
Nuclear medicine technologist	5	1.5	12	0.5	0	14.5

5 Anticipated CCB Workforce Impacts by DSRIP Project

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

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

In an effort to serve Brooklyn's racially, ethically, and linguistically diverse population through cultural sensitive, evidence-based coordinated care, CCB 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, some services currently performed by physicians to migrate to non-physicians, and also reduce duplication of tests.[12] For purposes of projecting target workforce needs, it was assumed that that improved 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 and support network integration). However, the IDS is necessary for the PPS's other DSRIP projects to be successful in identifying and risk stratifying patients to provide interventions and coordinate and manage care for these patients.

5.2 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. Therefor the workforce impacts will be captured in these projects detailed

[12] 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

below. The workforce impact related to the increased access to and retention in HIV care has not been separately modeled in this analysis. Although CCB 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.

5.3 Approach to modelling DSRIP projects

Subsequent sections within Section 5 of this report describe the modeling approach and assumptions used to project the workforce impacts of CCB's 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 CCB's 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 healthcare 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 healthcare 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's has chosen to implement. Therefore the workforce impacts described throughout this report are estimations and leveraged to simulate estimated workforce needs within CCB, and so, it is possible that the DSRIP projects may have minimal to no impact on the workforce despite the projections stated.

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

Overarching project goals of the Health Home at Risk Intervention project include proactive management of patients not currently eligible for Health Homes through access to high quality primary care and support services. CCB is designing this intervention to engage individuals with a single chronic disease (e.g., diabetes, CVD, asthma, COPD, neuro-generative diseases, and moderate depression). CCB has a particular focus on diagnoses that drive ED and hospital utilization among less engaged individuals who do not have an established PCP or have been frequent ED users.

CCB received prior funding which allowed PPS providers, including the Brooklyn Health Home and MMC to build a robust approach and network over the past three years on which to build the Health Home at Risk intervention program. CCB will leverage its wealth of experience and strong foundation in its implementation of this project. CCB is partnering with two health homes; the Brooklyn Health Home and Coordinated Behavioral Care. The number of actively engaged patients for this program is expected to grow from approximately 3,850 in 2017 to 77,000 by 2020, assuming current phase-in assumptions remain unchanged (Exhibit 6).[13] These patients will work with practice based health coaches. The following assumptions and inputs were used to model the workforce implications of this project:

- We assumed that participants in the project are at **moderate risk** for Health Home eligibility. We assumed that individuals at low risk do not require the intensity of care that this project will provide, and those at high risk would already be enrolled in a Health Home
- 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
- The analysis used the following assumptions about health coach caseloads
    - Health coaches will have an active case load of 260 patients a year beginning in DY2[14]

The projected PPS workforce impact associated with achieving the DSRIP goals of this initiative under current modeling assumptions and data inputs is detailed in Exhibit 6.Changes in utilization following project implementation may include:

[13] http://www.health.ny.gov/health_care/medicaid/redesign/dsrip/quarterly_rpts/docs/maimonides_med_ipp_quarterly_report.pdf

[14] Ratio provided by CCB

- Approximately 23,100 fewer inpatient days
- Potential increase in primary care visits by 15,400
- Decrease in ED visits by 7,700

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

- Approximately 296 FTEs associated with health coaches may be required
- **In outpatient/office settings:** An estimated increase of 58 FTEs associated with primary care providers, direct medical support direct administration support, and registered nurses
- **In the ED setting**: Potential decreases in FTEs associated with emergency physicians, nurse practitioners and physician assistants, and registered nurses
- **In the inpatient setting:** A potential decrease in FTEs, from an approximated 8 FTE decrease of LPNs to an estimated decrease of 138 RNs.

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

	2017	2018	2019	2020
Number of actively engaged patients	3,850	19,250	46,200	77,000
DSRIP impact				
Hospital inpatient days	-1,155	-5,775	-13,860	-23,100
Primary care visits	770	3,850	9,240	15,400
Emergency visits	-385	-1,925	-4,620	-7,700
Workforce FTE implications				
Outpatient/office				
Primary care providers	0.5	3.5	8	13
Direct medical support	1	6	14	23
Direct admin support	1	4	10	16.5
Registered nurses	0.5	1.5	3	5
Emergency department				
Emergency physicians	0	-1	-2	-3.5
NPs and PAs	0	0	-0.5	-0.5
Registered nurses	-0.5	-3	-7.5	-12.5
Inpatient				
Hospitalists	-0.5	-3	-7	-11.5
Registered nurses	-7	-34.5	-82.5	-137.5
Licensed practical nurses	-0.5	-2	-4.5	-8
Nurse aides/assistants	-1.5	-8.5	-21	-34.5
Coordinators/educators				
Care coordinators (Health Coaches)	15	74	178	296

The analysis suggests that project 2.a.iii's greatest impact on CCB workforce may be on the care coordinators/health coaches and RNs in the inpatient setting. It is estimated that 296

FTE care coordinators/health coaches will be required by 2020 to implement the project. Required 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. However, this analysis does not take into account potential existing capacity shortfalls for RNs in the inpatient setting.

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

Many patients who visit the emergency department have non-emergent conditions which could have been treated in a more appropriate setting that provides a continuum of care as well. The goals of this initiative are to:

- Identify ED patients who would be better served by a primary care provider who can provide continuity of care
- Link patients without a primary source of care to a primary care provider ("PCP")
- Educate patients on appropriate use of ED services.

One key DSRIP program goal is to reduce avoidable ED use among the Medicaid population by 25% within five years. Working towards this goal, CCB's initial focus for project 2.b.iii is neighborhoods with the highest rates of potentially preventable visits ("PPVs").

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

The target population includes patients that used the ED at least twice in a 12 month period for low severity issues. Individuals who visited the ED 5 or more times for low severity issues will be prioritized. Program components include PPS connectivity to community PCPs, especially Patient-Centered Medical Homes ("PCMHs"), and care management services.

For patients without a primary care provider presenting with minor illnesses, such as ear infections and bronchitis, patient navigators will assist the patient to secure an appointment with a PCP. For patients with a PCP, patient navigators will assist the member in scheduling a timely appointment.

For modeling, we use the following inputs and assumptions:

- Numbers of Medicaid attributed lives that are targeted to take part in this program (from CCB)

- 50% of diverted ED visits will result in a primary care visit[15]
- Patient navigators will be used, at a ratio of 1 : 2,760 patients a year[16]

This modeled analysis reflects the desired statewide achievement of 25% reduction in PPVs among the target population. Other DSRIP projects described later help explain how the 25% reduction might be achieved through counseling, improved access to outpatient services, and better management of patients with chronic conditions.

By 2020 the net projected PPS impact associated with achieving the statewide target of reducing avoidable ED visits by 25% among Medicaid and Uninsured populations is the following, detailed in Exhibit 7:

- Approximately 21,500 fewer ED visits.
- An additional 10,800 primary care visits as a result of the 50%[16] of diverted ED visits resulting in a visit to a PCP.

Exhibit 7: DSRIP ED Triage: Projected FTE Workforce Implications of Achieving 25% Reduction in PPV

Project Impact Assumptions	2017	2018	2019	2020
1. Actively Engaged patients are successfully and appropriately redirected to PCMH after triage	0	15,050	21,500	21,500
2. Anticipated PPV ED visits for the PPS's Medicaid population absent the DSRIP program	0	60,200	86,000	86,000
3. Assumed effectively avoided PPV visits (achieving DSRIP goals with project implementation phase-in)	0	-15,100	-21,500	-21,500
4. Estimated increase in primary care visits	0	7,500	10,800	10,800
Workforce Impacts (by FTE)	**2017**	**2018**	**2019**	**2020**
Office/Outpatient				
Primary Care Providers	0	3.5	5	5
Direct Medical Support	0	6	8.5	8.5
Direct Administrative Support	0	4	6	6
Staff Registered Nurses	0	1.5	2.5	2.5
Emergency Department	0	0	0	0
Emergency Physicians	0	-7	-9.5	-9.5
Nurse Practitioners	0	-0.5	-0.5	-0.5
Physician Assistants	0	-1	-1.5	-1.5
Staff Registered Nurses	0	-24.5	-35	-35

[15] IHS assumption
[16] CCB provided ratio

Care coordinators				
Patient navigators	0	5.5	8	8

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

- **In the office/outpatient settings:** an estimated additional 5 primary care provider FTEs and 8.5 FTEs in direct medical support may be required
- **In the ED setting:** The PPS network may require approximately 10 FTE fewer emergency physician, 35 FTE fewer RN, as well as slight decreases in nurse practitioners and physician assistant FTEs

The current analysis implies that should CCB successfully achieve the statewide target of a 25% reduction in avoidable ED visits, CCB's network will experience a decrease in ED-setting FTEs including staff RNs and emergency physicians. Conversely, under the assumption that patients will seek care from primary care settings instead, FTEs associated with providers in this setting will increase. However, projected reductions in ED FTEs may be offset by existing ED staff shortfalls in CCB's hospitals.

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

The objective of this DSRIP project is to reduce Potentially Preventable Readmissions ("PPRs") to hospitals by providing a 30-day supported transition period after a hospitalization for patients at high risk of readmission due to lack of effective patient adherence, 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. CCB is utilizing elements of the project BOOST care transition model. The Coleman and Naylor models are also being used to assess how to engage individuals at high risk for readmissions in the community. These models have been adapted by CCB to be more financially sustainable, and transitional care managers ("TCMs") (or Health home manager) will conduct home visits in selected cases (specifically, patients that require medication management post discharge) to be supported by transitional care nurses ("TCNs") for clinical support.

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

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

5. By how much will visits to primary care providers change due to the intervention?
6. What is the level and mix of providers to implement this intervention?

All of CCB's network hospitals will address the medical conditions targeted for this project; however, each will phase-in interventions based on the prevalence of their respective readmission trends. To support the project, CCB will retrain and redeploy staff as TCNs and TCMs. Care managers will assist with arranging follow-up appointments with primary care providers, psychiatrists and other providers through expanded and enhanced centralized scheduling systems.

This DRSIP project will be staffed with TCNs and TCMs similar to the Medicare Coordinated Care Demonstration (MCCD) programs.[17] 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 TCMs, with the remainder of the work performed by TCNs.

For modeling we use the following inputs and assumptions:

- The ratio of transitional care nurse-to-patients is 1:70 per month[18]
- The ratio of transitional care managers to patients is 1:70 per month[19]
- Patients will receive transition care for 30 days following discharge
- The overall calculated intervention impact is a 30% reduction in readmission rates (by weighting the category totals by estimates of the number of hospital admissions by diagnosis category for Medicaid patients in Brooklyn)[20]

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 1,300
- Inpatient days will potentially decline by approximately 6,600 days
- ED visits may reduce by 610 visits

[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
[18] CCB provided 1:840 as the ratio for a transitional care nurse to patients. IHS assumption is that this is the ratio for a year, so each TCN sees 70 patients a month
[19] CCB provided 1:840 as the ratio for a transitional care managers to patients. IHS assumption is that this is the ratio for a year, so each TCM sees 70 patients a month
[20] Calculated from impacts reported in the literature, Exhibit A-5 in the Appendix.

The projected estimates in the table below assumes that ratio of TCMs and TCNs is 1:1. As the project is implemented and progresses beyond DSRIP year 5, CCB may alter the structure of the care management team by increasing the ratio of TCMs to TCNs. This potential change is not modelled in Exhibit 8.

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

Year:	2017	2018	2019	2020
Number of actively engaged patients	1,575	13,125	17,500	17,500
Projected DSRIP impact				
Readmissions	-100	-1,000	-1,300	-1,300
Inpatient days	-600	-5,000	-6,600	-6,600
Emergency visits	-60	-460	-610	-610
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	-0.5	-2.5	-3	-3
Registered nurses	-3.5	-28.5	-38	-38
Licensed practical nurses	0	-1.5	-2	-2
Nurse aides	-1	-7	-9.5	-9.5
Care coordinators				
Transitional care nurses	2	15.5	21	21
Transitional care managers	2	15.5	21	21

Some key items to note from the staffing impact table above:

- **In the ED setting**: Minimal to no impact on FTEs associated with nurse practitioners and physician assistants, RNs, and emergency physicians
- **In the inpatient setting:** FTEs associated with RNs may decrease by approximately 38, and nurse aide FTEs may reduce by 10 FTEs, with smaller changes seen in hospitalist and licensed practical nurse FTEs
- The project may require approximately 21 TCN FTEs and 21 TCM FTEs to provide the transition coordination services for the project.

According to the analysis, project 2.b.iv's greatest impact on workforce FTEs may be on the inpatient setting, 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 may require a combined 42 additional FTE TCNs and TCMs.

5.7 Project 3.a.i: Integration of Primary Care and Behavioral Health Services

To address the needs of individuals with co-morbid physical and behavioral health ("BH") needs, CCB intends to better integrate behavioral health and primary care services by pursuing two related initiatives: (1) increasing the physical co-location of behavioral health providers into primary care sites and vice versa where feasible, and (2) implementing the Improving Mood–Providing Access to Collaborative Treatment (IMPACT) model for depression across CCB service area. The target population for the two models is Medicaid beneficiaries age five and older who receive primary care at committed partner sites.

The following assumptions and inputs, from sources such as literature and published reports, are used in this analysis:

- We assume that approximately 15% of the Medicaid 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.[21]
- We assume that 80% of the Medicaid population with unmet behavioral health needs visits a primary care provider during the year.[22]
- 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.[23] 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.[24] Under DSRIP we assume this referral completion rate will double to 50%.[25] Geisinger reports that after

[21] 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

[22] 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

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

[24] 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/

integrating behavioral health across the continuum of care, 85% of patients attended their first office visit with a behavioral health specialist.[26] As such, the impact being modelled is a conservative approach.

- Any care coordination services required by this population are modeled under the Health Home at Risk Intervention Program.

Changes in utilization as a result of program implementation by 2020 include the following:

- BH-related ED visits may decrease by 1010
- BH-related inpatient days may reduce by 1630 days

[25] 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).

[26] American Hospital Association (2014, February). Integrating behavioral health across the continuum of care. Chicago, IL: Health Research & Educational Trust. http://www.hpoe.org/Reports-HPOE/Behavioral%20health%20FINAL.pdf

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

	2017	2018	2019	2020
Population modeled (Medicaid + Uninsured)	366,400	366,400	366,400	366,400
Population with unmet BH needs	55,000	55,000	55,000	55,000
Population with unmet BH needs visiting PCP	44,000	44,000	44,000	44,000
Population screening positive for BH needs absent DSRIP	22,000	22,000	22,000	22,000
Population screening positive for BH needs with DSRIP	35,200	35,200	35,200	35,200
Screened population completing BH referral absent DSRIP	5,500	5,500	5,500	5,500
Screened population completing BH referral with DSRIP	17,600	17,600	17,600	17,600
Change in population receiving BH counseling	1,210	3,630	6,050	12,090
Healthcare use impact of DSRIP				
Encounters with BH care manager	3,390	10,160	16,930	33,860
Primary care visits	410	1,230	2,060	4,110
BH-related ED visits	-100	-300	-510	-1,010
BH-related inpatient days	-160	-490	-810	-1,630
Workforce FTE implications				
Outpatient/Office setting				
Licensed clinical social worker	8	24	40.5	80.5
Psychiatrists/depression care managers	1	2.5	4	8
Primary care providers	0	0.5	1	1.5
Direct medical support	0.5	1	1.5	3
Direct admin support	7	20.5	34.5	68.5
Staff registered nurses	0.5	1	2	4
Emergency Department				
Emergency physicians	0	0	0	-0.5
Nurse practitioners or physician assistants	0	0	0	0
Staff registered nurses	0	-0.5	-1	-1.5
Inpatient				
Hospitalists	0	0	-0.5	-1
Staff registered nurses	-1	-3	-5	-9.5
Licensed practical nurses	0	0	-0.5	-0.5
Nurse aides/assistants	0	-0.5	-1	-2.5

Based on modeling results summarized above, by 2020 the net projected PPS-wide workforce impact associated with this DSRIP initiative will likely include (Exhibit 9):

- **In the outpatient/office setting:** approximately 81 FTE increase in licensed clinical social workers ("LCNs")
- **In the ED setting**: Minimal anticipated impact on staffing
- **In the inpatient setting**: Potential reduction of 10 RN FTEs, with minimal to no impact on other staff

The project goals include increasing access to behavioral health services and management of mild/moderate depression and anxiety by PCPs, thereby improving access to care for

patients. Modeling results indicate a corresponding rise in BH care providers. While a reduction in workforce FTEs in the ED and inpatient settings is also anticipated, the projected impact is 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. These findings are independent of possible current shortages in BH staff.

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

CCB will pursue a multi-pronged approach to address cardiovascular disease ("CVD") risk factors. This includes improving prescribing and adherence to aspirin prophylaxis among eligible patients as appropriate, improving blood pressure control by updating and strengthening implementation of evidence-based anti-hypertensive guidelines, and improving cholesterol control by updating current cholesterol management and treatment guidelines. The targeted patient population will include all uniquely attributed adult patients (ages 18+ years) with cardiovascular conditions based on a defined set of ICD-10 diagnosis codes.

The following assumptions and inputs are used in this analysis based upon:

- Care management will decrease CVD-related emergency visits by 20%[27]
- Care management will decrease CVD-related inpatient hospital days by 39% [28]
- We assume that care management will increase visits to PCPs by 1 and cardiologists by 0.5 annually [29]
- In the inpatient setting impacts were scaled to reflect CCB provided data of 7387 CVD related discharges (2014 – 2015)
- Health coaches in this program will be used in the ratio of 1:2000[30]
- Any care coordination services required by this population are reflected 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:

- 900 fewer ED visits
- 3,500 fewer inpatient days
- 34,500 additional urgent (unscheduled) primary care visits
- 17,300 additional cardiologists visits

[27] Katch H et al. The role of self-efficacy in cardiovascular disease self-management: a review of effective programs. Patient Intelligence 2010:2 33–44.
[28] https://hpi.georgetown.edu/agingsociety/pubhtml/management/management.html
[29] IHS assumption
[30] CCB provided input

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

	2017	2018	2019	2020
Number of actively engaged patients	5,180	18,980	34,500	34,500
Projected DSRIP Impact				
Emergency visits	-100	-500	-900	-900
DRSIP impact on inpatient days	-500	-1,900	-3,500	-3,500
Additional visits to PCP	5,200	19,000	34,500	34,500
Additional visits to cardiologist	2,600	9,500	17,300	17,300
Workforce FTE implications				
Outpatient/Office setting				
Primary care providers	3	11.5	20.5	20.5
Direct medical support	5.5	20	36	36
Direct admin support	4	14	25.5	25.5
Staff registered nurses	2	8	14.5	14.5
Specialists (cardiologist)	1	3.5	6.5	6.5
Emergency Department				
Emergency physicians	0	0	-0.5	-0.5
Nurse practitioners and physician assistants	0	0	0	0
Staff registered nurses	0	-1	-1.5	-1.5
Inpatient				
Hospitalists	-1	-3	-5.5	-5.5
Staff registered nurses	-10	-36	-65.5	-65.5
Licensed practical nurses	-0.5	-2	-3.5	-3.5
Nurse aides/assistants	-2.5	-9	-16.5	-16.5
CVD health coaches	2.5	9.5	17.5	17.5

The projected workforce impact includes:

- An increase of 17.5 health coach FTEs **in outpatient/office settings:** a potential increase of 20.5 additional PCP FTEs, 36 direct medical support staff FTEs and 14.5 additional staff RN FTEs
- **In the ED setting**: likely minimal impact in emergency department staff
- **In inpatient settings:** a possible decrease in demand for hospital inpatient staff—including approximately 66 fewer RN FTEs

In terms of workforce implications, the analysis suggests that the greatest impact of this project on workforce may be in the outpatient settings. When the additional FTE requirements associated with primary care providers, direct medical support staff and staff RNS are combined, approximately 71 FTEs may be needed. In the smaller practices, which make up a majority of the primary care sites, medical assistants (as opposed to RNs) will likely account for a larger percentage of overall growth in support staff. The increase in RNs will likely be seen in the hospital based clinics and FQHCs.

The project may have workforce implications in the inpatient setting, with staff RNs estimated to decrease by approximately 66 FTEs. There is minimal impact in the ED setting. The larger impact in the outpatient setting appears indicative of where the most of the activities associated with this project will occur.

5.9 Project 3.d.ii: Expansion of Asthma Home-based Self-management Program

CCB's asthma self-management program targets adults, children, and the families/caregivers of patients with new or existing asthma diagnoses. The project will serve patients with intermittent or persistent asthma diagnoses. Primary project interventions intended to address identified gaps and provide opportunities to mitigate and decrease rates of asthma include:

- Increasing PC/PCMH capacity, including additional staffing, expanded hours of operation, and increased scope of onsite services, such as point-of-care testing and specialty services
- Implementing evidence-based practice clinical guidelines for asthma management at each PCMH site
- Developing home-based assessment and self-management programs in conjunction with a.i.r.NYC and other asthma service providers
- Developing care coordination teams
- Engaging in a PPS-wide medication adherence counseling effort
- Tracking population outcomes via an asthma registry

The following assumptions and inputs are used in this analysis:

- Asthma management will decrease asthma-related emergency visits by 18%.[31]
- Asthma management will decrease asthma-related hospitalizations by 34%.[32]
- Asthma management will decrease urgent primary care visits (i.e., unscheduled visits to a primary care provider) by 5% (approximately 1.8 visits/year)[33]
- Based on CCB provided data, we estimate that a child with asthma averages 0.13 asthma-related emergency visits. CCB also provided the average asthma related length of stay for children in the PPS network, 2.4 days, which is similar to the 2.3 days that has been calculated from SPARCS
- Community health workers (CHWs) will be used at the ratio of 1:100 at any one time.[34] The model assumes that each CHW will work with each patient an average of 4 hours.

[31] http://www.ncbi.nlm.nih.gov/pubmed/16740859
[32] http://www.nga.org/files/live/sites/NGA/files/pdf/031403DISEASEMGMT.pdf
[33] 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
[34] CCB provided ratio

Assuming 1920 typical working hours a year, this translates to a CHW seeing 480 patients a year, and working with each an average of 2.5 months.[35]

- Any care coordination services required by this population are reflected under the Health Home at Risk Intervention Program.

Exhibit 11 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:

- 400 fewer ED visits
- 500 fewer inpatient days
- 3,100 fewer urgent (unscheduled) primary care visits

The projected workforce impact overall is likely to be modest and may include:

- Approximately 36 additional community health worker FTEs
    - Minimal change in FTEs associated with other providers in this setting
- **In the ED setting**: A minimal change in demand for emergency department staff FTEs
- **In the inpatient s**etting: A small decline in demand for hospitalists and other hospital inpatient staff FTEs

[35] IHS assumption: 100 patients at any given time/480 a year = 0.21 of a year per patient, which is equal to 2.5 months

Exhibit 11: Asthma Management: Projected Workforce Impacts by Care Setting

	2017	2018	2019	2020
Number of actively engaged patients (children with asthma)	0	4,250	11,050	17,000
Projected DSRIP Impact				
Emergency visits	0	-100	-300	-400
Inpatient days	0	-100	-300	-500
Urgent office visit to primary care provider	0	-800	-2,000	-3,100
Workforce FTE implications				
Outpatient/Office Setting				
Primary care providers	0	-0.5	-1	-2
Direct medical support	0	-1	-2	-3
Direct admin support	0	-0.5	-1.5	-2.5
Staff registered nurses	0	0	-0.5	-1
Emergency Department				
Emergency physicians	0	0	0	0
Nurse practitioners & physician assistants	0	0	0	0
Staff registered nurses	0	0	-0.5	-0.5
Inpatient				
Hospitalists	0	0	0	-0.5
Staff registered nurses	0	-0.5	-2	-3
Licensed practical nurses	0	0	0	0
Nurse aides/assistants	0	0	-0.5	-1
Community Health workers (asthma educators)	0	9	23	35.5

The results of the analysis suggest that this DSRIP initiative will have minimal effect on the workforce providing direct medical care to this asthma population.

5.10 Project 3.g.1: Integration of Palliative Care into the PCMH Model

Palliative care is a specialized form of medical care, specifically for individuals with serious illnesses, with the goal of providing relief from the symptoms and stress of their condition to develop improved quality of life for both patients and their families. Focusing on pain and symptom control, communication and coordination, family/caregiver and emotional support, palliative care allows patients and their families to understand their treatment options and develop end of life plans as necessary.

This project was chosen for implementation as findings from the CNA indicated that many residents hospitalized with at least one chronic condition could benefit from palliative care services. The CNA also concluded that the prevalence of chronic conditions that could benefit from palliative care services outweighs the availability of such services, a deficiency that will only worsen with time, given the aging population. The target population will be attributed patients, aged 18 and older, who are eligible for a primary palliative care intervention, with eligibility criteria specified by diagnosis based on ICD-9 or -10 codes of chronic diseases that could benefit from palliative care (e.g., cancers, advanced depression, stroke, etc.). The main focus is on training and education for PCPs and staff on palliative care.

The following assumptions and inputs are used in this analysis:

- We assume a 24.5% all cause readmission rate[36]
- 50% of the readmissions come through the ED[37]
- We assume 6.4 days as the average length of stay in intensive care[38]
- Readmission rates in the target population may decrease by 31% following the intervention[39]
- Days in intensive care may be reduced by 0.5 days[40]
- Health coaches will provide outreach for this project at a ratio of 1:2000[41]

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 potentially the following:

- 1400 fewer readmissions
- 9300 fewer inpatient days
- 700 fewer ED visits

[36] Calculated from the literature, same underlying readmission rate used in the 30-day readmission project
[37] IHS assumption
[38] CCB provided data, however this number is for general inpatient length of stay and not for intensive care. Inpatient LOS is being used as a proxy as it is best available data from PPS
[39] http://www.ncbi.nlm.nih.gov/pubmed/26270277
[40] http://content.healthaffairs.org/content/30/3/454.abstract
[41] CCB provided input

Exhibit 12: Integration of Palliative Care: Projected Workforce Impacts by Care Setting

	2017	2018	2019	2020
Number of actively engaged patients	0	7,000	15,000	20,000
Projected DSRIP Impact				
Readmissions	0	-500	-1,100	-1,400
Inpatient days	0	-3,200	-7,000	-9,300
ED visits	0	-300	-500	-700
Workforce FTE implications				
Emergency Department				
Emergency physicians	0	0	0	-0.5
Nurse practitioners and physician assistants	0	0	0	0
Staff registered nurses	0	-0.5	-1	-1
Inpatient (hospital inpatient, nursing homes, SNFs)				
Hospitalists	0	-1.5	-3.5	-4.5
Staff registered nurses	0	-19.5	-41.5	-55
Licensed practical nurses	0	-1	-2.5	-3
Nurse aides/assistants	0	-5	-10.5	-14
Health Coaches 1:2,000 patients	0	3.5	7.5	10

The projected workforce impact by 2020 overall is likely to be modest and may include:

- 10 additional health coach FTEs
- **In the ED setting**: A minimal change in demand for emergency department staff FTEs
- **In the inpatient setting (hospital inpatient, nursing homes, SNFs)**: An estimated reduction of 55 FTE staff RNs and a 14 FTE reduction in nurse aide/assistant FTES

There is a need for greater access to palliative care services within CCB's service area. Although the analysis suggests a large decrease in FTEs counterintuitive to the goals of the project (to increase palliative care services), these are FTEs that are potentially associated with caring for patients who may have had readmissions or longer stays due to poor management of their serious illnesses.

6 Skills and Licensure Requirement's Related to DSRIP Positions

CCB has identified the desired skill set and licensure for the newly created job titles as a result of the implementation the DSRIP projects.

Transitional Care Nurses

TCN's will work closely with the case management/discharge planning staff the hospital. The position requires the employee to hold a registered nurse license. There are no minimum years of experience requirements.

Transitional Care Managers

A TCM's will support and answer to the TCN's. TCM's minimum education requirement is a Bachelor's degree. There are no minimum years of experience requirements.

Patient Navigators

The minimum education requirement for Patient Navigators is a Bachelor's degree in a related field. There are no minimum years of experience requirements. Experience working in the ED is strongly preferred and an understanding of social determinants of health and community resources is preferred.

Health Coaches

CCB's Health Coaches will be required to hold a high school diploma or an associate's degree as a minimum education requirement. Health Coaches will likely be MAs, LPNs, patient care technicians, or other clinical support staff who are trained to become Health Coaches within CCB. Health Coaches will be trained in measuring vital signs, the use of standardized assessments of basic medical and substance use history and symptoms, and Motivational Interviewing, including goal setting.

Community Health Workers (Certified Asthma Educators)

A Community Health Worker/Certified Asthma Educator's primary responsibility is the provision of asthma coordination and counseling services. They are an expert in educating individuals with asthma and their families on the knowledge and skills necessary to minimize the impact of asthma on their quality of life. The individual must have passed the exam set by the National Asthma Educator Certification Board, Inc. [CCB to add minimum degree/license requirements]

7 Summary Workforce Impact Tables

Through 2020, the demand for healthcare workers will change within the CCB 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 Brooklyn—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 CCB's 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 staff care coordinators, social workers, patient navigators, and health educators.

In this section we summarize the projected health workforce impact from DSRIP-related activities, and combine the estimated DSRIP impact with projected impacts of changing demographics and expanded medical coverage under the Affordable Care Act.

7.1 DSRIP-related Support Hires

To aid CCB's successful fulfillment of the DSRIP goals, CCB 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:

- David I. Cohen, MD, MSc – Chief Executive Officer
- Karen Nelson, MD, MPH – Chief Medical Officer
- Caroline D. Greene, MBA – Chief Administrative and Financial Officer

The CSO team currently consists of a team of 36 people, of which 12 were new hires and 24 were redeployed as a result of DSRIP.

CCB estimates it may hire up to 23 additional employees to fill CSO roles over DSRIP Year 2 to DSRIP Year 5. The potential new hires would be employed for a number of positions such as:

- Manager – programs and provider engagement
- Program Associate – project support
- IT Associate/Analyst
- Senior Analyst – population health

7.2 CCB Workforce Impact Summary

Exhibit 13 summarizes CCB's estimated health workforce impact of DSRIP projects across professions and settings.[42] The largest projected workforce impacts of DSRIP may take place among nursing staff, nurse aides and assistants, and care coordinators/navigators/health coaches. By 2020, demand for staff registered nurses is projected to decline by about 316 FTEs with the impacts primarily affecting those employed in hospital inpatient settings. The potential decline is offset by increases in RNs in care coordinator and coordinator manager roles and RNs in office/clinic settings. It should be noted that the Current State Workforce Survey reported over 500 current FTE RN vacancies at the responding organizations, of which over 270 FTEs were reported at home care agencies and hospices, 114 FTEs at hospital outpatient clinics (Article 28) and 107 FTEs at hospital inpatient/ED facilities. Increases are expected in the numbers of non-RN care managers, licensed educators, and clinical social workers providing behavioral health counseling, which reflects the important roles of these professions in a transformed healthcare environment. The greatest projected DSRIP impact is the estimated need for over 300 health coaches by 2020 to implement the Health Home at Risk Intervention project. Demand for clinical and administrative support staff is expected to grow by approximately 68 and 114 FTEs, respectively, by 2020. Projected changes in demand among other health professions are smaller. For example, demand for primary care providers is expected to rise by approximately 38 FTEs and fall among emergency physicians by about 15 FTEs.

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

Exhibit 13: Total CCB DSRIP-related Workforce Impacts

Occupation and Setting	2017	2018	2019	2020
Primary care providers	3.5	18.5	33.5	38
Specialist Physicians				
Emergency physicians	0	-8.5	-12.5	-15
Hospitalists	-2	-10	-19.5	-26
Cardiologists	1	3.5	6.5	6.5
Nurse practitioners and physician assistants				
Emergency department	0	-1	-2	-2.5
Nursing				
Staff registered nurses	-17	-125.5	-239.5	-315.5
Transitional care nurses	2	15.5	21	21
Hospital inpatient	-21.5	-122.5	-234.5	-308.5
Emergency	-0.5	-30.5	-47.5	-53
Office/clinic	3	12	21.5	25
Licensed practical nurses				
Hospital inpatient	-1	-6.5	-13	-17
Nurse aides/assistants				
Hospital inpatient	-5	-30	-59	-78
Clinical Support				
Medical Assistants	7	32	58	67.5
Administrative support staff	12	42	74.5	114
Behavioral health				
Psychiatrists/psychiatric nurses	1	2.5	4	8
Psychologists				
Licensed clinical social workers	8	24	40.5	80.5
Care managers/coordinators/navigators/ health coaches				
Care coordinators, health coaches & transitional care managers (non-RN)	17	90	199	317
Patients navigators	0	5.5	8	8
Community health workers (asthma educators)	0	9	23	35.5
CVD educators	2.5	9.5	17.5	17.5
Palliative care health coach	0	3.5	7.5	10
TOTAL FTEs	**17**	**58.5**	**126.5**	**248.5**

7.3 DSRIP Future State Workforce Staffing Impact Analysis

Exhibit 14 depicts the combined effects on workforce demand in 2020 of both DSRIP impacts and the impacts 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 magnify projected DSRIP workforce impacts.

For example, the largest anticipated adverse workforce impact is among registered nurses working in hospital inpatient settings, but these declines will be partially offset by greater demand for nurses in care coordination/management and office settings. However, growth of approximately 160 FTEs will be required to meet the needs of a growing and aging population (and in particular the Medicare population). The DSRIP impact on RN's may potentially be as great as a 316 FTE decline; as a result, the net effect upon demand for RNs in CCB's network may be a decrease of approximately 156 FTEs.

The greatest projected growth is estimated for the care managers/care coordinators/navigators/health coaches, with 388 FTE required. The greatest estimated growth being 317 FTE care coordinators/health coaches/TCNs, largely driven by the implementation of the Health Home at Risk Intervention Project.

Relative to 2015, CCB's network will require approximately 97 additional FTE primary care providers. This includes approximately 59 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 38 FTEs to support DSRIP. An additional 209 FTE administrative support staff and 170 FTE medical assistants are also estimated to be required.

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	58.5	38	96.5
Specialist physicians			
Emergency physicians	1	-15	-14
Hospitalists	3.5	-26	-22.5
Cardiologists	10	6.5	16.5
Endocrinologists	3	0	3
Nurse practitioners and physician assistants			
Emergency department	0.5	-2.5	-2
Nursing			
Staff registered nurses	159.5	-315.5	-156
Transitional care nurses	0	21	21
Hospital inpatient	126	-308.5	-182.5
Emergency	6.5	-53	-46.5
Office/clinic	27	25	52
Licensed practical nurses	25	-17	8
Hospital inpatient	16.5	-17	-0.5
Office/clinic	8.5	0	8.5
Nurse aides/assistants	37.5	-78	-40.5
Hospital inpatient	29	-78	-49
Office/clinic	8.5	0	8.5
Clinical support			
Medical assistants	102	67.5	169.5
Administrative support staff	95	114	209
Behavioral health			
Psychiatrist/psychiatric nurse	7.5	8	15.5
Psychologists	21.5	0	21.5
Licensed clinical social workers	0	80.5	80.5
Care managers/coordinators/navigators/ health coaches			
Care coordinators, health coaches & transitional care managers (non-RN)	0	317	317
Patient navigators	0	8	8
Palliative care health coach	0	10	10
Community health workers (asthma educators)	0	35.5	35.5
CVD educators	0	17.5	17.5
TOTAL	**524.5**	**248.5**	**773**

8 Conclusions and Implications of Target Workforce State Analysis Findings

Modeling the future state of the workforce following the implementation of various DSRIP projects is an immensely complex analysis, involving inputs from CCB, relevant literature, CCB anticipated targets and the best assumptions currently available. The complexity calls into question the extent to which a five year projection horizon is adequate to implement and assess impacts of DSRIP projects. This may not be enough time to capture the effect of most projects, given implementation phase-in assumptions, existing and future capacity and budget constraints, and availability of data sufficiently robust to evaluate results.

The results presented in this report are conservative projections based, in part, on literature that is not perfectly aligned to CCB's patient population, assumptions and models that will be refined over the course of the five years, and are contingent on early stage project implantation plans. The findings of this report must therefore be examined while taking these influencing factors into account.

Defining the target workforce state in line with DSRIP program goals requires information on the current health workforce supply in CCB's service area and how the demand for healthcare 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 gap analysis between the current state assessment of the workforce and the projected future state and a workforce transition roadmap.

The demand for healthcare services and providers within CCB's network will change over time, independent of the anticipated DSRIP impact. Under DSRIP, increases are expected in the numbers of licensed educators and care coordinators/navigators/health coaches which reflects the emphasis placed on these emerging roles. Demand for RNs is projected to decrease, particularly in inpatient and emergency settings, partially offset by existing vacancies and an increase in demand for RNs in outpatient settings, both in direct care as well as supervisory roles given the increase in care coordination/manager and office-based care of patients with complex illness. These projections suggest that any DSRIP-related changes in demand need to be understood in the context of broader, complex trends affecting the demand for healthcare services and providers.

In conclusion, based on the best available modeling inputs and assumptions, these results suggest that implementing DSRIP as designed may impact the CCB network and healthcare delivery workforce, beyond 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 CCB's initiatives relative to workforce development.

9 Appendix

HEALTHCARE DEMAND MICROSIMULATION MODEL

Introduction

This appendix provides technical documentation of the Healthcare 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 healthcare 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 healthcare use patterns of this population, published findings in the literature, and data from external sources such as NY SPARCS.

Background information and an overview of the workforce model is provided below. The appendix documents the data, methods, assumptions and inputs for the three main components of the demand model: the population file, the healthcare 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.[43]

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.[44] 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.[45]

[43] The most detailed information on the model is available at https://cdn.ihs.com/www/pdf/IHS-HDMM-DocumentationApr2016.pdf.
[44] http://bhpr.hrsa.gov/healthworkforce/supplydemand/simulationmodeldocumentation.pdf
[45] 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

Overview

The HDMM, as its name implies, models demand for healthcare services and providers. Demand is defined as the level and mix of healthcare 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 healthcare 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) healthcare use patterns that reflect the relationship between patient characteristics and healthcare use, and (3) staffing patterns that convert estimates of healthcare 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) healthcare occupation or medical specialty for office and outpatient visits. The services demand projections are workload measures, and demand for each health profession 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.

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.[46]
- **American Community Survey (ACS)**.[47] 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

[46] https://pad.human.cornell.edu/counties/projections.cfm
[47] https://www.census.gov/programs-surveys/acs/

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).** [48] 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.
- **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 healthcare 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

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

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

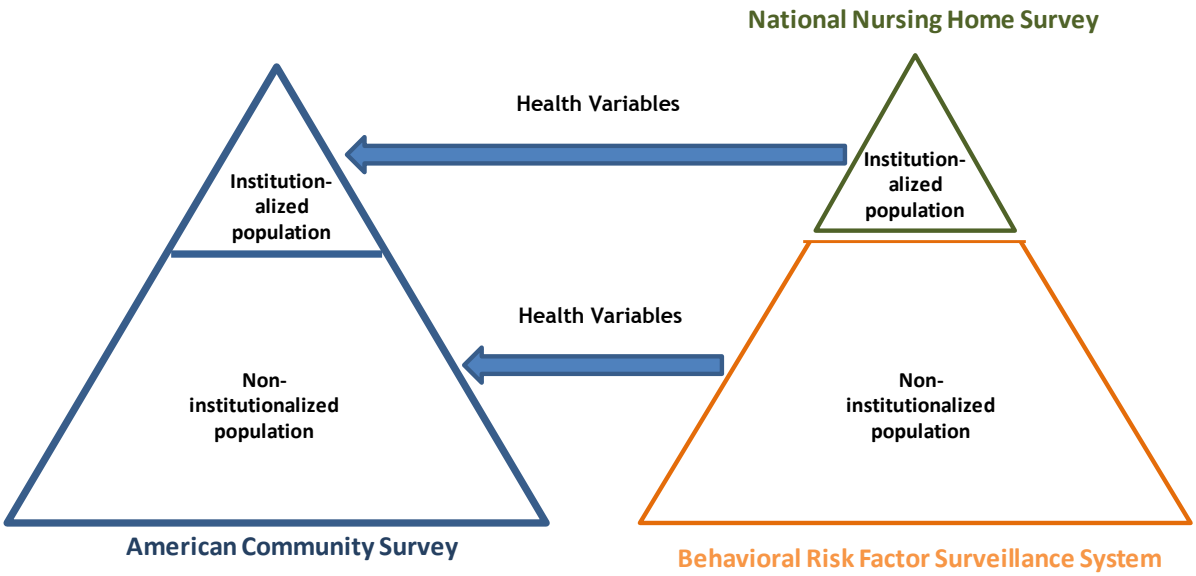


Exhibit A-2 summarizes the population characteristics in the final population database created for each county. This detailed information for each person captures systematic geographic variation in demographics, socioeconomic characteristics, and health risk factors (e.g., obesity, smoking, diabetes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

Healthcare Use

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

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 healthcare 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 1.0 (where a ratio of 1.0 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**	1.03	0.87**
	Non-Hispanic Black	0.78**	0.98	1.45**	1.41**
	Non-Hispanic White	1.00	1.00	1.00	1.00
	Non-Hispanic Other race	0.92**	0.82**	1.09	1.06
	Male	1.11**	1.48**	0.97*	1.07
Age	18-34 years	0.12**	0.13**	0.63**	0.37**
	35-44 years	0.23**	0.52**	0.98	0.80**
	45-64 years	0.52**	0.74**	1.10	1.14*
	65-74 years	0.87**	0.95*	1.12	1.57**
	75+ years	1.00	1.00	1.00	1.00
	Smoker	0.74**	0.75**	1.11	1.06
Diagnosed with	Hypertension	1.56**	1.15**	3.85**	2.71**
	Coronary heart disease	8.54**	9.60**	2.93**	3.96**
	History of heart attack	1.69**	1.63**	2.41**	2.59**
	History of stroke	1.11**	1.18**	3.11**	2.97**
	Diabetes	1.11**	1.37**	1.01	1.16**
	Arthritis	1.09**	1.23**	1.02	0.99
	Asthma	1.08**	1.10**	0.95	1.08
	History of cancer	1.08**	0.98	0.99	0.93
	Insured	2.48**	1.88**	0.89	1.02
	Medicaid	1.35**	1.42**	1.64**	1.71**
	Managed Care	0.97**	1.06**	1.01	0.99
Household Income	<$10,000	0.84**	1.05	1.20**	1.16**
	$10,000 to <$15,000	0.89**	0.72**	1.10	1.11
	$15,000 to < $20,000	0.90**	1.06	0.86	1.02
	$20,000 to < $25,000	0.84**	0.72**	1.15	1.09
	$25,000 to < $35,000	0.89**	1.08**	1.18**	1.05
	$35,000 to < $50,000	0.89**	0.96**	0.92	0.94
	$50,000 to < $75,000	0.93**	1.24**	0.89	0.82**
	$75,000 or higher	1.00	1.00	1.00	1.00
Body Weight	Normal	1.00	1.00	1.00	1.00
	Overweight	1.06**	1.02	1.16**	1.22**
	Obese	1.11**	1.08**	1.13**	1.26**
	Metro Area	1.31**	1.02	1.04	0.89

Note: 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.

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

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

Medical condition codes (ICD-9 CM)		Specialty/NPC Profession
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, 45.03, 45.26, 45.41, 45.49, 45.52, 45.71-45.76, 45.79, 45.81-45.83, 45.92-45.95, 46.03, 46.04, 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, 156.0, 164.1, 209.24, 155.0, 162.9, 183.0; 92.2 (http://www.donself.com/documents/ICD-10-for-Radiation-Oncology.pdf)	Radiation Oncology
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; 01.0-05; 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; 95.0-95.4	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,	Plastic surgery

Medical condition codes (ICD-9 CM)		Specialty/NPC Profession
	64.4, 78.4, 81.0-81.99, 82.7, 82.8, 83.8, 85.8, 86.84	
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

Healthcare Use Calibration

MEPS is a representative sample of the non-institutionalized population, and although the healthcare 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 healthcare use equals actual use. Applying the prediction equations to the population for 2011 through 2013 creates predicted values of healthcare 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 healthcare 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 healthcare 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.

Health Workforce Staffing Patterns

This section discusses the assumptions and methods used to convert demand for services into demand for healthcare workers. Demand for healthcare workers is derived from the demand

for healthcare 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 healthcare 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 healthcare services. However, the number and mix of health professionals required to provide the level of healthcare 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 healthcare delivery models and advances in technology may alter future healthcare 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.

HDMM VALIDATION, STRENGTHS, AND LIMITATIONS

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

- **Conceptual validation**: Through reports, presentations at professional conferences and submission of peer-reviewed manuscripts the model described here continue to undergo a peer-review evaluation of its theoretical framework. Contributors to these models include health economists, statisticians and others with substantial modeling experience; physicians, nurses, behavioral health providers and other clinicians; health policy experts; and professionals in management positions with health systems. Conceptual validation requires transparency of the data and methods to allow health workforce researchers and modelers to critique the model. This report is an attempt to increase the transparency of these complex workforce projection models where work is ongoing to improve the theoretical underpinnings, methods, assumptions, and other model inputs.

- **Internal validation**: The model runs using SAS software. As new capabilities are added to the model and data sources updated, substantial effort is made to ensure the integrity of the programming code. Internal validation activities include generating results for comparison to published statistics used to generate the model (e.g., ensuring that population statistics for the input files are consistent with published statistics).
- **External validation**: Presenting findings to subject matter experts for their critique is one approach to externally validate the model. Intermediate outputs from the model also can be validated. For example, the HDMM has been used to project demand for healthcare 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 healthcare 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).

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 healthcare 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 healthcare 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:

- Information on the influence of provider and payer networks on consumer service demand and migration patterns.
- Information on how care delivery patterns might change over time in response to emerging market factors.

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, 6-8.

- **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
4	CHF, acute myocardial infarction, and pneumonia [1]	26%	15%	-42%	VBMC-Harlington http://www.ahrq.gov/policymakers/case-studies/201420.html
5	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/
10	Diabetes	1.79/patient	1.18/patient	-34%	Naylor et al. (2004)[49]

[49] 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

Study #	Condition	Pre-Intervention Readmission Rate	Post-Intervention Readmission Rate	% Reduction in Readmission Rate	Source
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