COMMONWEALTH OF MASSACHUSETTS
HEALTH POLICY COMMISSION

TECHNICAL APPENDIX B
TRENDS IN THE MASSACHUSETTS DELIVERY SYSTEM

ADDENDUM TO COST TRENDS JULY 2014 SUPPLEMENT

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1 Mix of Providers for Inpatient Care

1.1 Discharges by payer type for inpatient service categories

Using the FY 2012 Massachusetts Health Data Consortium (MHDC) hospital discharge database, we grouped discharges based on their MS-DRG into inpatient service categories using definitions from the Health Care Cost Institute (HCCI). Definitions are available at http://www.healthcostinstitute.org/files/HCCI_HCCUR2011_Methodology.pdf (p. 15).

Payers were grouped into three categories – Commercial, MassHealth, and Medicare – and other payer types (e.g. self-pay) were excluded. Groupings of items in the MHDC payer field into these categories are defined as follows:

- *Private/Commercial:* HMO, PPO Other Managed Care Plans, Commercial Managed Care, Exclusive Provider Organization, Other Non-Managed Care, Point-of-Service Plan, Commercial Insurance, Blue Cross, Blue Cross Managed Care
- *Medicare*: Medicare, Medicare Managed Care
- *Medicaid/CHIP/Comm. Care/HSN/Uncompensated Care:* Medicaid, Medicaid Managed Care, Health Safety Net, Commonwealth Care Plans, Free Care
- *Self-Pay/Other:* Auto Insurance, Dental, Self Pay, None, Invalid Payor, Workers Compensation

Data are for acute hospital discharges, the MHDC discharge database does not include federal hospitals, long-term care hospitals, psychiatric hospitals, and other specialty hospitals.

1.2 Breakdown of higher rate of hospitalization by inpatient service category

Applying HCCI definitions for inpatient service categories to FY 2011 discharge data from the Healthcare Cost and Utilization Project's National Inpatient Survey discharge data, we estimated the proportion of discharges in medical, surgical, delivery, and mental health categories for Massachusetts and for the United States.

We applied these proportions by service category to inpatient discharge totals for Massachusetts and the U.S. from the 2011 American Hospital Association (AHA) Annual Survey to estimate the number of discharges for each service category for Massachusetts and for the United States. Figure B2 in the report displays the difference in number of discharges within each service category.

1.3 Proportion of non-emergent and non-transfer discharges in Massachusetts hospitals

We estimated the proportion of non-emergent and non-transfer discharges in Massachusetts hospitals using the FY 2012 MHDC hospital discharge database.

Our analysis was restricted to discharges for Massachusetts residents. "Non-transfer" discharges excluded discharges with an Admit Type of "other acute hospital." "Non-emergency discharges"

excluded discharges with an ED flag that reflected an admission from an ED or a visit to the ED in the discharge record.

We defined major teaching hospital based on the MedPAC definition of 25 residents per 100 beds, as determined by CHIA.

1.4 Analysis of inpatient discharge flows across regions

Total inflow/outflow

We analyzed discharges flows across regions using the FY 2012 MHDC hospital discharge database.

We restricted our data sample to non-transfer, non-emergency discharges for residents of Massachusetts (see **1.3** above for definitions of non-transfer and non-emergency discharges).

For each discharge, the region of the patient's residence was determined using the patient's zip code and the Commission's definitions of 15 geographic regions for use in cost trends analysis (see Technical Appendix B3: Regions of Massachusetts from the 2013 report, available at http://www.mass.gov/anf/docs/hpc/2013-cost-trends-report-technical-appendix-b3-regions-of-massachusetts.pdf). The region of the hospital at which the patient received care was defined using the same region set.

For each region, inflow was determined by counting discharges at hospitals within the region for patients residing in other regions, and outflow was determined by counting discharges for patients residing in the region at hospitals in other regions.

Similar patterns of inpatient discharge flow were observed for both tertiary/quaternary and non-tertiary/quaternary discharges. For this analysis, we defined tertiary/quaternary discharges as those (1) within the top 10% of DRGs by case weight and (2) where at least 50% of services were rendered at hospitals with an average case mix index of 1 or greater.

Because Metro Boston was the only region with net inflow of patients, we examined discharges flowing into Metro Boston in additional detail (Table B1.1 below).

Table B1.1: Inflow of discharges into Metro Boston, 2012

Number of non-emergency & non-transfer discharges, and percent of discharges flowing into Metro Boston, 2012

Hospital name	Number of discharges	Percent of total discharges
Brigham and Women's Hospital	13833	19%
Massachusetts General Hospital	11521	16%
Beth Israel Deaconess Medical Center	8836	12%
Newton-Wellesley Hospital	7222	10%
Children's Hospital Boston	7122	10%
Tufts Medical Center	6904	10%
New England Baptist Hospital	4748	7%
Boston Medical Center	2933	4%
St. Elizabeth's Medical Center	2063	3%
Mount Auburn Hospital	1901	3%
Faulkner Hospital	1297	2%
Melrose-Wakefield Hospital	978	1%
Cambridge Health Alliance - Cambridge Hospital	781	1%
Massachusetts Eye and Ear Infirmary	723	1%
Milton Hospital	442	1%
Dana-Farber Cancer Institute	289	0%
Lawrence Memorial Hospital	289	0%
Carney Hospital	174	0%
Beth Israel Deaconess Hospital - Needham	106	0%
Shriners Hospitals for Children Boston	59	0%
Cambridge Health Alliance - Whidden Memorial Hospital	41	0%
Subtotal for major teaching hospitals	*58418*	*81%*
Subtotal for Partners Health System	*33873*	*47%*
Total	**72262**	

Source: Massachusetts Health Data Consortium; HPC analysis

Comparison across payer and income groups

We used the MHDC's discharge database for the calendar year 2012 for our analysis and included patients that were at least 18 years of age, resided outside the Metro Boston Area, and were not transferred or admitted from an emergency department.[i]

We estimated a logistic probability (logit) model that predicted the probability of the patient being discharged outside of his or her home region as a function of community income, payer, and other demographic, regional, and clinical variables.

The logit model's dependent variable was a binary variable that indicated whether the patient was discharged from a hospital located outside of the patient's home region.

Our first independent variable of interest was income. Because patient-level income was not available, patients were assigned to an income level based on the median incomes in their zip code in 2012, as reported by the US Census' American Community Survey. Our sample was grouped into 5 income categories, less than $35,000 per year, between $35,000 and $49,999, between $50,000 and $74,999, between $75,000 and $99,999, and greater than $100,000.

[i] Includes: Other acute care hospital, outside hospital emergency room, within hospital emergency room transfer, transfer from outside ambulatory surgery.

Our second independent variable of interest was the patient's primary payer. Our sample was grouped into 4 payer categories: Medicaid/No Charge, Medicare, Private Insurance, and Self Pay/Other.

The specification also included independent variables to control for patient age, gender, the distance from the patient's zip code to the nearest hospital, the distance from the patient's zip code to the nearest academic medical center, and the distance from the patient's zip code from academic medical centers in downtown Boston (the Longwood Medical Area), and major diagnostic category for the discharge (25 indicators).

Income and payer effects are displayed in the report as probabilities of being discharged from outside the patient's home region care conditional on all other variables being held at their mean.

2 Concentration of Inpatient Care

2.1 Concentration of inpatient care in Massachusetts

We analyzed concentration of inpatient discharges in Massachusetts using the FY 2009 and 2012 MHDC hospital discharge databases.

Our data sample included only discharges for Massachusetts residents.

We constructed mappings of hospitals in Massachusetts to hospital systems in 2009, 2012, and 2014. For 2014, we constructed two mappings, one without and one with the Partners HealthCare System proposed acquisitions of South Shore Hospital and Hallmark Health Corporation. These mappings are defined in Table 2.1 below.

We analyzed concentration for all discharges as well as for discharges that had a private/commercial payer type (see **1.1** above for definitions of payer types).

Table 2.1: Hospital system definitions

MHDC Hospital Name	2009 System	2012 System	2014 System	2014 System (incl PHS)
Anna Jaques Hospital	Anna Jaques Hospital	Anna Jaques Hospital	Anna Jaques Hospital	Anna Jaques Hospital
Athol Memorial Hospital	Athol Memorial Hospital	Athol Memorial Hospital	Heywood Healthcare	Heywood Healthcare
Baystate Mary Lane Hospital	BH	BH	BH	BH
Baystate Medical Center	BH	BH	BH	BH
Berkshire Medical Center - Berkshire Campus	BHS	BHS	BHS	BHS
Berkshire Medical Center - Hillcrest Campus	BHS	BHS	BHS	BHS
Beth Israel Deaconess Hospital - Needham	BID	BID	BID	BID
Beth Israel Deaconess Medical Center - East Campus	BID	BID	BID	BID
Boston Medical Center - East Newton Campus	Boston Medical Center	Boston Medical Center	Boston Medical Center	Boston Medical Center
Boston Medical Center - Harrison Avenue Campus	Boston Medical Center	Boston Medical Center	Boston Medical Center	Boston Medical Center
Brigham and Women's Hospital	PHS	PHS	PHS	PHS
Brockton Hospital	Signature Health Brockton Hospital	Signature Health Brockton Hospital	Signature Health Brockton Hospital	Signature Health Brockton Hospital
Cambridge Health Alliance - Cambridge Campus	CHA	CHA	CHA	CHA
Cambridge Health Alliance - Somerville Campus	CHA	CHA	CHA	CHA
Cambridge Health Alliance - Whidden Memorial Campus	CHA	CHA	CHA	CHA
Cape Cod Hospital	CCHC	CCHC	CCHC	CCHC
Caritas Carney Hospital	Caritas Christi Health Care System	SHCS	SHCS	SHCS
Caritas Good Samaritan Medical Center - Brockton Campus	Caritas Christi Health Care System	SHCS	SHCS	SHCS
Caritas Good Samaritan Medical Center - NORCAP Lodge Campus	Caritas Christi Health Care System	SHCS	SHCS	SHCS
Caritas Holy Family Hospital and Medical Center	Caritas Christi Health Care System	SHCS	SHCS	SHCS
Caritas Norwood Hospital	Caritas Christi Health Care System	SHCS	SHCS	SHCS
Caritas Saint Anne's Hospital	Caritas Christi Health Care System	SHCS	SHCS	SHCS
Caritas St. Elizabeth's Medical Center	Caritas Christi Health Care System	SHCS	SHCS	SHCS
Children's Hospital Boston	Children's Hospital Boston	Children's Hospital Boston	Boston Children's Hospital	Boston Children's Hospital
Clinton Hospital	UMMHC	UMMHC	UMMHC	UMMHC
Cooley Dickinson Hospital	Cooley Dickinson Hospital	Cooley Dickinson Hospital	PHS	PHS
Dana-Farber Cancer Institute	Dana-Farber Cancer Institute	Dana-Farber Cancer Institute	Dana-Farber Cancer Institute	Dana-Farber Cancer Institute
Emerson Hospital	Emerson Hospital	Emerson Hospital	Emerson Hospital	Emerson Hospital
Fairview Hospital	BHS	BHS	BHS	BHS
Falmouth Hospital	CCHC	CCHC	CCHC	CCHC
Faulkner Hospital	PHS	PHS	PHS	PHS
Franklin Medical Center	BH	BH	BH	BH
Hallmark Health System - Lawrence Memorial Hospital Campus	HH	HH	HH	PHS
Hallmark Health System - Melrose-Wakefield Hospital Campus	HH	HH	HH	PHS
Harrington Memorial Hospital	Harrington Healthcare	Harrington Healthcare	Harrington Healthcare	Harrington Healthcare
Health Alliance Hospital - Burbank Campus	UMMHC	UMMHC	UMMHC	UMMHC
Health Alliance Hospital - Leominster Campus	UMMHC	UMMHC	UMMHC	UMMHC
Heywood Hospital	Heywood Hospital	Heywood Hospital	Heywood Healthcare	Heywood Healthcare
Holyoke Medical Center	Holyoke Medical Center	Holyoke Medical Center	Holyoke Medical Center	Holyoke Medical Center
Jordan Hospital	Jordan Hospital	Jordan Hospital	BID	BID
Lahey Clinic - Burlington Campus	Lahey Clinic	LH	LHS	LHS
Lawrence General Hospital	Lawrence General Hospital	CH	Lawrence General Hospital	Lawrence General Hospital
Lowell General Hospital	Lowell General Hospital	CH	CH	CH
Marlborough Hospital	UMMHC	UMMHC	UMMHC	UMMHC
Martha's Vineyard Hospital	PHS	PHS	PHS	PHS
Massachusetts Eye and Ear Infirmary	Massachusetts Eye and Ear Infirmary	Massachusetts Eye and Ear Infirmary	Massachusetts Eye and Ear Infirmary	Massachusetts Eye and Ear Infirmary
Massachusetts General Hospital	PHS	PHS	PHS	PHS
Mercy Medical Center - Providence Behavioral Health Hospital Campus	Catholic Health East	Catholic Health East	Catholic Health East	Catholic Health East
Mercy Medical Center - Springfield	Catholic Health East	Catholic Health East	Catholic Health East	Catholic Health East
MetroWest Medical Center - Framingham Campus	VHS	VHS	Tenet	Tenet
MetroWest Medical Center - Leonard Morse Campus (Natick)	VHS	VHS	Tenet	Tenet
Milford Regional Medical Center	Milford Regional Medical Center	Milford Regional Medical Center	Milford Regional Medical Center	Milford Regional Medical Center
Milton Hospital	Milton Hospital	BID	BID	BID
Morton Hospital and Medical Center	Morton Hospital and Medical Center	SHCS	SHCS	SHCS
Mount Auburn Hospital	Mount Auburn Hospital	Mount Auburn Hospital	Mount Auburn Hospital	Mount Auburn Hospital
Nantucket Cottage Hospital	PHS	PHS	PHS	PHS
New England Baptist Hospital	New England Baptist Hospital	New England Baptist Hospital	New England Baptist Hospital	New England Baptist Hospital
Newton-Wellesley Hospital	PHS	PHS	PHS	PHS
Noble Hospital	Noble Hospital	Noble Hospital	Noble Hospital	Noble Hospital
North Adams Regional Hospital	North Adams Regional Hospital	North Adams Regional Hospital		
North Shore Medical Center - Salem Campus	PHS	PHS	PHS	PHS
North Shore Medical Center - Union Campus	PHS	PHS	PHS	PHS
Northeast Health System - Addison Gilbert Campus	Northeast Health Systems	LH	LHS	LHS
Northeast Hospital - Beverly	Northeast Health Systems	LH	LHS	LHS
Quincy Medical Center	Boston Medical Center	SHCS	SHCS	SHCS
Saint Vincent Hospital	VHS	VHS	Tenet	Tenet
Saints Memorial Medical Center	Saints Memorial Medical Center	CH	CH	CH
Shriners Hospitals for Children Boston	Shriners	Shriners	Shriners	Shriners
Shriners Hospitals for Children Springfield	Shriners	Shriners	Shriners	Shriners
South Shore Hospital	South Shore Hospital	South Shore Hospital	South Shore Hospital	PHS
Southcoast Hospitals Group - Charlton Memorial Campus	Southcoast Health System	Southcoast Health System	Southcoast Health System	Southcoast Health System
Southcoast Hospitals Group - St. Luke's	Southcoast Health System	Southcoast Health System	Southcoast Health System	Southcoast Health System
Southcoast Hospitals Group - Tobey Hospital Campus	Southcoast Health System	Southcoast Health System	Southcoast Health System	Southcoast Health System
Steward - Merrimack Valley Hospital	Essent Healthcare	SHCS	SHCS	SHCS
Steward - Nashoba Valley Medical Center	Essent Healthcare	SHCS	SHCS	SHCS
Sturdy Memorial Hospital	Sturdy Memorial Hospital	Sturdy Memorial Hospital	Sturdy Memorial Hospital	Sturdy Memorial Hospital
Tufts-New England Medical Center	Tufts Medical Center	Tufts Medical Center	Tufts Medical Center	Tufts Medical Center
UMass Memorial Medical Center - Memorial Campus	UMMHC	UMMHC	UMMHC	UMMHC
UMass Memorial Medical Center - University Campus	UMMHC	UMMHC	UMMHC	UMMHC
Winchester Hospital	Winchester Hospital	Winchester Hospital	LHS	LHS
Wing Memorial Hospital and Medical Centers	UMMHC	UMMHC	UMMHC	UMMHC

2.2 Concentration of commercial inpatient discharges by diagnostic area

We used the discharge sample and system definitions for this analysis described in **2.1** above.

Discharges were segmented by major diagnostic category and by inpatient service category. Inpatient service category was determined using definitions from HCCI (see **1.1** above).

For each diagnostic category and service category, we ranked systems based on volume of discharges and identified the proportion of discharges in the highest-volume system and in the top five highest-volume systems.

2.3 Systems with leading share of commercial inpatient discharges by region, 2012

We identified hospital systems using the 2012 system definitions described in 2.1 above and assigned discharges in the FY2012 MHDC hospital discharge database to 15 regions based on patient zip code using the Commission's definition of 15 geographic regions (see Technical Appendix B3: Regions of Massachusetts from the 2013 report, available at http://www.mass.gov/anf/docs/hpc/2013-cost-trends-report-technical-appendix-b3-regions-of-massachusetts.pdf). We restricted our sample to discharges with a private/commercial payer type (see 1.1 above) and for patients residing in Massachusetts.

Within each region, we identified the system with the highest and second-highest volume of discharges and calculated the proportion of total discharges in the region those systems represented.

3 Alternative Payment Methods

3.1 Estimate of commercial APM coverage in 2012

Our estimate of commercial APM coverage is based on the data appendix to CHIA's Baseline Report on Alternative Payment Methods in the Massachusetts Commercial Market.

To estimate APM penetration for commercial payers, we summed member months associated with all payment methods excluding Fee for Service and divided by the total member months for these payers.

We performed this calculation for all product types combined to estimate overall penetration of APMs and for HMO and POS products only to estimate penetration of APMs among insurance products that require designation of a primary care provider.

3.2 Estimate of Medicare APM coverage in 2012

We estimated Medicare APM coverage in the Medicare Advantage population using the same methodology and data set as used in analyzing the commercial segment (see **3.1** above).

For Original Medicare (Medicare fee-for-service), we used data provided to the Commission by CMS on the number of beneficiaries aligned to each Massachusetts-based Pioneer ACO and Medicare Shared Savings Program ACO at year-end in 2012 and 2013 and on total enrollment for Medicare Parts A and B for those years. We used an adjusted beneficiary count, pro-rating the counts of beneficiaries aligned with ACOs at end-of-year for the proportion of the year in

which each ACO participated in the Medicare ACO programs (e.g., beneficiary counts were multiplied by ¾ for ACOs that began participation on April 1st of a particular year). This adjusted beneficiary count aligned with ACOs was divided by the total Medicare enrollment count for the year to obtain a coverage rate.

Overall Medicare APM coverage was estimated by averaging the Medicare Advantage and Original Medicare coverage rates, weighted by enrollment in each program.

3.3 Estimate of MassHealth APM coverage in 2012

Data were provided to the Commission by MassHealth:

- Beneficiaries as of May 2012 in MCO and PCC programs
- Beneficiaries as of May 2012 in FFS program for which MassHealth was the primary payer
- Number of PCC beneficiaries aligned with PCMHi in 2012

We estimated MassHealth APM coverage in MCOs using the same methodology and data set as used in analyzing the commercial segment (see **3.1** above).

MassHealth's APM for the PCC program in 2012 was the PCMHi program. We divided beneficiaries aligned with PCMHi in 2012 by the total number of PCC beneficiaries to estimate the proportion covered by APMs in the PCC program.

There were no global budget APMs applied to the FFS program in 2012.

For a total MassHealth APM coverage estimate, we divided total beneficiaries under APMs in the MCO and PCC populations by the total count of beneficiaries across the MCO, PCC, and FFS program for which MassHealth was the primary payer.

3.4 Estimate of statewide APM coverage in 2012

Statewide APM coverage was estimated as an average of the Commercial, Medicare, and MassHealth estimates, weighted based on the number of members/beneficiaries for which each payer type was the primary payer.