Hospital Payer and Racial/Ethnic Mix at Private Academic Medical Centers in Boston and New York City

Supplementary Material

Part A: Additional Details on Research Methods and Variable Definitions

Hospital AMC definition and list of non-AMCs

We obtained a list of "integrated" members of the Council of Teaching Hospitals (COTH) from the Association of American Medical Colleges (AAMC)[1] and included their affiliated hospitals in our definition of AMCs. Other hospitals (non-AMCs) included private nonprofit hospitals, public hospitals, and for-profit hospitals (Boston only), as shown in Table A1 below. We excluded some NYC hospitals listed as "integrated" members of COTH (i.e., Lenox Hill, Mount Sinai Beth Israel Medical Center, and Staten Island University Hospital) from our definition of AMCs, because our focus was on major AMCs that had been named in a civil rights complaint in 2008[2]. As our focus was on private AMCs, we excluded one public, state-owned AMC (SUNY Downstate/University Hospital Brooklyn).

[1] Author personal communication with Merle Haberman, Senior Director of Health Systems Economics, Data & Analysis at AAMC, Nov 15th, 2015.

[2] See: Golub M, Calman N, Ruddock C, et al. A community mobilizes to end medical apartheid. Prog Community Health Partnersh. 2011 Fall;5(3):317-25

Table A1. Non-AMC hospitals in NYC and Boston, showing hospital ownership and teaching status

NYC non-AMCs	Boston non-AMCs
Public hospitals – city/municipal	**Public hospitals**
Bellevue Hospital Center (T)	Cambridge Health Alliance (T)
Coney Island Hospital (T)	
Elmhurst Hospital Center (T)	**Private nonprofit hospitals**
Harlem Hospital Center (T)	Hallmark Health System (T)****
Jacobi Medical Center (T)	Massachusetts Eye and Ear Infirmary (T)
Kings County Hospital Center (T)	Mount Auburn Hospital (T)
Lincoln Medical & Mental Health Center (T)	New England Baptist Hospital (T)
Metropolitan Hospital Center (T)	
North Central Bronx Hospital (T)	**Private for-profit hospitals**
Queens Hospital Center (T)	Caritas St. Elizabeth's Medical Center (T)
Woodhull Medical & Mental Health Center (T)	Carney Hospital (T)
Public hospitals - state	
SUNY Downstate Medical Center at LICH (T)*	
SUNY Downst. Med. Ctr/Univ. Hosp. Brooklyn (T)**	
Private nonprofit hospitals* **	
Beth Israel Hospital Brooklyn/Kings Highway	

Beth Israel Medical Center (T)

Bronx-Lebanon – Concourse division (T)

Bronx-Lebanon – Fulton division (T)

Brookdale University Hosp. Med. Center (T)

Brooklyn Hospital Center – Downtown

Campus (T)

Calvary Hospital Inc.

Flushing Hospital Medical Center (T)

Forest Hills Hospital (T)

Interfaith Medical Center (T)

Jamaica Hospital Medical Center (T)

Kingsbrook Jewish Medical Center (T)

Lenox Hill Hospital (T)

Long Island Jewish Med. Ctr (T)

(only 2009; AMC in 2014)

Lutheran Medical Center (T)

Maimonides Medical Center (T)

Montefiore – North/Wakefield division (T)

Mount Sinai Hospital of Queens

Mount Sinai St. Luke's (T)

Mount Sinai West/Roosevelt (T)

North General Hospital (T)

(only 2009; closed in 2010)

NY Community Hospital of Brooklyn (T)

NY Presbyterian/Lower Manhattan

(Downtown) (T)

NY Eye and Ear Infirmary of Mount Sinai (T)

NY Presbyterian/Queens (NY Hosp. Queens)

(T)

NY Methodist Hospital (T)

NY Presbyterian – Allen Hospital (T)

NY Westchester Square Medical Center

(only 2009; closed in 2013)

Peninsula Hospital Center (T)

(only 2009; closed in 2012)

Richmond University Medical Center (T)

St Barnabas Hospital (T)

St John's Episcopal Hospital South Shore (T)

Staten Island University Hospital – North (T)

Staten Island University Hospital – South (T)

Wyckoff Heights Hospital (T)

Abbreviations: Teaching hospitals (T), including hospitals that have affiliation contracts with medical schools (but may not have full-time interns or residents).[3]

Footnotes: *LICH, Long Island College Hospital (closed in 2014). **A publicly owned AMC. *** All hospitals in New York State must operate as nonprofit hospitals; the state has no for-profit hospitals. ****This health system comprises two general acute care hospitals, of which Lawrence Memorial Hospital is a teaching hospital, but Melrose-Wakefield Hospital is not.

[3] Hospital teaching status retrieved from American Hospital Association Data Viewer (www.ahadataviewer.com) and the Association of American Medical Colleges Council of Teaching Hospitals and Health Systems (http://www.aamc.org/members/coth).

Payer (insurance) classification for NYC SPARCS data

Raw insurance categories used in SPARCS changed from Source of Payment in 2009 to Payment Typology in 2014. Tables A2 and A3 show how we constructed our five insurance categories (Private, Medicaid, Uninsured, Medicare, Other) in 2009 and 2014 using the SPARCS primary and secondary payer data.

Table A2. Insurance Classification for NYC 2009 SPARCS Data Using Source of Payment Insurance Classification

Primary expected source of payment	**Secondary Expected Source of Payment**										
	Missing	Blue Cross	CHAMPUS	Ins. Comp.	Medicaid	Medicare	Other Federal Program	Other non-Federal Program	Self-Pay	Unknown	Workers Comp.
Blue Cross	Private	Private	Private	Private	Medicaid	Medicare	Private	Private	Private	Private	Private
CHAMPUS	Other	Other	Other	Other	Other	Other	Other	Other	Other	Other	Other
Ins. Comp.	Private	Private	Private	Private	Medicaid	Medicare	Private	Private	Private	Private	Private
Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid
Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare
Other Federal Program	Other	Other	Other	Other	Other	Other	Other	Other	Other	Other	Other
Other Non-Federal Prog.	Other	Other	Other	Other	Other	Other	Other	Other	Other	Other	Other
Self-Pay	Unins.	Unins.	Unins.	Unins.	Medicaid	Medicare	Unins.	Unins.	Unins.	Unins.	Unins.
Unknown	Missing/ unknown	Other	Other	Other	Medicaid	Medicare	Other	Other	Other	Missing/ unknown	Other

Workers Compensation	Other	Private	Other	Private	Medicaid	Medicare	Other	Other	Other	Other	Other

Notes: Ins. Comp. = Insurance company; Priv. = private insurance; Unins. = Uninsured; SPARCS, Statewide Planning and Research Cooperative System.

Table A3. Insurance Classification for NYC 2014 SPARCS Data Using Payment Typology Insurance Classification

Primary expected source of payment	**Secondary Expected Source of Payment**										
	Missing	Blue Cross/ Blue Shields	Dept. of Corr.	Federal/ State/ Local/VA	Managed Care, Unspec.	Medicaid	Medicare	Misc./Other	Private Health Ins.	Self-Pay	Unknown
Blue Cross/Blue Shields	Private	Private	Private	Private	Private	Medicaid	Medicare	Private	Private	Private	Private
Dept. of Corr.	Other	Other	Other	Other	Other	Other	Other	Other	Other	Other	Other
Federal/ State /Local/VA	Other	Other	Other	Other	Other	Other	Other	Other	Other	Other	Other
Managed Care, Unspec.	Other	Other	Other	Other	Other	Medicaid	Medicare	Other	Other	Other	Other
Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid	Medicaid
Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare	Medicare
Misc./Other	Other	Other	Other	Other	Other	Medicaid	Medicare	Other	Other	Other	Other
Private Health Ins.	Private	Private	Private	Private	Private	Medicaid	Medicare	Private	Private	Private	Private

Self-Pay	Unins.	Unins.	Unins.	Unins.	Unins.	Medicaid	Medicare	Unins.	Unins.	Unins.	Unins.
Unknown	Missing /unknown	Other	Other	Other	Other	Medicaid	Medicare	Other	Other	Other	Missing/ unknown

Notes: Dept. of Corr = Department of Corrections; Fed. = federal; Ins. Comp. = Insurance company; Managed Care, Unspec. =, Managed Care, Unspecified; Misc. = Miscellaneous; Priv. = private insurance; Prog.= program; Unins.= Uninsured.; VA = Veterans Administration.

Race/ethnicity classification for NYC SPARCS data

The raw "race" and "ethnicity" categories in the SPARCS database that we used to construct our combined "race/ethnicity" variable changed during our study period, from 2013 to 2014. Tables A4 and A5 show how we constructed our four "race/insurance" categories (black, white, other) in 2009 and 2014 using the SPARCS raw "race" and "ethnicity" categories. The main difference between 2009 and 2014 race/ethnicity classification systems in the NYC SPARCS database was the elimination of the "unknown" race category, and the addition of the "multi-racial" race category and "multi-ethnic" ethnicity categories, in 2014. The increase in "other minorities" that we observed from 2009 to 2014 (6.7% for AMCs; 5.8% for non-AMCs) was not explained by the addition of "multi-ethnic" and "multi-racial" raw SPARCS categories, but rather an increase in patients reporting "other race" and "Not Spanish/Hispanic" ethnicity from 12% of total patient volume in 2009, to 18.3% in 2014 (data not shown).

Table A4. Race/Ethnicity Classification for NYC 2009 SPARCS Data

		Ethnicity		
		Not Spanish/ Hispanic	**Spanish / Hispanic**	**Unknown**
Race	**Black/ African American**	Black	Black	*Missing*
	Other Race	Other	Other	*Missing*

	Unknown	*Missing*	*Missing*	*Missing*
	White	White	Other	*Missing*

Table A5. Race/Ethnicity Classification for NYC 2014 SPARCS Data

		Ethnicity			
		Multi-ethnic	**Not Spanish/ Hispanic**	**Spanish/ Hispanic**	**Unknown**
Race	**Black/African American**	Black	Black	Black	Black
	Multi-racial	Other	Other	Other	Other
	Other race	Other	Other	Other	Other
	White	Other	White	Other	*Missing*

Index of Dissimilarity calculation

The Index of Dissimilarity is calculated as indicated in the formula below (using segregation between black and white patients as an example):

$$IoD = \left(\frac{1}{2}\right)\sum\left|\frac{B_i}{B} - \frac{W_i}{W}\right|$$

Where *B* is the total number of black patient discharges city-wide, B_i is the number of black discharges from of hospital i, W is the total number of white discharges city-wide, and W_i is the number of white discharges from hospital i.

The IoD ranges between 0 (indicating that the two groups are represented at all hospitals in the same proportions as in the city overall) and 1 (indicating that inpatient care for the two groups is completely segregated into separate hospitals).

Part B: Sensitivity Analyses for Hispanic Patients

Nearly one-quarter (23%) of hospitals in our Boston sample reported zero Hispanic discharges (3 of 13 hospitals), two of which were AMCs. All other Boston AMCs reported <1% Hispanic discharges. We therefore considered our Boston data unreliable for the purpose of analyzing Hispanic discharges.

In our NYC sample, 2 AMCs reported zero Hispanic discharges in 2014, although reporting 13% and 8% Hispanics in 2009. A third NYC AMC reported <0.01% Hispanic discharges in 2014 but 22% in 2009. These discrepancies are likely to be a result of the NYC SPARCS database changing to a different racial/ethnic classification system in 2014 (see Tables A4 and A5). Therefore, we also considered our NYC data for Hispanic discharges to be unreliable.

Table B1. Race/ethnicity of Adults Discharged from Private Academic Medical Centers and Other Hospitals in New York City, 2009 and 2014, and Boston, 2009, Showing Hispanic Discharges

	NYC 2014			NYC 2009			Boston 2009		
	AMC (%)	**Non-AMC (%)**	**p-value**	**AMC (%)**	**Non-AMC (%)**	**p-value**	**AMC (%)**	**Non-AMC (%)**	**p-value**
Race / ethnicity [a]			P<0.001			P<0.001			P<0.001
Black	17.7	28.4		16.7	31.1		13.9	8.0	
White	41.3	26.6		51.8	30.5		69.9	80.4	
Hispanic	15.3	20.4		19.8	19.0		0.2	1.7	
Other Minority	24.0	18.8		11.6	12.2		8.9	6.8	
Missing/ unknown	1.6	5.8		0.2	7.3		7.1	3.1	
TOTAL, discharges (hospitals)	280,079 (10)	638,710 (44)		251,795 (9)	787,130 (49)		170,640 (6)	64,272 (7)	

Notes: P-values represent chi-squared tests for differences between AMCs and non-AMCs. AMC = Academic Medical Centers.

[a] Black includes non-Hispanic black only; white reflects non-Hispanic only; Hispanic includes individuals of any race (white, black, other, multi-race and missing); other minority includes “other race,” “multiethnic white/other race.”

Table B2. Adjusted Odds of Hospitalization at Private Academic Medical Centers in New York City, 2009 and 2014, and Boston, 2009, Showing Hispanic Discharge Analyses

	2014 NYC	2009 NYC	2009 Boston
	Adjusted[a] OR (95% CI)		
Age (years)			
18-29	Ref	Ref	Ref
30-49	0.98 (0.97-1.00)	1.05 (1.04-1.07)	1.07 (1.03-1.11)
50-69	1.20 (0.18-1.22)	1.28 (1.26-1.30)	1.04 (1.01-1.08)
70 and over	0.98 (0.96-1.00)	0.84 (0.82-0.86)	0.72 (0.69-0.75)
Gender			
Female	1.09 (1.08-1.10)	1.03 (1.02-1.04)	0.87 (0.85-0.88)
Race/ethnicity [b]			
White	Ref	Ref	Ref
Black	0.50 (0.49-0.50)	0.37 (0.37-0.38)	2.09 (2.02-2.16)
Hispanic [c]	0.64 (0.64-0.65)	0.77 (0.76-0.78)	0.13 (0.12-0.15)
Other Minority	1.01 (1.00-1.02)	0.66 (0.65-0.67)	1.51 (1.46-1.57)
Insurance			
Private	Ref	Ref	Ref
Medicaid	0.29 (0.29-0.30)	0.41 (0.41-0.42)	0.58 (0.56-0.59)
Uninsured	0.20 (0.19-0.20)	0.22 (0.21-0.22)	0.70 (0.63-0.77)
Medicare	0.56 (0.55-0.56)	0.85 (0.84-0.86)	0.67 (0.65-0.69)
Other	0.63 (0.61-0.66)	0.90 (0.85-0.94)	0.59 (0.56-0.62)

Notes: [a] Adjusted for patients' age, gender, race/ethnicity, and insurance coverage.

[b] Black includes non-Hispanic black only; white reflects non-Hispanic only; Hispanic includes individuals of any race (white, black, other, multi-race, and missing); other minority includes "other race," "multiethnic white/other race."

[c] Unadjusted OR (95% CI) for Race/Ethnicity - Hispanic: 0.48 (0.48-0.49) for NYC 2014; 0.61 (0.61-0.62) for NYC 2009; 1.99 (1.93-2.06) for Boston 2009.

Table B3. Racial/ethnic Segregation as Measured by the Index of Dissimilarity Across Hospitals in New York City, 2009 and 2014, and Boston, 2009, Showing Hispanic Discharge Analyses

	Race[a] (relative to white)		
	Black	**Other minority**	**Hispanic**
NYC 2014	0.52	0.35	0.54
NYC 2009	0.54	0.40	0.49
Boston 2009	0.33	0.25	0.52

Notes: [a] Black includes non-Hispanic black only; white reflects non-Hispanic only; Hispanic includes individuals of any race (white, black, other, multi-race, and missing); other minority includes "other race," "multiethnic white/other race."

Part C: Sensitivity Analyses for the Index of Dissimilarity Excluding Hospitals with At Least 20% Race/Ethnicity Data Missing

In 2014, seven of 54 (14%) NYC hospitals had missing racial/ethnic data for at least 20% of discharges. Excluding these hospitals resulted in a slight decrease in segregation index for black patients compared to our main analyses (0.50 vs. 0.52 in main analysis including these hospitals); this value is still considered moderately high in the social science literature. For other minorities, exclusion of these hospitals had a negligible effect on the index of dissimilarity (0.40 vs. 0.41 in main analysis).

In 2009, four of 58 (7%) NYC hospitals had missing racial/ethnic data for at least 20% of discharges. Excluding these hospitals resulted in no change in index of dissimilarity results for black patients (0.54 in main analysis and sensitivity analysis) and a negligible change for other minorities (0.42 vs. 0.41 in main analyses), relative to our main analyses, which included these hospitals.

Part D: Additional Sensitivity Analyses for Boston

First, we conducted sensitivity analyses where "free care" discharges were counted as "uninsured." These analyses are presented in Tables D1 and D2 as "Sensitivity Analysis 1." Overall, the results of these analyses were not markedly different from our main analyses, where "free care" discharges were included in the "other" payer category. In multivariable logistic regression analyses, the odds of being discharged from an AMC became slightly higher for uninsured (OR 0.76 vs. 0.70 in main model) and slightly lower for the "other" category (0.50 vs. 0.58 in main model), relative to our main model. In segregation analyses, uninsured patients had a slightly higher index of dissimilarity in our sensitivity analysis, relative to our main model (0.26 vs 0.22 in main analysis).

Second, we conducted sensitivity analyses where discharges from Boston Medical Center, an AMC that is also a major safety-net hospital, were classified as non-AMC discharges. These analyses are identified in Tables D1 and D2 as "Sensitivity Analysis 2." In multivariable logistic regression analyses, the odds of being discharged from an AMC for black patients relative to white patients reversed in direction, relative to our main model (OR 0.59, $p<0.001$ vs. 2.09, $p<0.001$ in main model). Other minorities remained more likely than whites to be discharged from an AMC, although the odds were slightly lower compared to our main model (OR 1.10, $p<0.001$ vs. 1.23, $p<0.001$ in main model).

Table D1. Characteristics of Adults Discharged from Private Academic Medical Centers and Other Hospitals in Boston in 2009, Showing Sensitivity Analyses

	Sensitivity analysis 1 [a]			**Sensitivity Analysis 2** [b]		
	AMC (%)	**Non-AMC (%)**	**p-value**	**AMC (%)**	**Non-AMC (%)**	**p-value**
Age (years)						P<0.001
18-29	-	-		10.4	11.2	
30-49	-	-		27.1	23.6	
50-69	-	-		35.1	31.4	
70 and over	-	-		27.4	33.8	
Gender – female				56.7	56.8	p=0.601
Race / ethnicity[c]						P<0.001
Black	-	-		9.5	16.6	
White	-	-		75.8	68.0	
Other Minority	-	-		9.3	8.5	
Missing/ unknown	-	-		5.4	6.9	
Insurance			P<0.001			P<0.001
Private	-	-		46.5	27.1	

Medicare	-	-	39.1	46.0
Medicaid	-	-	10.3	21.4
Uninsured	2.7	1.9	1.0	1.1
Other	2.1	2.8	3.1	4.4
TOTAL, discharges (hospitals)	-	-	144,254 (5)	90,658 (8)

Notes: AMC = Academic Medical Centers. P-values represent chi-squared tests for differences between AMCs and non-AMCs. A dash ('-') indicates no change to this category.

[a] Uninsured discharges include "free care" in addition to "self-pay."

[b] Indicates that Boston Medical Center discharges are categorized as non-AMC discharges.

[c] Black includes black of any ethnicity; white reflects non-Hispanic only; "other minority" includes other race, white Hispanic, multiethnic white/other race.

Table D2. Adjusted Odds of Hospitalization at Private Academic Medical Centers in Boston in 2009, Showing Sensitivity Analyses

	Sensitivity analysis 1 [a]		**Sensitivity Analysis 2 [b]**	
	AOR [c]	**95% CI**	**AOR [c]**	**95% CI**
Age (years)				
18-29	Ref		Ref	
30-49	1.08	(1.04-1.12)	1.04	(1.01-1.08)
50-69	1.05	(1.02-1.09)	0.98	(0.95-1.01)
70 and over	0.73	(0.70-0.76)	0.78	(0.75-0.81)

Gender				
Female	0.87	(0.85-0.89)	0.97	(0.95-0.99)
Race/ethnicity [d]				
White	Ref		Ref	
Black	2.09	(2.01-2.15)	0.59	(0.58-0.61)
Other Minority	1.23	(1.19-1.27)	1.10	(1.07-1.14)
Insurance				
Private	Ref		Ref	
Medicaid	0.58	(0.56-0.59)	0.32	(0.32-0.33)
Uninsured	0.76	(0.71-0.82)	0.59	(0.54-0.64)
Medicare	0.66	(0.47-0.53)	0.59	(0.42-0.47)
Other	0.50	(0.65-0.68)	0.44	(0.57-0.60)

Notes: Ref = Reference category.

[a] Uninsured discharges include "free care" in addition to "self-pay."

[b] Boston Medical Center discharges classified as "non-AMC" discharges.

[c] Adjusted for patients' age, gender, race/ethnicity, and insurance coverage.

[d] Black includes black of any ethnicity; white reflects non-Hispanic only; "other minority" includes other race, white Hispanic, multiethnic white/other race.