Costs in Pituitary Surgery: Racial, Socioeconomic, and Hospital Factors

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Abstract

Objective To investigate the influence of patient demographic factors and hospital factors on cost and length of stay in patients undergoing pituitary surgery.

Design/Setting A retrospective cross-sectional study of the 2008 to 2012 Nationwide/National Inpatient Sample.

Participants Patient demographics and hospital characteristics for patients undergoing pituitary surgery were compared between white, black, and Hispanic patients.

Main Outcome Measures Variables associated with increased cost and increased length of hospital stay were ascertained and compared against each racial and ethnic group via multiple linear regression analysis.

Results Of 8,812 patients who underwent pituitary surgery, 5,924 (67.2%) patients were white, 1,590 (18.0%) were black, and 1,296 (14.7%) were Hispanic. Patient variables found to be significantly different between racial groups via univariate analysis were age, chronic conditions, gender, income, and primary payer. Hospital variables found to be significantly different were location/teaching status, region, and ownership. Hospitalization cost was significantly lower for whites (−$3,082, 95% confidence interval [CI] −$3,961 to −$2,202) and significantly higher for both blacks ($1,889, 95% CI $842–$2,937) and Hispanics ($2,997, 95% CI $1,842–$4,152). Length of hospital stay was also significantly lower in whites (−1.01, 95% CI −1.31 to −0.72) and significantly higher for both blacks (0.65, 95% CI 0.30 to 1.00) and Hispanics (0.96, 95% CI 0.57–1.35).

Conclusions Racial and ethnic factors contribute to differences in hospital utilization and cost for patients undergoing pituitary surgery. Further investigations are necessary to uncover the sources of these disparities in an effort to provide safer and more affordable care to all patients.

Keywords
- pituitary surgery
- skull base
- health care disparities
- cost
- outcomes/cost-effectiveness

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Introduction

The implementation of cost-effective care in the United States has increasingly become a priority; health care costs per capita are significantly higher in the United States than in any other country.[1] However, stark differences exist in hospitalization costs and patient length of stay (LOS) for a given condition across health care systems.[2,3] For similar treatments, Medicare spending varies up to 50% in different areas of the country, even when adjusting for patient demographic factors, such as age, sex, and race.[4] These increases in costs do not appear to translate to improved patient outcomes. Studies of a variety of conditions, including hip fracture, colorectal cancer, acute myocardial infarction, and head and neck cancer, demonstrate no correlation between costly care and survival or other outcomes.[4,5] The causes of cost disparities are likely multifactorial, and there is a relative paucity of literature examining the individual variables driving the incongruent spending in treatment across hospitals, particularly in skull base surgery.

Pituitary surgery is performed in a variety of centers across the United States, and is generally a high-cost, subspecialty procedure. Our prior work has demonstrated that there are disparities in complication rates in pituitary surgery based on race, ethnicity, socioeconomic status, insurance status, and hospital factors.[6] This corroborates studies examining other medical and surgical conditions that have shown discrepancies in mortality, complications, LOS, costs, and readmissions when stratifying patients by race, socioeconomic status, or location.[7–11] It is well documented that black and Hispanic patients receive less value-based care and have substandard access to advanced care hospitals.[12] The reasons for this deficit in care are, in part, likely due to hospital quality, lower levels of insurance (such as Medicaid), or restricted access to highly skilled providers. These factors all could have large impacts, alone or in combination, on the costs of patient care immediately following pituitary surgery. Importantly, the elimination of these disparities has been identified as a clear goal of the Health and Human Services' "Healthy People 2020" Initiative.[13]

In this study, we attempt to quantify variation in costs of care following pituitary surgery across the United States, and identify the patient and hospital features that are driving these differences. We hypothesize that there are several important demographic, insurance, and surgical factors that influence expenditure for this complex surgery. Identifying these differences provides the foundation for policy and clinical interventions to standardize care, promote equality in outcomes, and reduce costs.

Materials and Methods

Study Design/Sample

Using the 2008 to 2012 Nationwide Inpatient Sample and National Inpatient Sample (NIS) of the Healthcare Cost and Utilization Project (HCUP), we conducted a retrospective cross-sectional investigation of all pituitary surgery patients following Institutional Review Board approval. The NIS is a discharge database that represents 20% of all inpatient admissions to nonfederal hospitals in the United States.[14,15] Each discharge in the database represents one hospitalization. The NIS does not have unique patient data; therefore, one patient may represent multiple discharges. In the present study, a discharge is referred to as a patient.

All patients undergoing pituitary surgery were identified using ICD-9 codes (International Classification of Diseases, 9th Revision, Clinical Modification) 07.13, 07.14, 07.61, 07.62, 07.64, and 07.65. Analysis was limited to patients whose race was coded as white, black, or Hispanic as the most highly represented groups.

Variables

We first examined the variables age, gender, number of chronic conditions, number of procedures on record, income quartile, and primary expected payer. Payment type was divided into Medicare, Medicaid, private insurance, and other. Hospital variables examined were size of hospital categorized into small, medium, and large hospitals by number of beds; hospital location and teaching status categorized into rural, urban nonteaching, and urban teaching; hospital geographical region; and hospital ownership categorized into nonfederal government, not-for-profit, and investor owned. These variables were chosen to evaluate patient and hospital characteristics and their association with racial and ethnic group, and also to establish significant cohort characteristics for regression analysis. Although "Hispanic" is considered to be an ethnic group, this variable is independently coded as a race in the NIS and will be referred to as such in the body of this paper.

Hospital charges and LOS are reported in the NIS database. Hospitalization cost was calculated from hospital charges using HCUP cost-to-charge ratio files,[16] and cost data from the 2008 to 2011 databases were adjusted for inflation to 2012 rates.

Data Analyses

Data analysis examined the influence of race on hospitalization cost and LOS. First, the association between patient, hospital, and complication variables with racial groups was examined using chi-square tests or Fisher's exact tests as appropriate. For purposes of binomial logistic regression, racial groups were dichotomized into indicator variables (black/white, black/Hispanic, Hispanic/white) to allow for direct comparison. All patient and hospital variables found to be significantly associated with race were used in logistic regression, and each complication found to be significant was tested for significance in this analysis.

Next, simple linear regression analysis was performed for all described variables to determine significant differences in cost and LOS. Racial groups were again dichotomized (white/other, black/other, Hispanic/other) to be independently included in multiple linear regression analysis. All variables found to be significantly associated with cost or LOS were compared against each racial indicator variable to determine the influence of each race on these variables. A p value of < 0.05 was considered significant. Statistical analyses

were performed using SPSS Statistics Version 22 (IBM Corporation, Armonk, New York, United States).

Results

There were 8,812 patients who underwent pituitary surgery. Five-thousand nine-hundred twenty four (67.2%) patients were white, 1,590 (18.0%) were black, and 1,296 (14.7%) were Hispanic. Patient and hospital characteristics by racial and ethnic group are shown in ►**Table 1**. Significant income disparities exist between the groups, with white patients more frequently residing in higher-income zip codes (57.6%) as compared with black (35.6%) and Hispanic (43.3%) patients ($p < 0.001$). Black and Hispanic patients also less frequently had private health insurance (45.9% and 45.4%, respectively) when compared with white patients (63.4%, $p < 0.001$). White patients also had pituitary surgeries performed at hospitals with a higher case volume than either of the other two groups ($p < 0.001$).

Analysis of Cost and LOS by Patient and Hospital Characteristics

Multiple patient and hospital characteristics had statistically significant impacts on cost and LOS, and these results are summarized in ►**Table 2**. Male gender was associated with a lower hospitalization cost, while number of chronic conditions and number of previous hospital procedures accompanied expectedly higher hospitalization costs and longer LOS. Patient race and ethnicity had a large association with hospitalization costs, with much lower hospitalization costs for white patients (−$5,246, 95% confidence interval [CI] −$6,247 to −$4,246, $p < 0.001$) and much shorter hospital stays (−1.82 days, P5% CI −2.14 to −1.51, $p < 0.001$) than black patients ($3,229, 95% CI $2,001 to $4,456 and 1.42 days,

Table 1 Patient and hospital characteristics by racial and ethnic group

Variable	White ($n = 5,924$)	Black ($n = 1,590$)	Hispanic ($n = 1,296$)	p Value
Patient characteristics				
Age	51.8 ± 17.3	51.3 ± 15.4	45.5 ± 17.0	<0.001[a]
Chronic conditions, mean ± SD	3.5 ± 2.5	3.8 ± 2.6	3.0 ± 2.3	<0.001[a]
Male gender	49.5%	47.9%	44.4%	0.007[a]
Income quartile				<0.001[a]
0–25th percentile	18.9%	40.6%	35.1%	
26th–50th percentile	23.6%	23.9%	21.6%	
51st–75th percentile	26.8%	19.2%	24.3%	
76th–100th percentile	30.8%	16.4%	19.0%	
Primary payer				<0.001[a]
Medicare	25.2%	25.5%	15.0%	
Medicaid	5.7%	14.6%	20.8%	
Private insurance	63.4%	45.9%	45.4%	
Other	5.7%	14.0%	18.8%	
Region				<0.001[a]
Northeast	24.7%	19.5%	12.0%	
Midwest	15.1%	13.0%	4.6%	
South	34.2%	55.6%	42.1%	
West	26.0%	11.9%	41.4%	
Teaching status of hospital				<0.001[a]
Nonteaching	16.3%	13.8%	18.6%	
Teaching	83.7%	86.2%	81.4%	
Hospital case volume, mean ± SD	52.6 ± 46.8	37.1 ± 37.1	44.8 ± 43.1	<0.001[a]
Procedures on record, mean ± SD	2.5 ± 2.0	2.7 ± 2.3	2.7 ± 2.4	0.051
Surgical approach				<0.001[a]
Transsphenoidal	93.6%	92.4%	89.9%	
Transfrontal	6.2%	7.0%	9.9%	

Abbreviation: LOS, length of stay; SD, standard deviation.
[a]Statistical significance.

Table 2 Unadjusted linear regression analysis of patient/hospital variables with hospitalization cost and LOS

	Hospitalization cost			LOS		
Variable	**Coefficient (95% CI)**		***p* Value**	**Coefficient (95% CI)**		***p* Value**
Age	−$36	(−$64 to -$9)	0.009[a]	−0.01	(−0.013 to 0.004)	0.306
Male gender	−$1,081	(−$133 to −$2,029)	0.025[a]	0.09	(−0.21 to 0.39)	0.537
Chronic conditions	$1,856	($1,670 to $2,043)	<0.001[a]	0.62	(0.56 to 0.67)	<0.001[a]
Procedures on record	$5,353	($5,166 to $5,539)	<0.001[a]	1.48	(1.42 to 1.54)	<0.001[a]
Race						
White	−$5,246	(−$6,247 to −$4,246)	<0.001[a]	−1.82	(−2.14 to −1.51)	<0.001[a]
Black	$3,229	($2,001 to $4,456)	<0.001[a]	1.42	(1.03 to 1.81)	<0.001[a]
Hispanic	$5,359	($4,036 to $6,682)	<0.001[a]	1.53	(1.11 to 1.95)	<0.001[a]
Income quartile						
0–25th percentile	$1,385	($284 to $2,486)	0.014[a]	1.05	(0.71 to 1.40)	<0.001[a]
26th–50th percentile	−$576	(−$1,704 to $553)	0.317	0.04	(−0.32 to 0.40)	0.829
51st–75th percentile	$384	(−$722 to $1,490)	0.496	−0.16	(−0.51 to 0.19)	0.371
76th–100th percentile	−$1,344	(−$2,426 to −$263)	0.015[a]	−0.97	(−1.31 to −0.63)	<0.001[a]
Primary payer						
Medicare	−$183	(−$1,295 to $929)	0.747	0.22	(−0.13 to 0.57)	0.224
Medicaid	$12,674	($11,087 to $14,261)	<0.001[a]	3.92	(3.41 to 4.42)	<0.001[a]
Private insurance	$5,496	(−$6,445 to −$4,546)	<0.001[a]	−1.92	(−2.22 to −1.62)	<0.001[a]
Hospital						
Size						
Small	−$2,929	(−$4,964 to −$893)	0.005[a]	−1.25	(−1.92 to −0.59)	<0.001[a]
Medium	$432	(−$951 to $1,815)	0.541	0.70	(0.27 to 1.14)	0.002[a]
Large	$221	(−$949 to $1,391)	0.711	−0.47	(−0.84 to −0.10)	0.013[a]
Location/teaching status						
Rural	$4,098	(−$197 to $8,393)	0.061	0.55	(−0.68 to 1.78)	0.382
Urban nonteaching	−$232	(−$1,544 to $1,080)	0.729	0.05	(−0.38 to 0.48)	0.816
Urban teaching	−$618	(−$1,850 to $615)	0.326	−0.50	(−0.90 to −0.10)	0.013[a]
Region						
Northeast	−$1,029	(−$2,257 to $200)	0.101	−0.31	(−0.67 to 0.06)	0.099
Midwest	$867	(−$496 to $2,229)	0.213	−0.06	(−0.51 to 0.38)	0.782
South	−$1,281	(−$2,241 to −$322)	0.009[a]	0.69	(0.39 to 1.00)	<0.001[a]
West	$1,895	($809 to $2,980)	0.001[a]	−0.55	(−0.89 to −0.21)	0.002[a]
Ownership						
Government, nonfederal	$3,170	($2,013 to $4,327)	<0.001[a]	1.09	(0.71 to 1.47)	<0.001[a]
Private, not-for-profit	−$1,198	(−$2,228 to −$167)	0.023[a]	−1.14	(−1.47 to −0.81)	<0.001[a]
Private, investor-owned	−$4,870	(−$6,638 to −$3,101)	<0.001[a]	0.02	(−0.56 to −0.60)	0.945

Abbreviations: CI, confidence interval; LOS, length of stay.
[a]Statistical significance.

95% CI 1.03 to 1.81, $p < 0.001$) or Hispanic patients ($5,359, 95% CI $4,036 to $6,682 and 1.53 days, 95% CI 1.11 to 1.95, $p < 0.001$).

Socioeconomic status and insurance primary payer also played significant roles in hospitalization costs and LOS. Patients in the lowest income quartile had significantly higher costs and longer LOS on average, while patients in the highest income quartile had lower hospitalization costs and shorter LOS ($p < 0.001$). Hospitalization cost was lowest for patients with Medicare, while patients with private insurance or Medicaid had much higher hospitalization expenses. Lastly, private insurance status was inversely correlated with LOS, and patients with Medicaid insurance had longer LOS ($p < 0.001$).

Small hospitals had lower costs of hospitalization and shorter LOS than medium or large sized hospitals ($p = 0.005$), and hospitals in the West had higher hospitalization costs despite also having significantly shorter LOS than hospitals in other regions of the United States ($p = 0.002$). Private hospitals, both not-for-profit and investor-owned, were cheaper than nonfederal government-run hospitals ($p < 0.001$). Not-for-profit private hospitals had significantly shorter LOS for patients, while nonfederal government-run hospitals had a longer patient LOS ($p < 0.001$).

Effects of Race on Hospitalization Cost and LOS

After looking at all variables individually, multiple linear regression analysis was then used to compare the influence of each race on cost and LOS, taking into consideration only those variables found to be statistically significant and controlling for these variables. These results are summarized in ►**Table 3**. Hospitalization cost is significantly lower for whites (−$3,082, 95% CI –$3,961 to −$2,202, $p < 0.001$, $R^2 = 0.323$) and significantly higher for both blacks ($1,889, 95% CI $842–$2,937, $p < 0.001$, $R^2 = 0.320$) and Hispanics ($2,997, 95% CI $1,842–$4,152, $p < 0.001$, $R^2 = 0.321$). Length of hospital stay was correspondingly significantly lower in whites (–1.01, 95% CI –1.31 to −0.72, $p < 0.001$, $R^2 = 0.241$) and significantly higher for both blacks (0.65, 95% CI 0.30–1.00, $p < 0.001$, $R^2 = 0.239$) and Hispanics (0.96, 95% CI 0.57–1.35, $p < 0.001$, $R^2 = 0.239$).

Discussion

In this study, we investigated systematic variations in cost of hospitalization for pituitary surgery using the Nationwide Inpatient Sample, a discharge database encompassing 20% of all nonfederal hospital discharges from 2008 to 2012.[17] Using this resource, we were able to identify several patient and hospital factors affecting cost variation, and highlight some general trends regarding race, hospitalization expense, and LOS.

Overall, our findings suggest that race has a significant association on costs, with black and Hispanic patients having significantly higher hospitalization costs and longer LOS than white patients, even when controlling for several other individual patient factors, including age, socioeconomic status, and number of chronic conditions. The reasons for these discrepancies are not fully elucidated and are likely multifactorial. Our previous work has demonstrated that black and Hispanic patients have increased complication rates following pituitary surgery, including the development of central nervous system infections.[6] Increased complications could be driving higher costs in this group, necessitating longer hospital stays and further expensive workup. Established literature also suggests that for other types of cancers, minorities present at a significantly later stage at diagnosis and are less likely to have insurance.[14,15] This is likely extremely important in relation to access to care. Individuals without health insurance often delay seeking treatment,[18] which can lead to more challenging surgical procedures with elevated morbidity and mortality. Separate studies have also demonstrated that education level is a good predictor of survival in head and neck cancer, even independent of socioeconomic or other demographic variables.[19] We did not look at education level specifically in this investigation, but this is a confounding factor to consider if this information is available in future work.

Beyond race and ethnicity, socioeconomic status and insurance status also had an unambiguous influence on hospitalization status and LOS. Individuals with the lowest incomes had substantially higher costs and longer LOS, while individuals with the highest incomes had less expensive hospitalizations with shorter LOS. This is likely linked to patient support networks and resources following discharge, as patients of a higher socioeconomic status have more structures in place to support outpatient care, potentially lessening the need for a prolonged hospital stay.[20] Patients of lower socioeconomic status may be less likely to be discharged without certainty of follow-up or appropriate postoperative supports outside of the hospital. Previous work has also shown that Medicaid insurance status can potentially

Table 3 Multiple linear regression analysis of racial group influence on hospitalization cost and LOS compared against statistically significant patient and hospital variables

	Hospitalization cost			LOS		
Race	Coefficient (95% CI)		*p* Value	Coefficient (95% CI)		*p* Value
White	−$3,082	(−$3,961 to −$2,202)	<0.001[a]	−1.01	(−1.31 to −0.72)	<0.001[a]
Black	$1,889	($842 to $2,937)	<0.001[a]	0.65	(0.30 to 1.00)	<0.001[a]
Hispanic	$2,997	($1,842 to $4,152)	<0.001[a]	0.96	(0.57 to 1.35)	<0.001[a]

Abbreviations: CI, confidence interval; LOS, length of stay.
[a]Statistical significance.

serve as a proxy for socioeconomic status,[8] and our analysis demonstrated that Medicaid patients had the highest hospitalization expenses and longest LOS. Conversely, patients with private insurance had the shortest LOS, likely reflecting both increased socioeconomic status and financial pressures for expedient discharge.

Expectedly, patients with a large number of chronic conditions or previous hospital-based procedures had higher hospitalization costs for pituitary surgery and longer LOS. Hospitalization cost and LOS are also inextricably linked. While these correlations are perhaps less opaque than the influence of other demographic factors on cost, they are important to consider as hospitals provide individualized value-based care of all chronic conditions during a hospital visit. Higher costs may be anticipated or tolerable for delivery of more complex medical care.

Individual patient characteristics were not the only influential factors on our cost end points; hospital factors such as location, ownership, and size also demonstrated significant influential variations. Smaller hospital size or private ownership was independently associated with decreased costs, and nonfederal government-run hospitals were both more expensive and had longer LOS for patients. When broken down by region, hospitals in the western United States were more expensive while also having shorter LOS. This etiology for this discrepancy is unknown, but can be postulated to be due to more rural location and more limited hospital resources in this area of the country. An additional critical factor to consider is surgeon experience. At hospitals with lower pituitary surgical volume, relative procedural inexperience may contribute to increased costs and LOS without well-defined defined operative or postoperative procedures and pathways.

This study is limited to reviewing the factors available and recorded in the NIS database, and the accuracy is dependent on coding provided by contributing institutions. It is likely that there are additional elements beyond the ones that we investigated that influence cost and LOS. While we attempted to control for confounding and effect modification between our factor variables, intrapatient demographic data are inherently related, and each variable cannot truly be examined in isolation.

Conclusion

We provide compelling evidence that hospital cost and LOS disparities exist among racial groups, socioeconomic strata, and health care providers. Racial and ethnic minorities, poorer patients with Medicaid, and nonfederal government-run hospitals comprise the groups with the highest costs and LOS, likely largely due to systemic inequalities in health care access and efficient delivery. It is our hope that awareness of the key influences on cost variation will help eliminate some of these disparities, while also helping attenuate increasing health care expenditure in the United States. The impetus to provide cost-effective, equal care to all groups regardless of backgrounds is clearly present today, and identification of areas to improve is a critical first step.

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References

1 Reinhardt UE, Hussey PS, Anderson GF. U.S. health care spending in an international context. Health Aff (Millwood) 2004;23(03):10–25
2 Epstein AM, Stern RS, Weissman JS. Do the poor cost more? A multihospital study of patients' socioeconomic status and use of hospital resources. N Engl J Med 1990;322(16):1122–1128
3 Mehta V, Flores JM, Thompson RW, Nathan CA. Primary payer status, individual patient characteristics, and hospital-level factors affecting length of stay and total cost of hospitalization in total laryngectomy. Head Neck 2017;39(02):311–319
4 Fisher ES, Wennberg DE, Stukel TA, Gottlieb DJ, Lucas FL, Pinder EL. The implications of regional variations in Medicare spending. Part 2: health outcomes and satisfaction with care. Ann Intern Med 2003;138(04):288–298
5 Divi V, Tao L, Whittemore A, Oakley-Girvan I. Geographic variation in Medicare treatment costs and outcomes for advanced head and neck cancer. Oral Oncol 2016;61:83–88
6 Goljo E, Parasher AK, Iloreta AM, Shrivastava R, Govindaraj S. Racial, ethnic, and socioeconomic disparities in pituitary surgery outcomes. Laryngoscope 2016;126(04):808–814
7 Hall EC, Hashmi ZG, Zafar SN, Zogg CK, Cornwell EE III, Haider AH. Racial/ethnic disparities in emergency general surgery: explained by hospital-level characteristics? Am J Surg 2015;209(04):604–609
8 Mukherjee D, Patil CG, Todnem N, et al. Racial disparities in Medicaid patients after brain tumor surgery. J Clin Neurosci 2013;20(01):57–61
9 Alosh H, Li D, Riley LH III, Skolasky RL. Health care burden of anterior cervical spine surgery: national trends in hospital charges and length of stay, 2000-2009. J Spinal Disord Tech 2015;28(01):5–11
10 Schoenfeld AJ, Tipirneni R, Nelson JH, Carpenter JE, Iwashyna TJ. The influence of race and ethnicity on complications and mortality after orthopedic surgery: a systematic review of the literature. Med Care 2014;52(09):842–851
11 Girotti ME, Shih T, Revels S, Dimick JB. Racial disparities in readmissions and site of care for major surgery. J Am Coll Surg 2014;218(03):423–430
12 Quality AfHRa. National Healthcare Disparities Report. Rockville, MD: Agency for Healthcare Research and Quality; 2013
13 Healthy People 2020. Department of Health and Human Services, Office of Disease Prevention and Health Promotion: Washington, DC
14 Ragin CC, Langevin SM, Marzouk M, Grandis J, Taioli E. Determinants of head and neck cancer survival by race. Head Neck 2011; 33(08):1092–1098
15 Gourin CG, Podolsky RH. Racial disparities in patients with head and neck squamous cell carcinoma. Laryngoscope 2006;116(07): 1093–1106
16 HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). Quality AfHRa (Ed). Rockville, MD: Agency for Healthcare Research and Quality: 2008–2012
17 Quality AfHRa. HCUP National Inpatient Sample (NIS) Healthcare Cost and Utilization Project (HCUP). Rockville, MD: Agency for Healthcare Research and Quality 2008–2011
18 Weissman JS, Stern R, Fielding SL, Epstein AM. Delayed access to health care: risk factors, reasons, and consequences. Ann Intern Med 1991;114(04):325–331
19 Choi SH, Terrell JE, Fowler KE, et al. Socioeconomic and other demographic disparities predicting survival among head and neck cancer patients. PLoS One 2016;11(03):e0149886
20 Billings J, Zeitel L, Lukomnik J, Carey TS, Blank AE, Newman L. Impact of socioeconomic status on hospital use in New York City. Health Aff (Millwood) 1993;12(01):162–173