National Trends in Health Care Utilization

And Disparities in Pediatric Pyogenic Arthritis

By

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Abstract

OBJECTIVE: To determine the national trends in health care utilization and disparities in pediatric pyogenic arthritis over a thirteen-year period.

METHODS: We determined the trends in length of hospital stay, disposition, and total cost for pediatric patients hospitalized with pyogenic arthritis from 1988 to 2000. Patients were selected using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9, CM) codes in the Nationwide Inpatient Sample (NIS). The NIS is part of the Healthcare Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality (AHRQ). There were 12,925 cases analyzed by age, prematurity, joint location, socioeconomic status, and race.

RESULTS: The average length of stay (LOS) decreased from 10 days in 1988 to 5 days in 2000, with whites having a shorter LOS than non-whites. LOS decreased for both whites and non-whites but the difference in length of stay between the two remained constant. LOS was also shorter for patients with a higher socioeconomic status but differences in LOS between socioeconomic classes decreased from 1988 to 2000. The percentage of patients being discharged to home health care increased from 1988 to 2000. Both whites and non-whites had an increase in percentage of patients discharged to home health care but the increase was much greater for whites than non-whites. Inflation adjusted total cost increased over time.

CONCLUSIONS: There was a trend toward decreased health care utilization but no decrease in cost due to pediatric pyogenic arthritis from 1988 to 2000. Disparities between whites and non-whites exist and have not improved over time.

Keywords: length of stay / utilization / arthritis, infectious / costs and cost analysis / patient discharge / pediatrics

Introduction

The United States spends more money, both in actual dollars and as a percentage of the Gross Domestic Product (GDP), on health care than any other country in the world.[1] This rate has been increased substantially over the last decades[2], with hospital spending being the key driver in this trend.[2,3] Although hospitalizations due to infectious diseases are responsible for a large percentage of this increase[4,5], few studies have evaluated this upward trend.

This upward trend in health spending provides the impetus to find ways to decrease health care utilization and the associated cost. Because of the impact of hospital spending on total health care expenditures, reduction in the delivery of inpatient services has been one of the main strategies to reduce health care costs.[6] One way to reduce the use of inpatient services is to reduce the length of stay of a given hospitalization. In the case of septic arthritis, which has traditionally required a two to four week length of stay to finish a complete course of parenteral antibiotics, [7,8,9] research has been aimed at finding treatments to reduce the length of time required for intravenous antibiotics. [10,11] This research has the potential to reduce the length of stay associated with pyogenic arthritis. A reduced length of hospital stay, either through a shortened course of parenteral antibiotics or through outpatient antibiotic therapy, can lead to a decrease in health care utilization due to pyogenic arthritis. [12] In this paper, we have attempted to assess whether the length of hospital stay has declined for patients with pyogenic arthritis and whether this resulted in decreased medical costs.

Along with rising health care costs, the unequal treatment of racial and ethnic minorities has also received national attention. [13] These concerns lead to one of the

goals of the Healthy People 2010 initiative being to eliminate racial and ethnic disparities in six key health areas. Studies have shown higher mortality rates for minorities with stroke, diabetes, cancer, heart disease, acquired immunodeficiency syndrome (AIDS), and lung disease. Infection was second only to cardiovascular disease in terms of major categories of disease contributing to disparities in mortality. [14] Due to the contribution of infectious disease to the problem in health disparities, we attempted to assess whether disparities also exist for pediatric pyogenic arthritis. In this paper, we also attempted to discover if the efforts being made to reduce the length of stay associated with pyogenic arthritis[10,11], would have an impact on any racial disparities that do exist.

Methods:

Study Population

Patients with ICD-9, CM (International Classification of Diseases, Ninth Revision, Clinical Modification) diagnostic codes for pyogenic arthritis were selected from the Nationwide Inpatient Sample (NIS) (Appendix-A). Patients over the age of 21 were excluded.

The NIS databases provide demographic data, admission and discharge dates, inpatient stay records including clinical and resource use information typically available from discharge abstracts, as well as discharge status. The procedure and diagnostic codes are classified according to the ICD-9, CM. The NIS is part of the Healthcare Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality (AHRQ), and contains 5 to 8 million hospital stays from about 1000 hospitals to approximate a 20% stratified sample of the U.S. community hospitals. Sampling strata were employed for the creation of the NIS based on five hospital characteristics to ensure maximal representativeness of the US population (geographic region, ownership, location, teaching status, bedsize). The NIS contains data over a 13-year time period, from 1988 to 2000, allowing for analysis of trends over time.

The NIS was validated by reviewing the univariate statistics for all numeric data elements, checking range against norms, frequency distributions for all categorical and some continuous data elements, and performing edit checks that identify inconsistencies

between related data elements.[15] The NIS also performed well for many estimates when validated against the National Hospital Discharge Survey (NHDS).[16]

Outcomes

Length of stay (LOS): LOS, measured in days, was defined as the difference between date of admission and date of discharge of the patient. Length of stay was coded as 0 for patients discharged within 23 hours from admission.

Disposition: Patient disposition was dichotomized into those receiving home health care and those that did not.

Total charges: Total charges were the charges of a patient's hospitalization, not including professional fees and non-covered charges. Values were adjusted for inflation to represent year 2000 dollars[17] and rounded to the nearest dollar. Zero and negative values were set to missing.

Covariates

Patients (<21 years old) were categorized into neonates (<90 days old), children (90 days old – 13 years old) and adolescents (13-21 years old). Neonates were considered premature if they had a birthweight of 1000-2499 grams and/or gestation of 28-37 completed weeks, and extremely premature if they had a birthweight of less than 1000

grams and/or a gestation of less than 28 completed weeks (Appendix B). Joint location was coded as pelvic region and thigh, lower leg (lower leg, ankle, and foot) and other (unspecified site, shoulder region, upper arm, forearm, hand, other specified sites, and multiple sites). Race was categorized as whites, blacks, and others. Socio-economic status (SES) was categorized using the median household income for the patient's ZIP code. It was divided into four categories: $1-$24,999 (lower), $25,000-$34,999 (lower-middle), $35,000-$44,999 (upper-middle), and $45,000 and above (upper).

Statistical Methods

The NIS database is a stratified probability sample and calculations were adjusted for survey sampling characteristics (probability weights, cluster sampling, and stratification). All statistical analyses were performed using Stata version 8.0 (Stata Corporation, Intercooled Stata 8.0 for Unix).

Results

The databases contain information about 12,925 inpatient encounters for treatment of pyogenic arthritis.

Baseline Characteristics

In the total patient population, the majority of the cases (69.6%) were children, male (63.8%), and predominantly white (37.5%). Among the adolescents, over two thirds (71.8%) of the patients were male. Patients were evenly distributed across the four income categories with no group being represented by less than 17%. Overall, the most common site of infection was the lower leg (38.6%). This is in contrast with neonates, where the pelvis or thigh region was more common (33.0%) than the lower leg (31.9%). For adolescents the pelvis or thigh region was less common (9.3%) than the lower leg (39.1%). (Table 1)

LOS

The average length of stay was 25.3 days for a neonate, 9.5 days for a child, and 8.0 days for an adolescent. Of the 373 neonates with pyogenic arthritis, 42 patients (11.3%) had an ICD-9 code for prematurity, and 24 (6.4%) had a code for extreme prematurity. Extremely premature infants had a longer mean LOS (62.25 days) than did premature

infants (44.55 days). Both groups had a longer LOS than those without a prematurity code (18.90 days). LOS was longer for those with a pelvis or thigh infection (10.57 days) than those with a lower leg or other infection (8.84 days). The average length of stay declined steadily across the thirteen years of the study (figure 1).

In 1988, LOS was longer for patients with a lower socio-economic status compared to patients with a higher socio-economic status. The difference in LOS between different socio-economic groups was significantly reduced by the year 2000 (figure 2). Overall there was a trend towards a shorter LOS over time but the difference in LOS for whites versus blacks and others did not change significantly over the thirteen years (figure 3).

Disposition

There were 20 in-hospital deaths among the 12, 925 patients (0.2%), with no preference for neonates (1/373, 0.3%), children (15/8997, 0.2%), or adolescents (4/3555, 0.1%). Adolescents were more likely to receive home health care (13.2%) than neonates (11.5%) or children (11.7%). There was a trend over the thirteen years to send more people home to complete their care (figure 4). This increase was more prominent for patients from households with higher incomes (figure 5). The trend over the thirteen years was for patients of all races to receive home health care but the gap between whites and non-whites widened (figure 6).

Total charges

There was a trend toward an increase in total charges across the thirteen years (figure 7). Outliers were excluded.

Discussion

In 1988, patients with a higher SES had a shorter LOS compared to patients with a lower SES. Similarly, whites had a shorter LOS compared to non-whites. However, by the year 2000, SES was much less likely to predict LOS, while non-whites continued to have a longer LOS than whites. For all patients, regardless of race or SES, LOS has decreased from 1988 to 2000. Unfortunately the associated costs have actually increased.

To the best of our knowledge, this is the first attempt to demonstrate that the efforts to shorten the course of parenteral antibiotics required to treat patients with pyogenic arthritis[10,11] have actually resulted in a reduced length of hospital stay. Other studies have demonstrated that changes in treatment practices can reduce the LOS for a other conditions. Treating methicillin-resistant *Staphlococcus aureus* infections with Linezolid (available both intravenously and orally) as opposed to vancomycin (only available intravenously) facilitates earlier discharge from the hospital.[18] Despite assertions that decreasing the LOS by promoting earlier hospital discharge will significantly reduce the overall costs, in this case no evidence that costs were actually reduced was provided.[18] In some situations alternative treatments for a given disease have been shown to reduce both LOS and cost. Treating pyogenic liver abscesses with sequential intravenous/oral antibiotics as opposed to treating them with continuous intravenous antibiotics reduced both LOS and cost. [19] Treatment of gram-positive infections with intravenous linezolid followed by oral administration was found to reduce the length of stay and the associated cost of treatment when compared with

intravenous or intramuscular teicoplanin. [20] Our study found that while efforts to reduce the LOS associated with pyogenic arthritis have been successful, these efforts have not resulted in decreased costs.

While there has been a trend towards a reduced length of stay for all patients, the disparities between whites and non-whites has remained. Whites consistently have a shorter length of stay than non-whites across all thirteen years of the study. Other studies have shown similar differences by race for LOS. In 1995, white patients with systemic sclerosis had an average LOS 10% shorter than non-whites. [21] Additionally, from 1993 to 1997 the mean LOS for HIV-related admissions was found to be shorter for whites than non-whites. The mean LOS decreased over this time but the difference between races remained. [22] This may be an access to care issue. Patients that seek care later in the course of the illness will more than likely require a longer length of stay compared to patients with easier access to care that can begin treatment while the infection is still localized to one joint. The longer length of stay for non-whites may be due reduced access to care.

Non-whites have less access to care than whites as they are less likely to have health insurance, have more difficulty getting healthcare, and have less choice in their healthcare. [13] In addition, non-whites are less likely than whites to visit a primary care physician or have a usually source of care. [13, 23, 24] Disparities between whites and non-whites have also been found to exist for specific health care services, including rehabilitative and long-term services.[25] Whites tend to use home health care more often than non-whites.[26, 27] However, to the best of our knowledge, this is the first study that has specifically looked at trends in racial disparities in home health care. From 1988 to

2000, there was an increase in the difference between the percentage of whites receiving home health care for pyogenic arthritis compared to non-whites.

This study has several limitations. First the NIS database does not provide information regarding the timing of the diagnosis or when appropriate treatment was begun once the diagnosis was made. Second, there is no way to determine the severity of the infection or if the severity of infection was different for whites or non-whites, or different for people from different socio-economic classes. Additionally, a patient's race was missing for 36.3% of the cases. Third, it was not possible to determine if patients being discharged from the hospital were requiring readmission. A reduced length of stay would not indicate less health care utilization if patients were consistently having to be readmitted. While the database was designed to be a 20% stratified sample of the United States' population, trends in incidence of pyogenic arthritis could not be determined due the variation in the number of hospitals sampled and the dynamic population of the country.

Our study shows a decrease in health care utilization due to pyogenic arthritis over time but no associated decrease in cost. Disparities between whites and non-whites exist and have not improved over time. Future studies should examine geographic and insurance coverage differences to determine their effect on disparities. Also, a study should be performed to determine the clinical significance of an earlier hospital discharge. Readmission rates and the development of complications in patients discharged earlier need to be compared to patients with a longer LOS. Total health care utilization due to pyogenic arthritis and total cost can only be measured if patients with a shorter length of stay do as well as those that stayed in the hospital longer.

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Table 1. Baseline Characteristics for 12,925 Pediatric Patients with Pyogenic Arthritis, NIS, 1988 to 2000

		Total n = 12,925	Neonates n = 373	Children n = 8997	Adolescents n = 3555
Mean Age (years)		8.39	31.21 days	5.03	17.77
Gender	Male	63.8%	51.7%	61.1%	71.9%
	Female	36.2%	48.3%	38.9%	28.1%
	Missing	0.02%	0%	0%	0.06%
Race	White	37.5%	32.2%	37.0%	39.2%
	Black	13.1%	16.1%	12.6%	14.2%
	Other	13.1%	15.0%	14.2%	10.1%
	Missing	36.3%	36.7%	36.2%	36.5%
SES	Lower	29.2%	33.2%	29.1%	28.9%
	Lower Middle	22.0%	20.6%	21.9%	22.4%
	Upper Middle	18.1%	18.8%	18.2%	17.7%
	Upper	26.5%	22.8%	26.5%	26.6%
	Missing	4.3%	4.6%	4.2%	4.3%
Location	Pelvis and Thigh	23.9%	33.0%	29.3%	9.3%
	Lower Leg	38.6%	31.9%	38.6%	39.1%
	Other	37.6%	35.1%	32.1%	51.6%
Disposition	Home Health	12.1%	11.5%	11.7%	13.2%
	Other	87.5%	87.4%	88.0%	86.2%
	Missing	0.4%	1.1%	0.3%	0.7%
Mean LOS (days)		9.25	24.59	9.16	7.87

Figure 1. Average Length of Stay of Pyogenic Arthritis Patients, NIS, 1988-2000

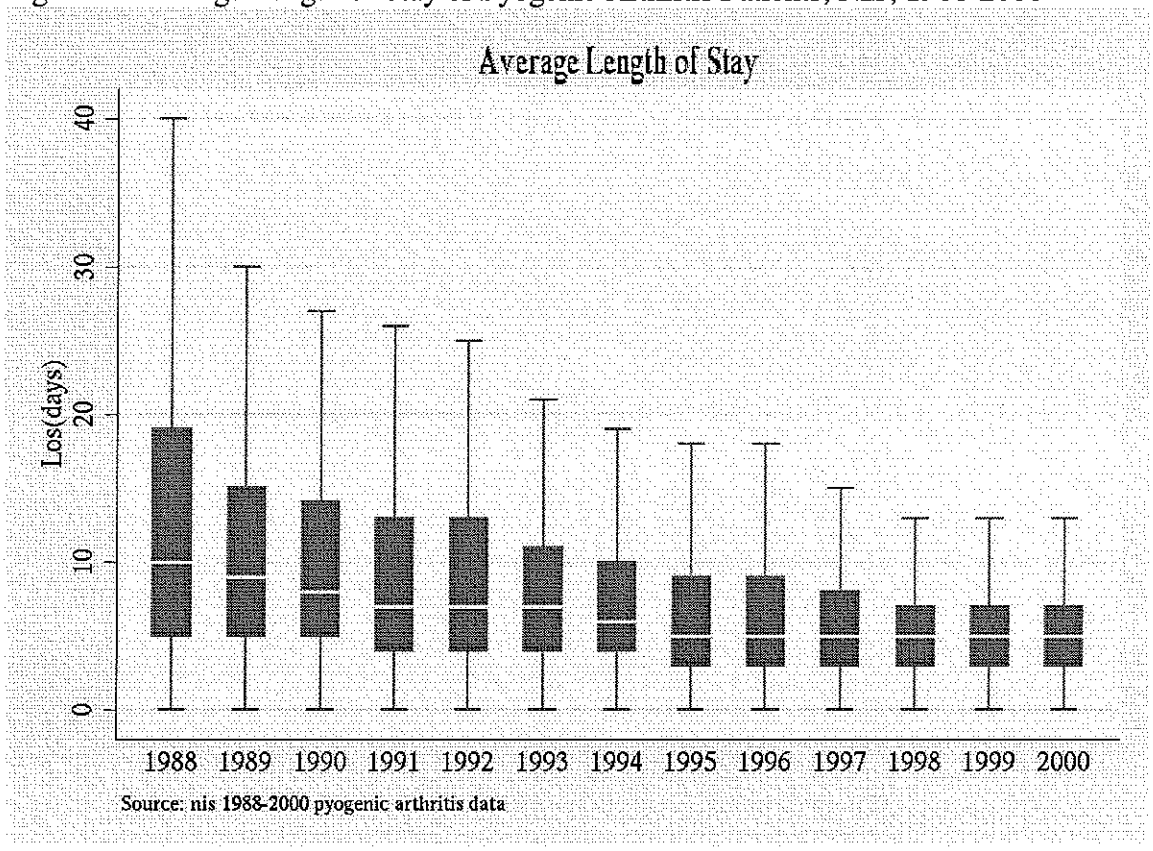


Figure 2. Average Length of Stay of Pyogenic Arthritis by Socioeconomic Status, NIS, 1988-2000

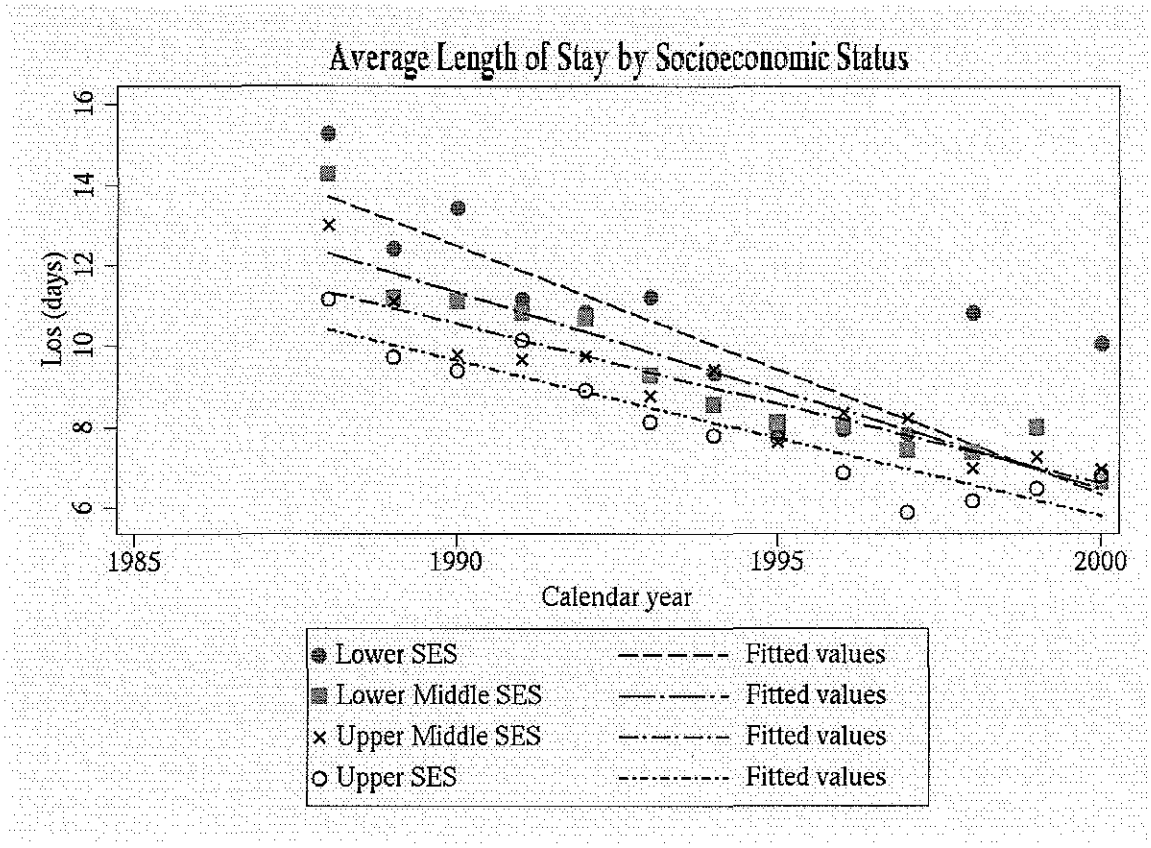


Figure 3. Average Length of Stay of Pyogenic Arthritis by Race, NIS, 1988-2000

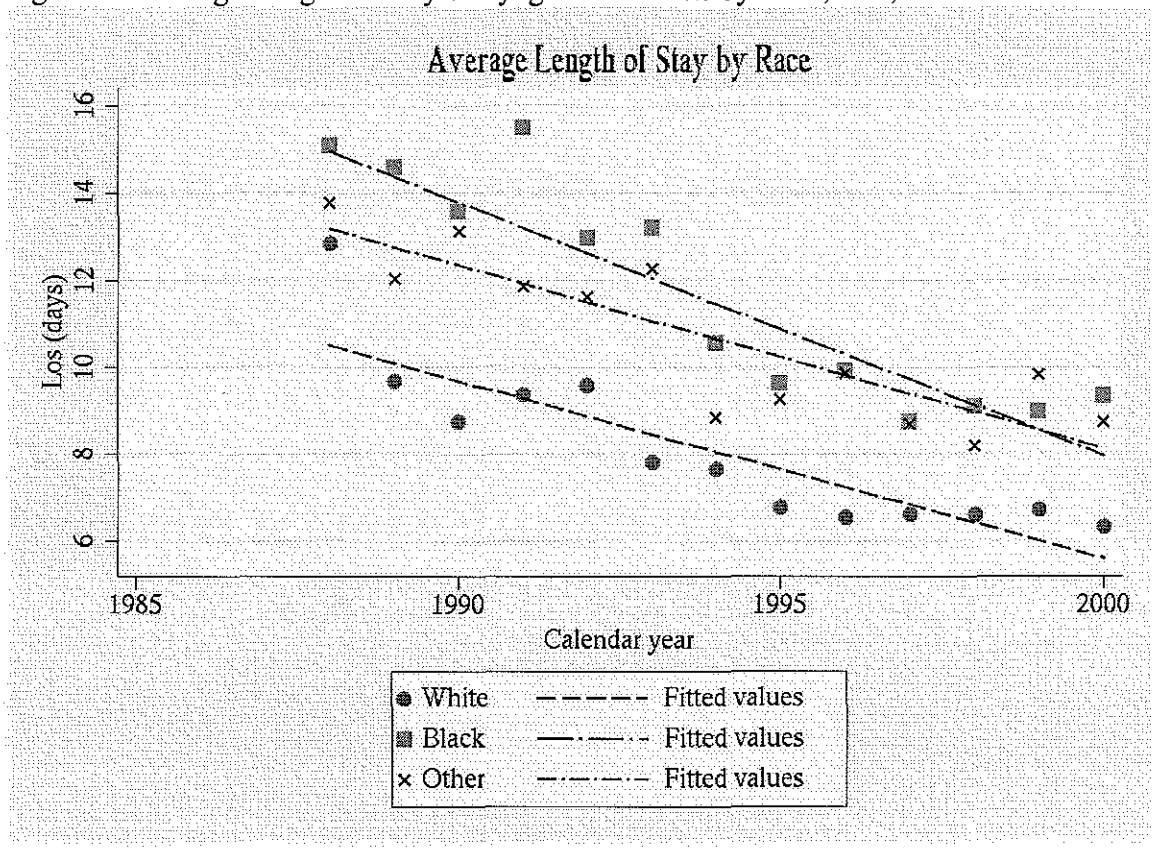


Figure 4. Percentage of Pyogenic Arthritis Patients Discharged to Home Health, NIS, 1988-2000

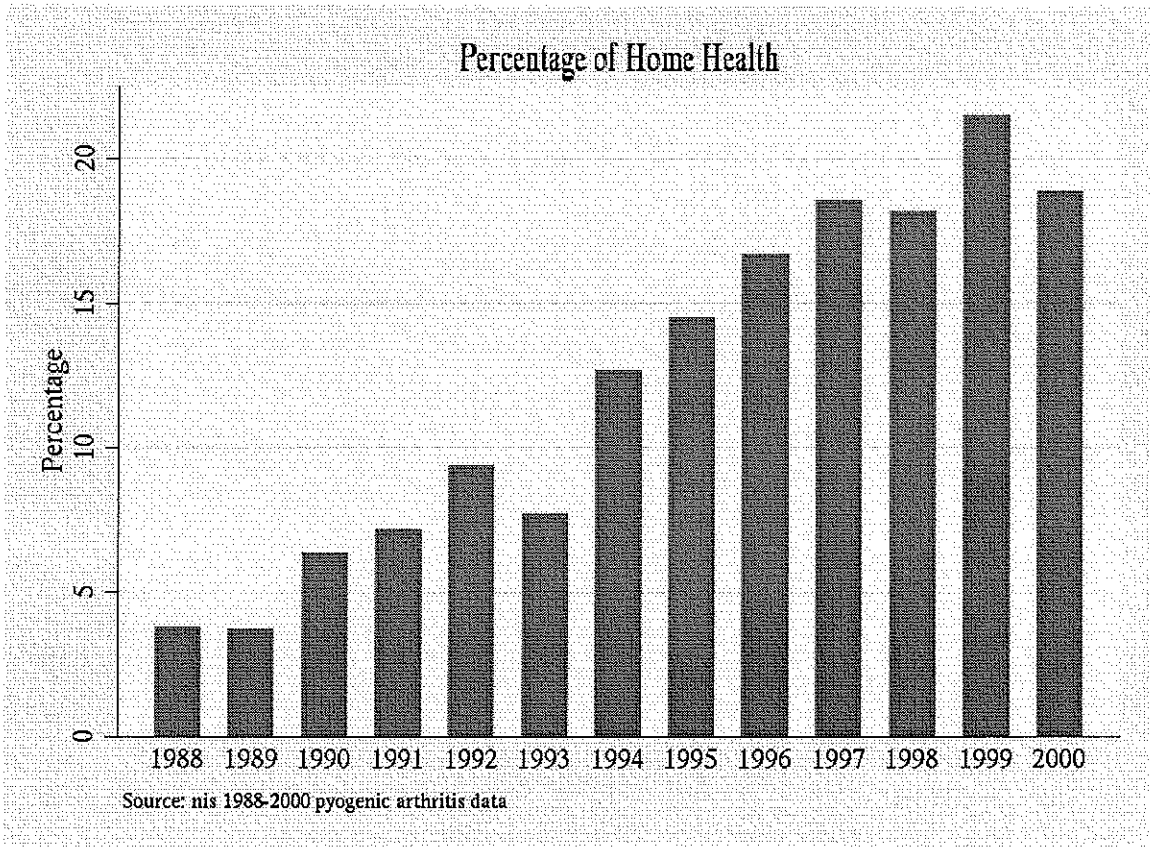


Figure 5. Percentage of Pyogenic Arthritis Patients Discharged to Home Health by Socioeconomic Status, NIS, 1988-2000

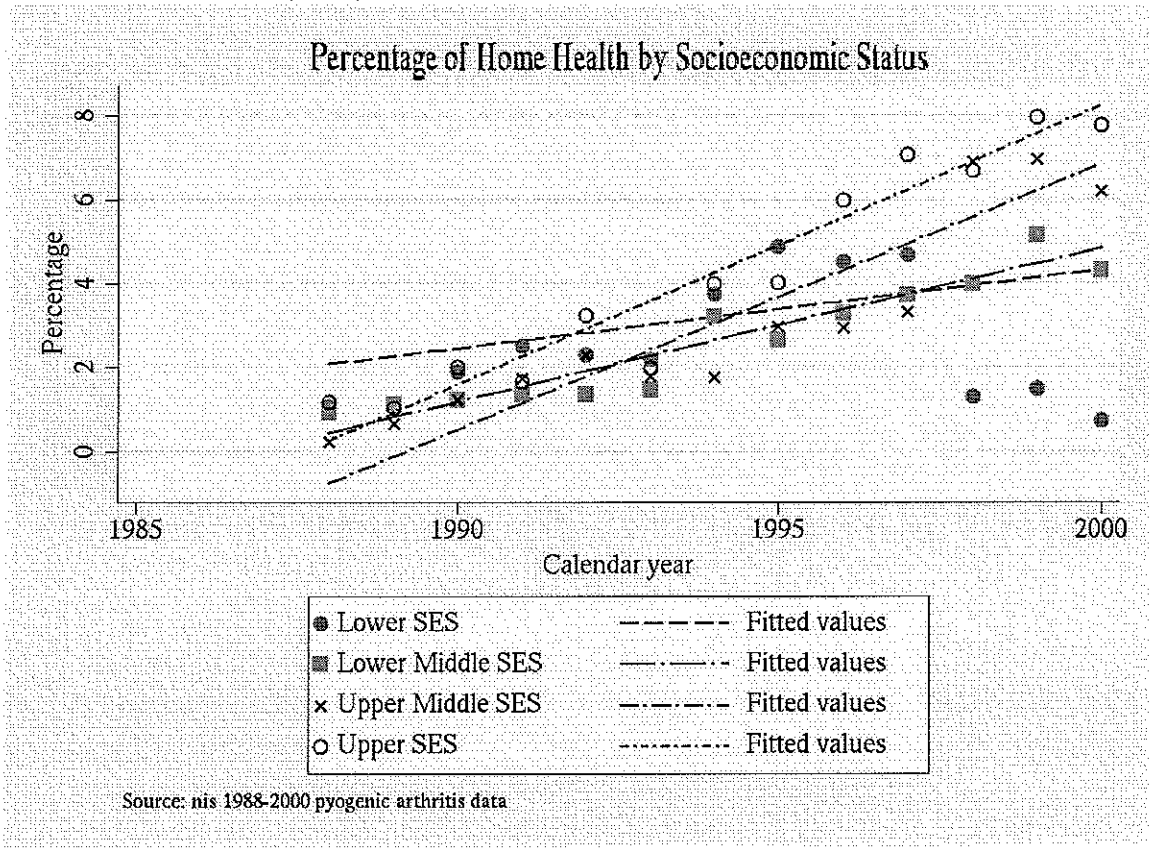


Figure 6. Percentage of Pyogenic Arthritis Patients Discharged to Home Health by Race, NIS, 1988-2000

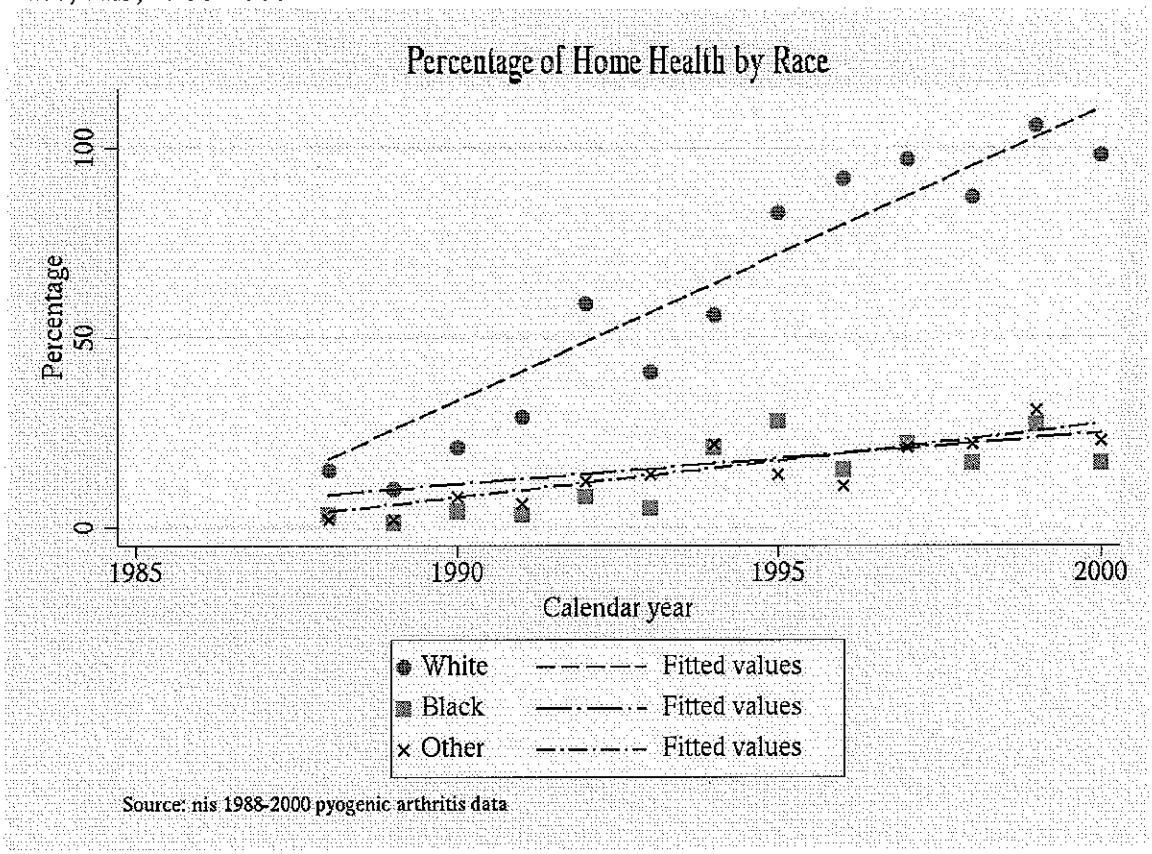
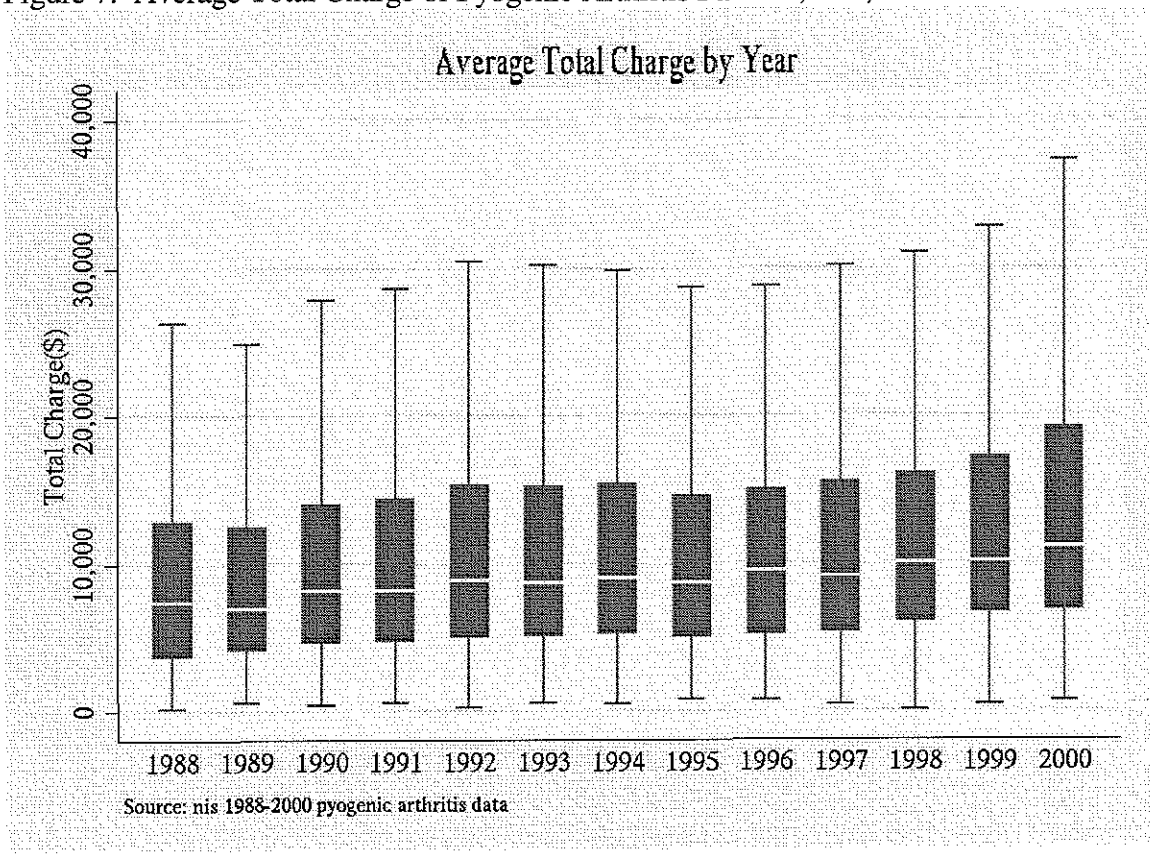


Figure 7. Average Total Charge of Pyogenic Arthritis Patients, NIS, 1988-2000



Appendix A. ICD-9, CM codes for Pyogenic Arthritis Patients.

Arthropathy associated with infections	711	
Pyogenic Arthritis	711.0	
Arthropathy associated with other bacterial diseases		711.4
Arthropathy associated with other viral diseases	711.5	
Arthropathy associated with mycoses		711.6
Arthropathy associated with other infectious and parasitic diseases	711.8	
Unspecified infective arthritis		711.9
The following fifth-digit subclassification is for use with category 711:		
site unspecified	0	
shoulder region	1	
upper arm	2	
forearm	3	
hand	4	
pelvic region and thigh	5	
lower leg	6	
ankle and foot	7	
other specified sites	8	
multiple sites	9	
Gonococcal arthritis	098.50	
Arthritis due to rubella	056.71	

Appendix B. ICD-9, CM codes for Prematurity.

Disorders relating to short gestation and unspecified low birthweight	765
Extreme immaturity (Usually implies a birthweight of less than 1000 grams and/or a gestation of less than 28 completed weeks)	765.0
Other preterm infants (Usually implies a birthweight of 1000-2499 grams and/or a gestation of 28-37 completed weeks)	765.1