



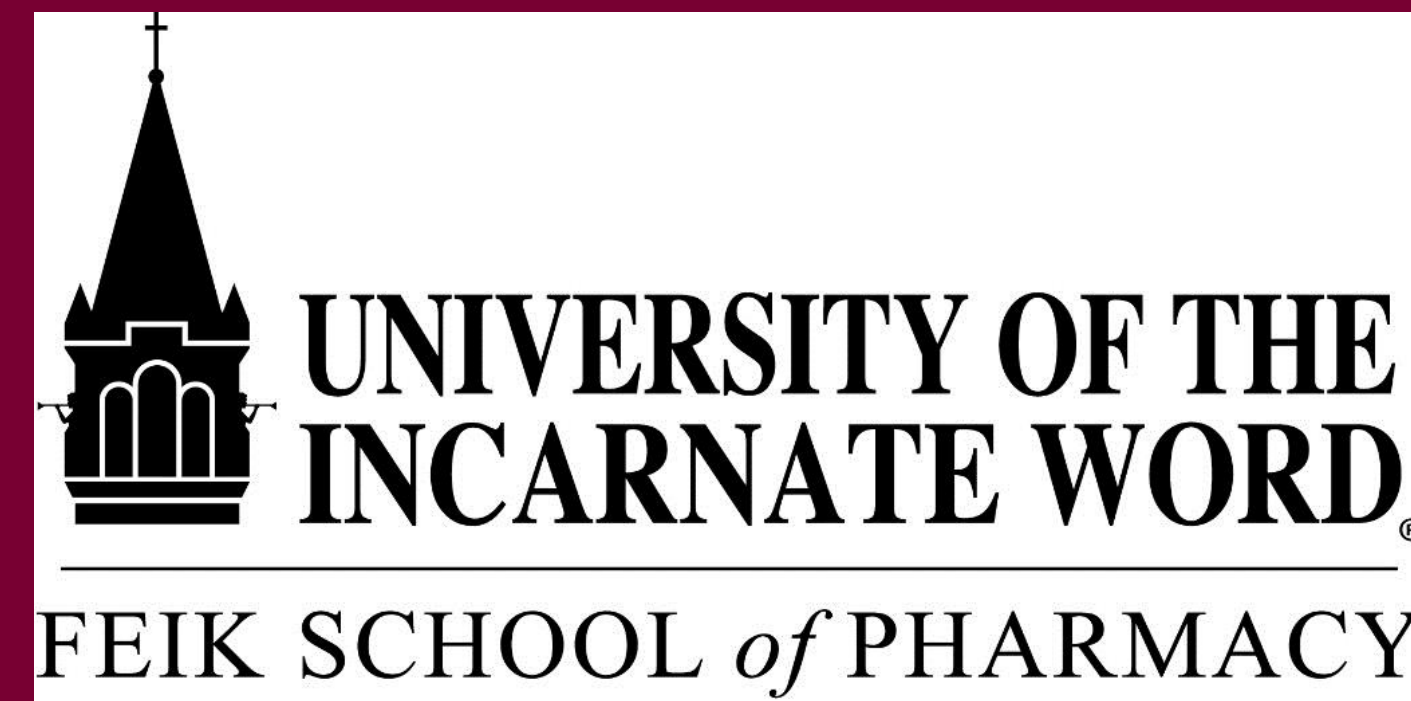
National Costs of Inpatient Pneumonia Care Among U.S. Adults from 2001-2012: Data from the U.S. National Inpatient Sample

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Abstract

Purpose: Limited national U.S. data describe the epidemiology of inpatient pneumonia care, particularly with regards to cost. Our primary objective was to describe current, national trends for the cost of adult, inpatient pneumonia care in the U.S. from 2001-2012.

Methods: We used the National Inpatient Sample (NIS) from the Agency for Healthcare Research and Quality's (AHRQ) Healthcare Cost and Utilization Project (HCUP) to extract cases of adults hospitalized with pneumonia in the U.S. from 2001-2012. Patients <18 years of age were excluded. We defined cases of pneumonia using ICD-9 codes into two groups: cases with a principal discharge diagnosis (PDD) of pneumonia, and cases with a PDD of sepsis or respiratory failure plus a secondary discharge diagnosis of pneumonia. Costs were adjusted to 2012 U.S. dollars using the medical consumer price index to determine inflation over time. Data weights were used to provide national estimates.

Results: We identified nearly 15.3 million cases of inpatient pneumonia from 2001-2012. Median age was 72 years (interquartile range [IQR], 58-82), 47.3% were male, and 60% were Caucasian. From 2001-2012, the average annual cost of care in the U.S. was \$16.6 billion, increasing from \$12.1 billion in 2001 to \$19 billion in 2012. The cost per pneumonia hospitalization has increased from \$10,632 in 2001 to \$14,239 in 2012. The mean annual cost to care for pneumonia cases with a PDD of pneumonia is substantially less than cases with a PDD of sepsis or respiratory failure (\$9,714 vs. \$24,534). Over the study period, the percentage of hospitalized pneumonia patients with a PDD of sepsis or respiratory failure has steadily increased from 11.2% in 2001 to 34.6% in 2012.

Conclusions: Costs of adult, inpatient pneumonia care increased from 2001-2012, which may be due to an increased proportion of cases with a PDD of sepsis or respiratory failure.

Background

- Limited data describe costs of inpatient pneumonia care in the U.S. [*Clin Ther* 1998;20(4):820; *Am J Med* 2013;126:266].
- In 2012, Lindenauer *et al.* described 2003-2009 data from the Nationwide (now termed National) Inpatient Sample and noted significant temporal changes in diagnostic coding of inpatient pneumonia [*JAMA* 2012;307(13):1405].
- Using the National Inpatient Sample from 2001-2012 and similar definitions for pneumonia as Lindenauer *et al.*, our primary objective was to describe the costs of inpatient pneumonia care over the study period. We hypothesized that the documented temporal changes in diagnostic coding may have significant effects on the cost of care.

Methods

- 2001-12 data from AHRQ's Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample (NIS)
- Data weights used to provide national population-based estimates
- Discharge diagnoses obtained via ICD-9-CM codes
- Pneumonia definition:
 - PNA 1** = Principal discharge diagnosis of pneumonia (481-486)
 - PNA 2** = Principal discharge diagnosis of respiratory failure (518.81, 518.82, 518.84, 799.1) **or** sepsis (038, 995.92, 995.91, 785.52) plus secondary discharge diagnosis of pneumonia
- Comorbidities defined using HCUP's Clinical Classifications Software (CCS)
- Costs were adjusted to 2012 dollars using the medical consumer price index provided by the U.S. Bureau of Labor Statistics
- U.S. census data was used for population statistics

Results

Table 1: Patient Characteristics

Variable	Overall (n=15,253,750)	PNA 1 (n=11,778,614)	PNA 2 (n=3,475,136)
Age, years; median, IQR	72, 58-82	73, 58-82	72, 59-82
Male sex, %	47.3	46.8	49.0
†Race, %			
White	60.0	59.8	60.6
Black	9.1	8.6	10.6
Hispanic	5.8	5.7	6.4
Source of admission, %			
Emergency room	60.1	61.4	55.9
Skilled nursing facility (SNF)	1.7	1.3	3.0
Other community sources	19.8	20.4	17.7
Comorbidities, %			
Alcohol abuse	2.7	2.4	3.7
Heart failure	25.5	22.9	34.4
Chronic pulmonary disease	43.6	43.2	44.9
Diabetes	24.9	23.9	28.2
Liver disease	2.3	1.9	3.5
Obesity	6.6	5.9	9.0
Renal failure	12.6	10.7	19.1
Neoplastic disease	8.5	8.0	10.2

† All other races <3%

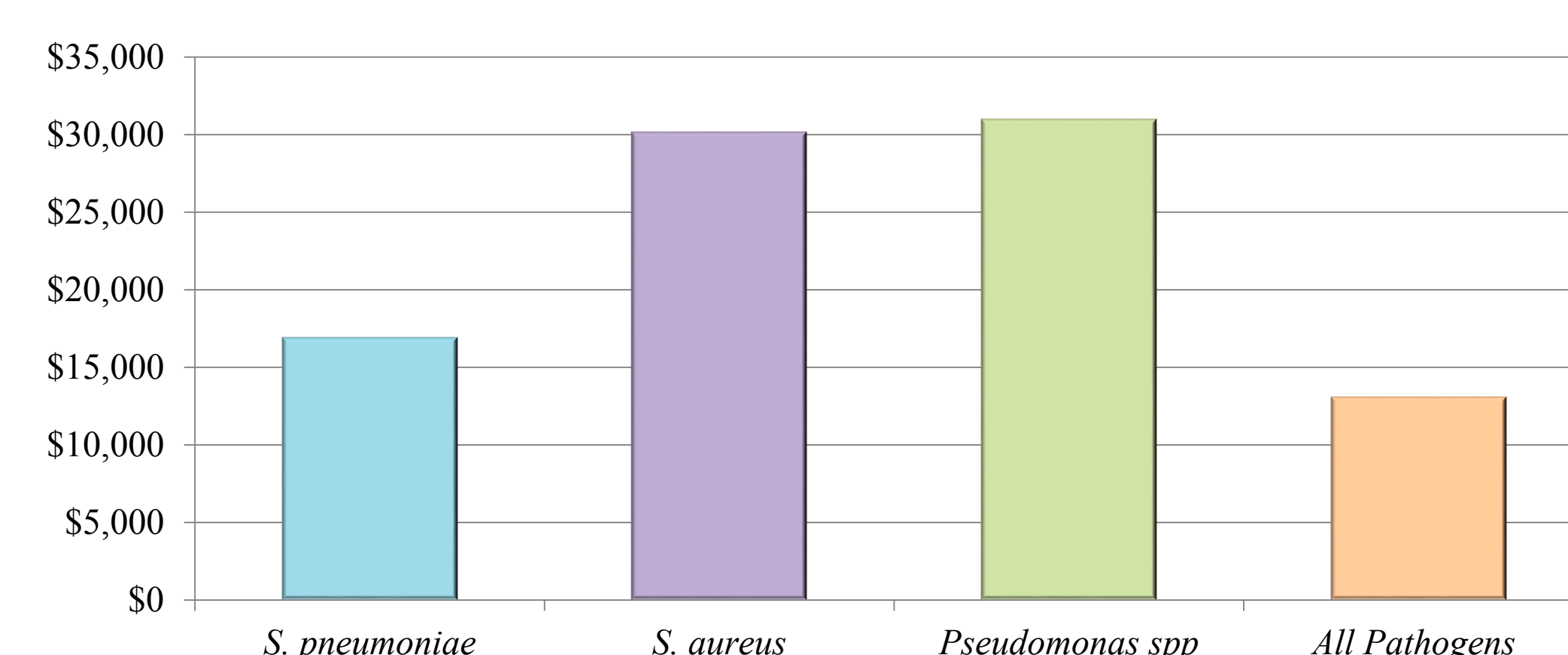


Figure 1: Average Cost of Hospitalization from 2001-2012, by Pathogen

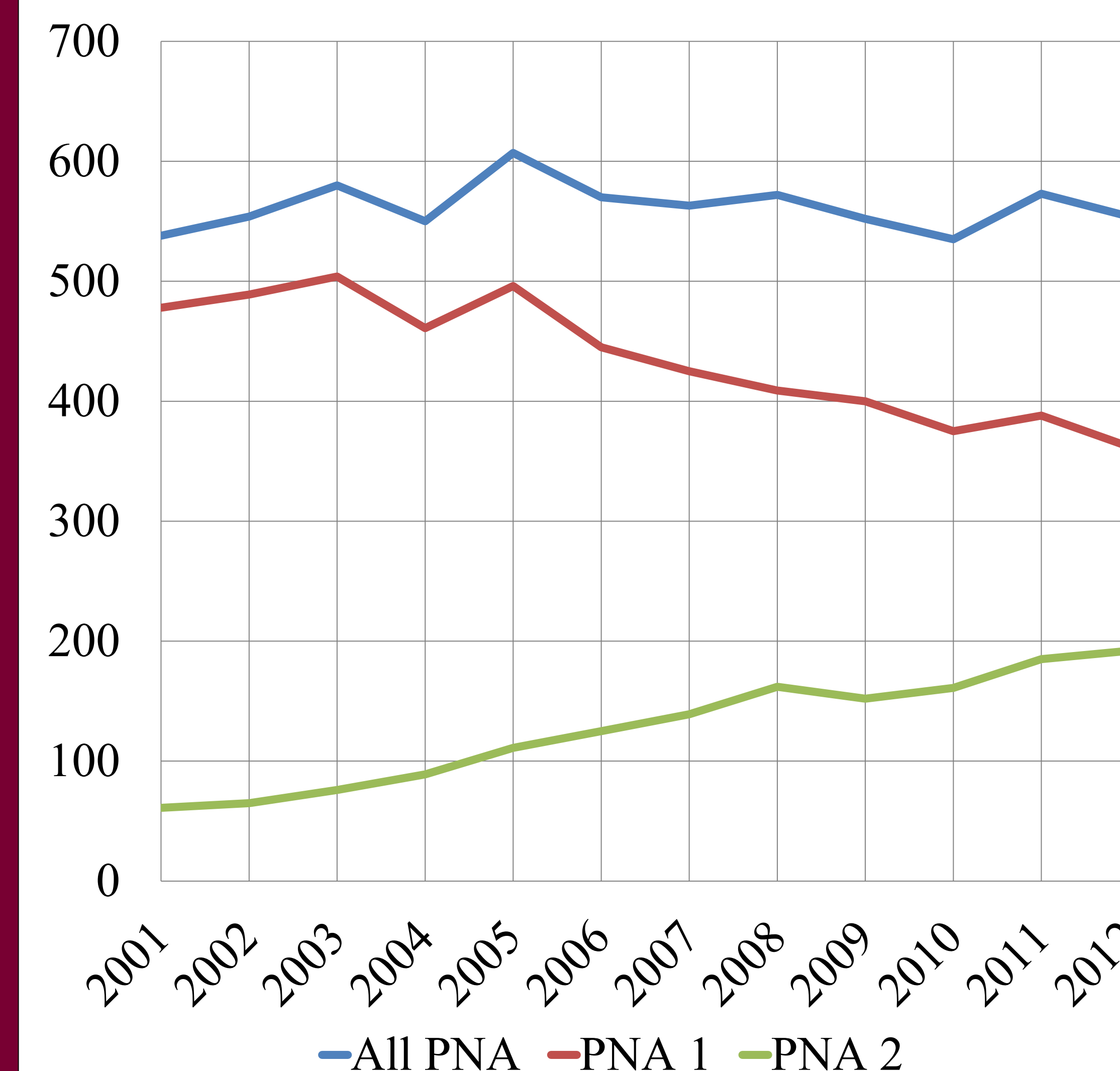


Figure 2: Trends in Pneumonia Incidence (per 100,000 U.S. Adults), by Year and Pneumonia Definition

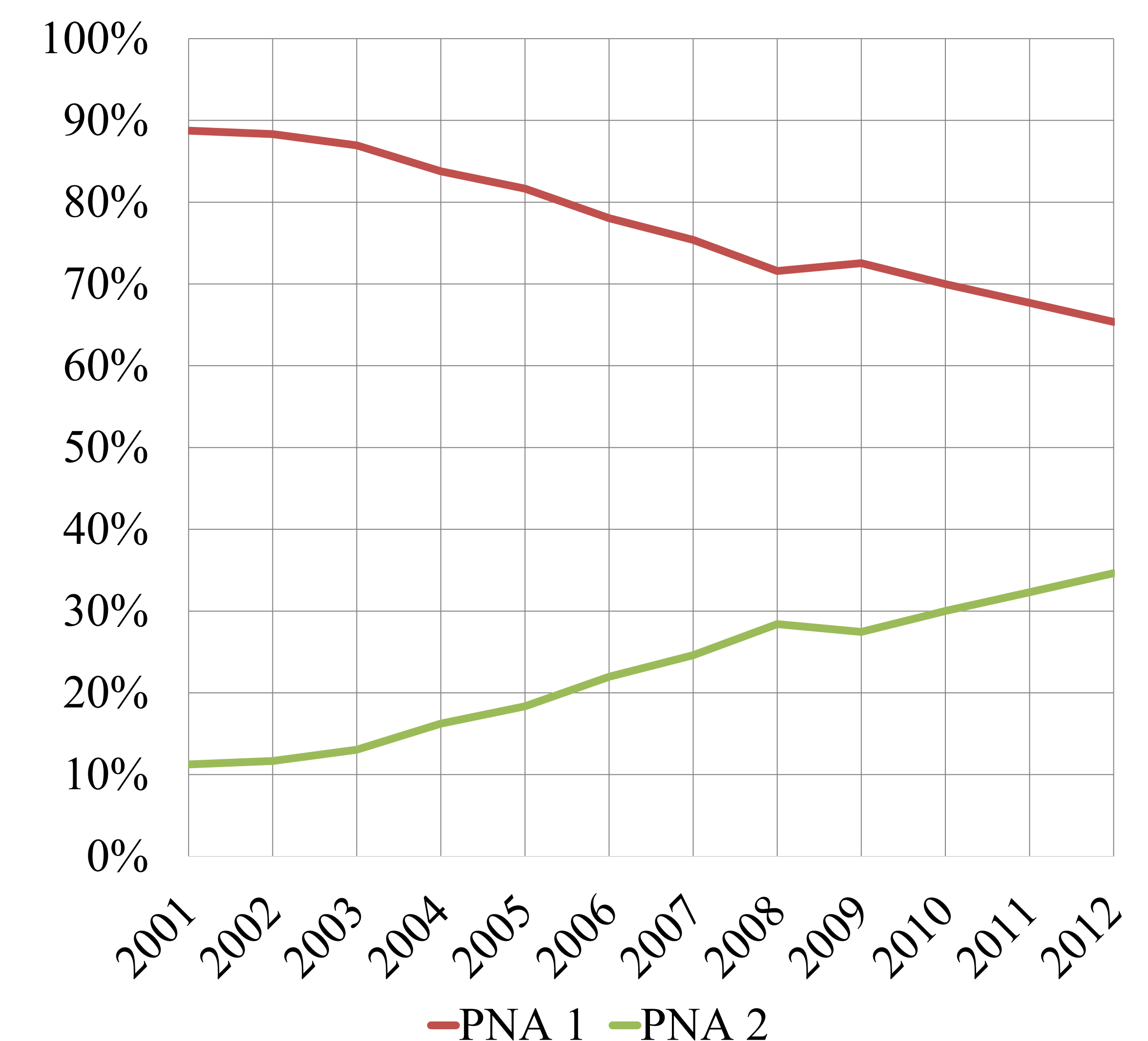


Figure 3: Trends in Pneumonia Discharge Diagnoses, by Year and Pneumonia Definition

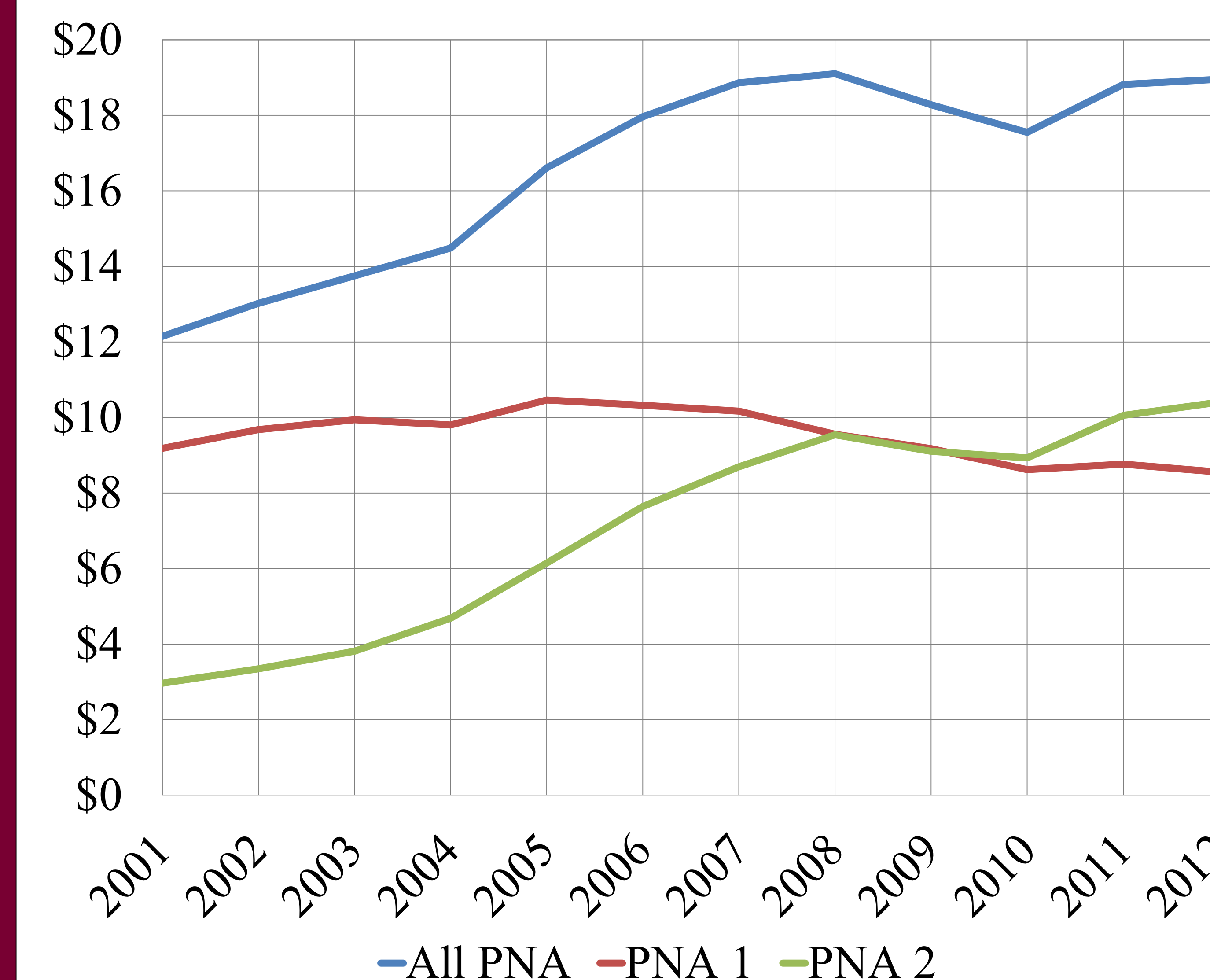


Figure 4: Trends in Inpatient Pneumonia Costs (in Billions of U.S. Dollars, Adj to 2012), by Year and Pneumonia Definition

Conclusions

- Over the study period, the percentage of hospitalized pneumonia patients with a principal discharge diagnosis (PDD) of sepsis or respiratory failure increased from 11.2% in 2001 to 34.6% in 2012.
- Annual cost to treat an adult inpatient with pneumonia has increased approximately 57% from 2001 to 2012.
- The mean cost per hospitalization increased from \$10,632 in 2001 to \$14,239 in 2012.
- The mean cost to care for pneumonia cases with a PDD of pneumonia is substantially less than cases with a PDD of sepsis or respiratory failure (\$9,714 vs. \$24,534).
- These data indicate that the increased cost to treat pneumonia over time may be due to an increased proportion of patients with a PDD of sepsis or respiratory failure.