Incidence and 30-Day Mortality of Community-Acquired Pneumonia (CAP) in the Medicare Fee-For-Service (FFS) Population

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BACKGROUND

- Community-acquired pneumonia (CAP), defined as pneumonia not acquired in a hospital or a long-term care facility, is a significant cause of morbidity and mortality in all age groups in the United States, especially the elderly.[1]
- The annual incidence of CAP has been estimated at 5 to 11 per 1,000 adult population.[2]
- Among infectious diseases, CAP is the leading cause of death in the developed world and is associated with a substantial economic burden—annual expenditures attributable to CAP are estimated to be $8.4–10 billion (USD value from 1995) annually in hospitals in the United States.[3]
- A majority of the older adults impacted by CAP are covered by Medicare; we examined the epidemiologic burden of CAP in the Medicare fee-for-service (FFS) patient population.

OBJECTIVE

- To estimate the CAP incidence and 30-day case-fatality rates in the 2007–2008 Medicare FFS patient population using data from a Medicare 5% random sample.

METHODS

Patient population

- Patients in the Medicare 5% random sample with Medicare Part A and Part B enrollment in 2007 and 2008 were considered for inclusion.
- Inclusion criteria:
  - aged ≥65 years
  - continuously enrolled in Medicare Part A and Part B for ≥1 year without losing Medicare entitlement during the study period (2007–2008)
  - Medicare as primary coverage/payer
  - resident in one of the 50 states or DC

Identification of CAP episodes

- Medicare data from July 1, 2007 to June 30, 2008, were used to identify pneumonia claims.
- Pneumonia claims were used to identify CAP episodes:
  - inpatient pneumonia was defined as a primary diagnosis of pneumonia; or sepsis or respiratory failure as primary diagnosis plus pneumonia as secondary diagnosis on Part A hospital discharge claims
  - outpatient pneumonia was defined as a pneumonia diagnosis on a Part A outpatient or Part B claim, plus indication of a chest X-ray within 14 days of the pneumonia diagnosis
- CAP episodes were then constructed from pneumonia claims (Figures 1 and 2); consecutive pneumonia claims with <90-day gaps between claims were grouped into the same episode.
- Episodes containing a CAP hospitalization were considered inpatient (IP CAP), regardless of whether the episode initiated with a CAP hospitalization. Episodes without a CAP hospitalization were considered outpatient CAP (OP CAP).
- Additional exclusion criteria were applied to further refine CAP episode identification
  - no days spent in hospital or a long-term care facility within 14 days prior to the first day of the CAP episode
  - no claims indicating mechanical ventilator use within 14 days prior to the first day of the CAP episode

Risk and comorbidity strata

- Risk strata were identified for each CAP episode based on indication of immunocompromising and/or chronic conditions in the 6 months prior to, and/or 6 months after the CAP index date:
  - high risk: episodes with indication of any immunocompromising condition
  - medium risk: episodes with no indication of any immunocompromising condition, but with a chronic condition
  - low risk: episodes with no indication of either an immunocompromising or chronic condition
- Comorbidity strata were identified based on indication of any of the following comorbidities in the 6 months prior to, and/or 6 months after the CAP index date:
  - chronic obstructive pulmonary disease (COPD)
  - coronary arterial disease (CAD)
  - asthma
  - diabetes
  - congestive heart failure (CHF)
- Individuals can be assigned to more than one comorbidity stratum.

Figure 1. Hypothetical Patient With Multiple CAP Episodes in the Study Period

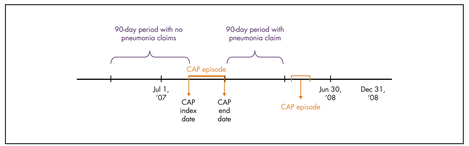
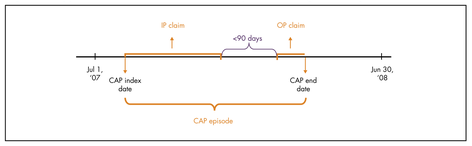


Figure 2. Hypothetical Patient With One CAP Episode During the Study Period



METHODS *(continued)*

Analyses

Incidence

- Incidence was calculated by dividing the number of CAP episodes by the total follow-up time using the following parameters:
  - the denominator for the incidence calculation is based on follow-up time for the eligible study population as defined by the inclusion/exclusion criteria
  - the follow-up was calculated from July 1, 2007, to June 30, 2008, and censored at death or end of Medicare entitlement
  - denominators were calculated for each of the population strata to allow for calculations of stratum-specific incidence rates (e.g. by risk level)
- To shed light on seasonality, we explored the frequency and distribution of all CAP episodes by calendar month from July 2007 to June 2008; a CAP episode contributed to the month in which the CAP episode started.
- Incidence is stratified by age, and risk and comorbidity status.

Length of CAP episodes

- The length of a CAP episode was calculated as the difference between the CAP end date or the censor date, whichever was earlier, and the CAP index date + 1.

30-Day mortality

- 30-Day mortality was defined as death within 30 days of a CAP index date (all-cause).
- The numbers of all-cause deaths within 30 days of the CAP index date and 30-day all-cause case-fatality rates in the CAP population are reported.
- Mortality is stratified by risk and comorbidity.

RESULTS

- 56,262 CAP episodes were identified (Table 1); 38% were inpatient and 62% were outpatient episodes.
- Overall, CAP incidence was 4,584 per 100,000 person-years.
- 38.2% of all episodes were inpatient; inpatient episodes accounted for 43% of high-risk episodes, 38% of moderate-risk episodes, and 18% of low-risk episodes.

Table 1. Characteristics of Patients With CAP

Characteristic	CAP population, *n* (%)
Total no. of patients	53,394 (100.0)
Total no. of episodes	56,262 (100.0)
Mean age ± SD, years	78.8 ± 8.1
Age group*, years	
65–69	8,306 (16.6)
70–74	9,633 (18.0)
75–79	10,683 (20.0)
80–84	10,968 (20.5)
≥85	13,804 (25.9)
Sex	
Female	30,419 (57.0)
Male	22,975 (43.0)
Race	
White	47,622 (89.2)
Black	3,269 (6.1)
Other	2,503 (4.7)
Geographic distribution	
Northeast	10,040 (18.8)
Midwest	14,276 (26.7)
South	20,040 (37.5)
West	8,428 (15.8)
Missing	610 (1.2)
CAP risk level	
High	29,320 (54.9)
Medium	17,239 (32.3)
Low	6,835 (12.8)
Comorbidities†	
CAD	19,762 (37.0)
CHF	19,699 (36.9)
Diabetes	17,844 (33.4)
Asthma	2,529 (4.7)
COPD	25,090 (47.0)

*Age on July 1, 2007. †Comorbidities are not mutually exclusive. SD, standard deviation.

- CAP incidence was highest among those aged ≥85 years (8,449 per 100,000 person-years) (Figures 3 and 4).
- The peak frequency of CAP occurred between January and March 2008; incidence was lowest in the summer months (July–September) (Figure 5).
- The overall mean ± SD length of an inpatient and outpatient episode was 32.7 ± 46.3 days and 12.8 ± 27.6 days, respectively.
- The majority of the outpatient episodes had an episode length of 1 (median 1) based on claims data.

Figure 3. CAP Incidence Rates by Age and Risk

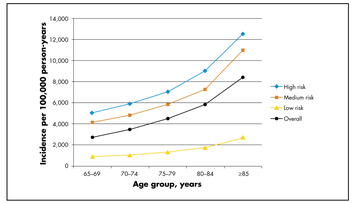


Figure 4. CAP Incidence Rates by Age and Comorbidities

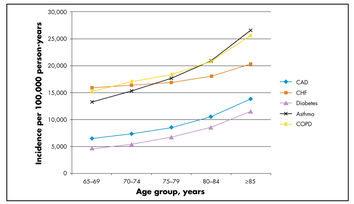
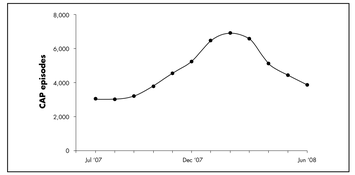


Figure 5. Frequency of CAP Episodes by Calendar Month*, July 2007 to June 2008



- Of the 34,669 OP CAP episodes identified in the dataset, 1,462 (4.2%) resulted in death within 30 days of the index date. Of the 24,593 IP CAP episodes, 1,982 (9.2%) resulted in death within 30 days (Table 2).

Table 2. 30-Day All-Cause Case-Fatality Rate*, by Risk and Chronic Disease

	CAP episode, %		
	OP CAP	IP CAP	All CAP
Overall	4.2	9.2	6.1
Age group, years			
65–69	1.8	6.0	3.2
70–74	2.1	7.0	3.9
75–79	3.2	7.9	5.0
80–84	4.4	8.4	6.0
≥85	8.2	13.4	10.4
CAP risk level			
High	4.9	9.9	7.1
Medium	3.6	7.7	5.2
Low	3.3	9.9	4.4
Comorbidities			
CAD	3.8	7.2	5.3
CHF	6.2	10.0	8.0
Diabetes	3.7	7.4	5.3
Asthma	1.9	3.4	2.7
COPD	3.7	7.3	5.4

*All-cause death in 30 days from the CAP index date; when calculating death rate, the denominator is total episodes.

CONCLUSIONS

- **CAP represents an important public-health burden in the Medicare FFS population aged ≥65 years, with an incidence rate of 4,584 per 100,000 person-years in 2007–2008.**
- **Incidence and mortality increase with increasing age and presence of comorbidities.**
- **CAP occurs year-round, but is more frequent in the winter months (January–March).**
- **Additional research is being conducted to assess how the epidemiologic burden of CAP translates into an economic burden.**
- **Based on the incidence rate and the size of the Medicare FFS population aged ≥65 years, these results suggest an estimated 1.13 million cases of CAP and 69,000 CAP-related deaths annually among this population.**

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