The Relative Burden of Community-Acquired Pneumonia Hospitalizations Compared to Other Serious Conditions in the Older Population

Joshua D. Brown[1], Richard L. Sheer[2], Kyle D. Null[2], Margaret K. Pasquale[2], Reiko Sato[3]

1. Institute for Pharmaceutical Outcomes and Policy, University of Kentucky College of Pharmacy, Lexington, KY
2. Comprehensive Health Insights, Humana Inc., Louisville, KY 3. Global Health and Value, Outcomes and Evidence, Pfizer Inc., Collegeville, PA

Background

An estimated 1.3 million annual cases of community-acquired pneumonia (CAP) occur among adults aged 65 years and older, contributing to significant morbidity, mortality and economic burden in the United States. [1] The risk of CAP increase with age, contributing to an economic burden of $13 billion annually in the Medicare fee-for-service population. [1, 2] However, the burden of illness and cost of preventing CAP has not been compared to other serious disease states.

Objectives

1) To compare the relative burden of hospitalization attributable to CAP compared with myocardial infarction (MI), stroke, and osteoporotic fractures (OF) in a population of older adults within a large, national health plan
2) To assess the relative expenditures of preventive measures for each of these four conditions

Methods

- **Study Design:** Retrospective cross-sectional analysis
- **Data Source:**
  - Humana Medicare Advantage with Prescription Drug plan (MAPD) beneficiaries extracted from the Humana Research Database (Louisville, KY)
- **Inclusion and Exclusion Criteria:**
  - Adults aged 65 to 89 years with continuous MAPD enrollment during 2013-2014 were included in the study.
  - Subjects who were hospitalized for CAP, MI, stroke or OF in 2013 or had a cumulative stay in a long-term care facility for ≥90 days during 2013 were excluded.
  - Subjects who died in 2014 were retained since death was an outcome of interest.
- **Outcomes:**
  - Hospitalizations for CAP, MI, stroke, and OF were identified during the 2014 calendar year.
  - Hospitalizations for each condition were described by length of stay (LOS), percent with a readmission or death within 30 days, and total costs. Preventive measures included vaccinations for CAP and medications for MI, stroke, and OF.
  - The 2013 calendar year was used to assess demographics and clinical characteristics, as well as capture preventive medication use and costs for each of the four conditions.
- **Statistical Analyses:**
  - Pairwise comparisons were made for hospitalization rates, readmission, mortality, LOS, and costs between CAP and MI, stroke, and OF.
  - T-tests and chi-square tests were used for continuous and categorical variables, respectively, with an *a priori* significance level of α=0.05.
  - Data management and analysis were conducted using SAS Enterprise Guide 5.1 (SAS Institute, Cary, NC) .

Results

Table 1. Patient Demographics Table

Characteristic	N (%)
N	1,585,022
Age	
Mean ± SD	74.2 ± 6.1
65-74	920,210 (58.1)
75-84	542,477 (34.2)
85-89	122,335 (7.7)
Gender	
Male	703,269 (44.4)
Female	881,753 (55.6)
Race	
White	1,342,189 (84.7)
Black	171,910 (10.8)
Hispanic	20,252 (1.3)
Other	36,313 (2.3)
Unknown	14,358 (0.9)
Geographic Region	
Northeast	31,985 (2.0)
Midwest	432,485 (27.3)
South	978,256 (61.7)
West	142,293 (9.0)
Dual Eligible	120,158 (7.6)
Deyo-Charlson Comorbidity Score, Mean ± SD	1.3 ± 1.8
Chronic conditions (most prevalent)	
Diabetes	500,754 (31.6%)
COPD	334,146 (21.1%)
Coronary artery disease (CAD)	324,451 (20.5%)
Heart Failure	139,854 (8.8%)

SD=standard deviation; COPD=chronic obstructive pulmonary disease

- The rate of CAP hospitalizations was highest at 1,262 per 100,000 person-years compared to MI (673, p<0.001), stroke (610, p<0.001), and OF (706, p<0.001). See Table 2 and Figure 1.
- The total cost of index CAP hospitalizations was higher at $303 million compared to $224 million for MI, $144 million for stroke, and $183 million for OF (Figure 1).
- CAP was also associated with higher readmission rates compared to stroke and OF (Figure 1).

Table 2. Comparison of CAP, MI, stroke, and OF related hospitalizations in 2014

Outcome	CAP	MI	Stroke	OF
Persons hospitalized	18,687	10,250	9,263	10,790
Number of hospitalizations	19,679	10,496	9,518	11,019
Hospitalization rate per 100,000 person-years	1,262	673**	610**	706**
Number of readmissions	2,762	1,573	1,040	1,279
30-day readmission rate (%)	12.7%	13.5%*	10.0%**	10.8%**
Number of deaths during hospitalization or within 30 days of discharge	2,978	1,187	1,126	710
30-day case-fatality rate	15.1%	11.3%**	11.8%**	6.4%**
Length of stay per hospitalization				
Mean (95% CI)	6.9 (6.8-7.0)	5.8 (5.6-6.0)**	7.9 (7.5-8.3)**	6.1 (6.0-6.2)**
Median	5	4	4	5
Length of stay per readmission				
Mean (95% CI)	7.9 (7.6-8.2)	6.5 (6.2-6.8)**	7.7 (7.2-8.2)	7.6 (7.2-8.0)
Median	6	4	5	6

**p<0.05 vs CAP; **P<0.001 vs CAP*
CAP=community-acquired pneumonia; MI=myocardial infarction; OF=osteoporotic fracture; CI=confidence interval

Figure 1. Comparison of CAP, MI, stroke, and OF related hospitalization rates and total costs in 2014

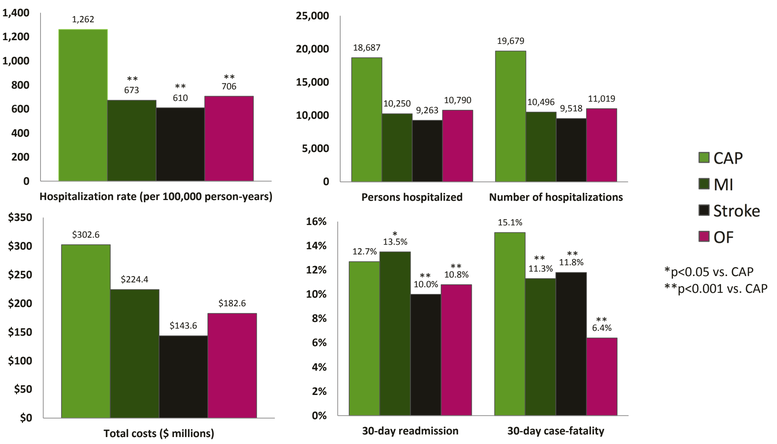

Table 3. Preventive medication and vaccination use in 2013

Outcome	Individuals treated N (%)	Total health plan cost	Health plan cost PMPM	Patient OOP cost	Total cost
CAP Prevention					
Pneumococcal vaccination	115,132 (7.3%)	$8,717,773	$0.46	$34,302	$8,752,075
PCV13	5,578 (0.4%)	$734,978	$0.04	$2,038	$737,016
PPSV23	108,741 (6.9%)	$6,471,463	$0.34	$25,181	$6,496,644
Influenza vaccination	800,870 (50.5%)	$23,160,780	$1.22	$26,062	$23,186,843
Total	835,137 (52.7%)	$31,878,554	$1.68	$60,364	$31,938,918
MI Prevention	1,051,272 (66.3%)	$337,789,565	$17.76	$106,261,777	$444,051,341
Stroke Prevention	1,057,858 (66.7%)	$373,218,527	$19.62	$118,246,346	$491,464,873
OF Prevention	92,813 (5.9%)	$43,429,680	$2.28	$8,544,883	$51,974,563

MI Prevention included use of ACE inhibitors, ARBs, beta-blockers, calcium channel blockers, diuretics, statins, other cholesterol medications, and aspirin. Stroke prevention included use of all MI prevention medications as well as antiplatelets and anticoagulants. OF prevention included use of bisphosphonates, SERMs, monoclonal antibodies, and parathyroid hormone (PTH).

- CAP had a higher hospitalization burden, higher total costs, and higher case-fatality rate compared to MI, stroke, and OF (Figure 1).
- Although CAP had a higher hospitalization burden and total costs than MI, stroke, and OF in the older population (Figure 1), prevention efforts were much smaller for CAP (Table 3).
- During 2013, 7.3% of individuals received at least one pneumococcal vaccination and 50.5% received an influenza vaccination (Table 3).
- The proportion of individuals receiving pneumococcal or influenza vaccinations was far below the Healthy People 2020 goal of 90%.[2]
- Expenditures on preventive vaccinations for CAP were nearly $32 million, including $8.7 million for pneumococcal and $23 million for influenza vaccines (Table 3). The cost of preventive medications was $337 million for MI, $373 million for stroke, and $43 million for OF.

Conclusions

- Among seniors with Medicare Advantage insurance coverage, the rate of CAP-related hospitalization was double that of MI, stroke, and OF.
- CAP had similar 30-day readmission rates and higher mortality than MI, stroke and OF. Despite the higher incidence and high overall total costs, expenditures on preventive vaccinations were a fraction of the expenditures for these other disease states.
- Given the suboptimal vaccination rates that fall well below national goals [3], public health officials, healthcare providers, and managed care organizations should prioritize efforts to increase flu and pneumococcal vaccinations in order to reduce the significant burden of CAP in the older population.

Limitations

- The current study likely underestimated the burden of CAP since only inpatient CAP episodes were considered, which have been shown to include only 40% of cases in the older population. [1,4] Additionally, the study considered only the principal diagnosis for inpatient hospitalizations.
- Limitations inherent to using administrative claims data [5,6,7] such as lack of certain information in the database (e.g. lab results) and errors or omissions in claims coding apply to this study.
- No causal inference can be ascertained from this study, as it is an observational study using retrospective claims data. The results may not be generalizable to the general population.

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