
Final Report

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Opinions and interpretations expressed herein are not necessarily the position of CMS or any other federal agency.
ABOUT MQMS

BACKGROUND

The Medicare Quality Monitoring System (MQMS) is a system that monitors the quality of care delivered to Medicare fee-for-service beneficiaries. The MQMS is developed in the context of growing public concerns over quality of care, patient safety, and hospital performance. It is directed by the Centers for Medicare & Medicaid Services (CMS) with assistance from its contractors. MQMS development and production involves a diverse group of CMS staff, including clinical area team leaders (clinicians), epidemiologists, statisticians, and data analysts in the central and regional offices. CMS also consulted with leading experts in other federal agencies—such as the Agency for Health Care Research and Quality, the Centers for Disease Control—and in quality improvement organizations and academia.

PURPOSE

MQMS uses Medicare administrative and survey data to track trends, patterns, and variations in health, disease-specific, and procedure-specific outcomes at the national and state level that are related to CMS’ quality improvement program and initiatives. It provides input for broad and high-level policy making and program planning within CMS.

- Specifically the MQMS data are to be used for:
  - Identifying potential quality problems
  - Targeting interventions
  - Prioritizing activities & allocation of resources
  - Focusing on a particular problem
  - Raising research questions/hypothesis for further investigation

- The MQMS data should not be interpreted as:
  - Research that links cause and effect
- Evaluation of individual QIO or state performance
- Evaluation of the effectiveness of the QIO program and other CMS quality improvement policies and initiatives

**Population and Health Issues Examined**

The MQMS population consists of aged and disabled Medicare fee-for-service (FFS) beneficiaries. MQMS is limited to FFS beneficiaries because of the current lack of encounter data from Medicare managed care plans. The analysis is limited to the national and/or state level, showing trends over time for various demographic and geographic subgroups. The trends and patterns are adjusted for variations in the age and sex composition of the population. MQMS monitors the following types of quality measures:

- Mortality, survival rates, readmission rates, length of stay, and cost of hospitalizations for five conditions common in the Medicare population—acute myocardial infarction (AMI), heart failure, pneumonia, stroke, and diabetes
- Mortality and readmission rates following cancer-related and cardiac-related high-risk surgical procedures
- Patient safety
- Preventable hospitalization

**Methods**

MQMS products, listed below, are designed as national- and state-level monitoring tools, and not as provider-level monitoring tools. Since the figures are presented at the national and state level, they are adjusted to a standard distribution of age and sex. The age-sex adjustment eliminates state-to-state and year-to-year variations in the age and sex composition of the population as a cause of the MQMS findings.

MQMS results are not risk adjusted beyond the age-sex adjustment. This approach assumes that the distribution of health risks is similar from one state population to another state population, and that the distribution of health risks in the national population is similar from one year to another. CMS continues to assess the validity of this assumption.

MQMS results are based on data from all fee-for-service beneficiaries and claims, rather than a sample of such beneficiaries and claims. This means that the rates presented in MQMS reports do not contain sampling error. MQMS rates are not presented with confidence intervals or significance testing, since these intervals and tests are based on properties of sampling error. This approach implies that the FFS population is not interpreted as a sample drawn from a super-population, such as all Medicare beneficiaries or FFS beneficiaries from another time period.

*About MQMS*
MQMS results are subject to measurement error in the Denominator File and MedPar database, as well as to modeling error resulting from the age-sex adjustment. CMS continues to investigate the magnitude of these errors.

**PRODUCTS**

The MQMS products are a series of reports on quality measures, a set of tables on CMS’ web site, plus the data files at the person and aggregate level used to generate the reports and documentation of the methodology. The reports are available on the CMS website; the data files are located on the CMS mainframe. To facilitate the use of the data and replication of the analysis, CMS makes available SAS programs and data processing documentation. Access to the data can be granted to CMS analysts on request. Other federal agencies and CMS contractors may obtain the data through a formal data request process.

MQMS reports include:

- Provider-Level Structural Data—Tables on www.cms.hhs.gov
EXECUTIVE SUMMARY

This report summarizes trends and variation in the outcomes of Medicare beneficiaries hospitalized for pneumonia, septicemia with a secondary diagnosis of pneumonia, and respiratory failure with a secondary diagnosis of pneumonia. The report describes discharge rates, length of stay, cost, readmission, and mortality from 1992 to 2002. It tracks the utilization measures for the pneumonia population as a whole and by demographic subgroups over the study period. Intended as one component of a surveillance effort, the report highlights recent trends and possible changes in trends in the care of pneumonia patients. It also points to geographic or demographic differences in utilization and mortality of beneficiaries hospitalized for pneumonia. The report addresses three specific questions:

• What are the characteristics of the Medicare pneumonia population and how similar is this population to the general Medicare fee-for-service (FFS) population?

• What are the trends and variation in hospitalization for pneumonia in the Medicare FFS population, and how do these trends differ by region and demographic group?

• What are the trends and variations in readmission and mortality after pneumonia hospitalization, over varying time periods, after initial discharge?

Characteristics of the Pneumonia Population

• The pneumonia population was older than the overall FFS population and was more likely to be male. Males comprised 46 percent of the pneumonia population in 2001, while they were 44 percent of the Medicare FFS population. Those aged 80 and over constituted 46 percent of the pneumonia population but only 25 percent of the FFS population.

• The racial distributions of the pneumonia and overall FFS populations were similar in 2001. The pneumonia population was more likely to live in rural areas and in the South and Midwest than the overall FFS population.
• Pneumonia beneficiaries were much more likely to be dual-enrolled as indicated by the presence of a state Medicaid buy-in. While dual-enrolled beneficiaries were 17 percent of the FFS population in 2001, they were 29 percent of the pneumonia population. They were more likely to be qualified for Medicare under the end-stage renal disease (ESRD) benefit, but were less likely to be qualified as disabled, compared to the overall population.

Hospitalization, Length of Stay, and Expenditure for Pneumonia

• Rates of hospital discharges for pneumonia increased by 11 percent between 1992 and 2002, from 17.1 per 1,000 beneficiaries to 19.0 per 1,000 beneficiaries. Hospitalization for septicemia with pneumonia increased sharply by 54 percent over the period. For respiratory failure with pneumonia, the increase was greater still – 135 percent.

• Medicare payment per pneumonia discharge increased by six percent, from $6,070 to $6,408 over the same period. Inflation-adjusted total Medicare payments for pneumonia hospitalizations fell between 1992 and 2002. Payments for septicemia with pneumonia and respiratory failure with pneumonia grew much more rapidly, by 135 percent and 216 percent respectively.

• The increase in hospitalization for pneumonia was slightly greater for beneficiaries under the age of 75 than for those 75 and over.

• State-level pneumonia discharge rates ranged from 14.0 per 1,000 to 29.1 per 1,000 in 2002. Five states showed increases of 20 percent or more between 1992 and 2002; nine states showed decreases in discharge rates.

• The average length of hospital stay declined by 2.9 days both for pneumonia and for septicemia with pneumonia. It declined by 3.4 days for respiratory failure with pneumonia.

Hospital Readmission Among Pneumonia Beneficiaries

• The rate of hospital readmission for pneumonia-related illness within 30 days of discharge increased by 28 percent for pneumonia, 27 percent for septicemia with pneumonia, and 58 percent for respiratory failure with pneumonia between 1992 and 2002.

• Readmission for pneumonia-related conditions increased more rapidly for blacks than for whites between 1992 and 2001. Thirty-day readmission for pneumonia-related illness increased by 37 percent for blacks and by 27 percent for whites. One-year rates increased by 17 percent for blacks and by 13 percent for whites.

• Pneumonia readmission rates were higher for dual-enrolled beneficiaries than for those not enrolled in Medicaid – 58 per 1,000 vs. 42 per 1,000.
Mortality Among Pneumonia Beneficiaries

- In 2002, 103 of every 1,000 beneficiaries hospitalized for pneumonia died within 30 days of admission; 307 per 1,000 died within one year of admission. In that same year, the 30-day mortality rate was 308 per 1,000 for septicemia with pneumonia and 324 per 1,000 for respiratory failure with pneumonia.

- Mortality following pneumonia hospitalization declined slightly between 1992 and 2002. Mortality within 30 days of pneumonia admission fell from 116 per 1,000 in 1992 to 103 per 1,000 in 2002. One-year mortality fell from 316 per 1,000 in 1992 to 307 per 1,000 in 2001.

- By 2002, 6 states exhibited mortality rates within 30 days of hospitalization for pneumonia of less than 110 per 1,000. Four states had 30-day mortality rates exceeding 140 per 1,000.
I. INTRODUCTION

Pneumonia, an inflammation of the lung commonly due to infection by bacteria, viruses, and sometimes by aspiration, fungi, or chemicals, is the fifth leading cause of death among persons aged 65 and over. Kaplan et al. (2003) documented that mortality within one year of hospital admission was significantly greater for Medicare beneficiaries hospitalized for community-acquired pneumonia than it was for a matched comparison group of beneficiaries hospitalized for reasons other than pneumonia.\(^1\) Because pneumonia mortality increases sharply with age and has been described as relatively painless, Sir William Osler famously termed pneumonia “the old man’s friend.” In the Medicare population, it is the second most common cause of hospitalization (after heart failure).

This report uses data from the Medicare Quality Monitoring System (MQMS) to study trends and variations in pneumonia discharges, readmissions, and mortality among Medicare fee-for-service (FFS) beneficiaries from 1992 through 2002. Other MQMS reports provide information on four other Clinical Priority Areas in the Health Care Quality Improvement Project (HCQIP): acute myocardial infarction, diabetes, pneumonia, and stroke. During the 1990s, the Centers for Medicare and Medicaid Services (CMS) increased its efforts to improve the quality of care for beneficiaries hospitalized with these conditions. In 1999, CMS began evaluating the Quality Improvement Organizations (QIO) on inpatient quality indicators for each condition. Criteria for selecting the Clinical Priority Areas are given in Jencks et al. (2000). All were projects under the Sixth Scope of Work for Medicare QIOs.

This report presents results for three clinical cohorts, defined on the basis of primary and secondary diagnoses: (1) pneumonia, regardless of secondary diagnosis, (2) septicemia with a secondary diagnosis of pneumonia, and (3) respiratory failure with a

\(^{1}\)Mortality rates estimated by Kaplan et al. (2003) exceed those found here. Those authors, however, excluded certain diagnoses used here (ICD-9 codes 480, 483, and 487) from their case definition.
secondary diagnosis of pneumonia. CMS chose to include the latter two cohorts because pneumonia is so frequently the cause of septicemia or respiratory failure.

The term “pneumonia” will be used here to refer to the first cohort, that is, persons with a principal diagnosis of pneumonia. The term “pneumonia-related conditions” will be used to refer generically to all three of the cohorts. Thus “readmission for pneumonia-related conditions after hospitalization for pneumonia” means readmission with a diagnosis in any of the three cohorts after a hospital stay with a principal diagnosis of pneumonia.

Appendix A contains a detailed description of the data sources, sample selection, and variable construction for each outcome measure used in this report. Appendix B provides supporting tables for each outcome, offering greater detail by demographic groups, state, and region than is presented in the body of the text.
II. CHARACTERISTICS OF THE MEDICARE FFS PNEUMONIA POPULATION

About 557,000 Medicare beneficiaries (or about 1.75 percent of the Medicare FFS population) were hospitalized for pneumonia in 2001. An additional 46,000 (about 1/10th of 1 percent) were hospitalized for septicemia with pneumonia or respiratory failure with pneumonia. Appendix B, Table B.1-3 presents a comparison of the pneumonia population with the overall Medicare FFS population in 1992 and 2001.

Figure II.1. Medicare FFS Pneumonia Population and the Entire Medicare FFS Population, by Sex and Age Group, 2001

- Beneficiaries hospitalized for pneumonia were substantially older than the overall Medicare FFS population. In 2001, 23 percent of FFS beneficiaries were aged 80 or older, compared with 46 percent of beneficiaries hospitalized for pneumonia (Figure II.1).
- Males accounted for 45.5 percent of the pneumonia population, a slightly greater share than in the Medicare FFS population (43.6 percent). The racial distribution of the pneumonia population was quite similar to that of the Medicare FFS population (Appendix B, Table B.1-3).
- Beneficiaries hospitalized for pneumonia were much more likely than those in the general Medicare FFS population to be enrolled in Medicaid.
- Residents of rural areas represented 27.4 percent of the Medicare FFS population, but 31.4 percent of those hospitalized for pneumonia in 2001.
• Beneficiaries with end-stage renal disease (ESRD) constituted 0.9 percent of the Medicare population, but constituted 3 percent of the pneumonia population in 2001.
III. HOSPITALIZATION FOR PNEUMONIA-RELATED CONDITIONS:
RATES, EXPENDITURES, AND LENGTHS OF STAY

Figure III.1. Discharge Rate for Pneumonia, Septicemia with Pneumonia, and Respiratory Failure with Pneumonia, 1992-2002

- There were nearly 19 hospitalizations for pneumonia for every 1,000 Medicare FFS beneficiaries in 2002.

- The rate of pneumonia hospitalization increased by 10.7 percent between 1992 and 2002. The increase, however, was not uniform over the period. The rate increased by 3.1 percent per year from 1992 though 1999 and declined by 3.8 percent per year from 1999 though 2002.

- The proportion of beneficiaries discharged for pneumonia increased more slowly than did the overall discharge rate, by 9.4 percent over the period (Appendix B, Table B.1-5).

- The mean number of pneumonia discharges per beneficiary with at least one pneumonia discharge changed little during the period, rising from 1.10 in 1992 to 1.12 in 2002 (Appendix B, Table B.1-10).

- Rates of discharge for septicemia with pneumonia and respiratory failure with pneumonia were far lower than for pneumonia itself. Discharge rates were 1.26 per 1,000 beneficiaries for septicemia and 1.34 per 1,000 beneficiaries for respiratory failure in 2002.
Discharge rates for both septicemia with pneumonia and respiratory failure with pneumonia increased much more rapidly between 1992 and 2002 than for pneumonia. The discharge rate for septicemia increased by 54 percent from 0.82 to 1.26 per 1,000 beneficiaries. The rate for respiratory failure increased by 135 percent from 0.57 to 1.34 per 1,000 beneficiaries (Figure III.2).

The proportion of beneficiaries discharged with either septicemia with pneumonia or respiratory failure with pneumonia increased by 52 percent and 129 percent, respectively over the same period (Appendix B, Tables B.2-5 and B.3-5).

Hospitalization for respiratory failure with pneumonia and septicemia with pneumonia slowed markedly after 1997. The rate of hospitalization for respiratory failure with pneumonia increased by 15.5 percent per year between 1992 and 1997 and by 2.8 percent per year between 1997 and 2002. Hospitalization for septicemia with pneumonia increased by 10.2 percent per year between 1992 and 1997, but fell by 1.1 percent per year between 1997 and 2002.
• Total Medicare payments for pneumonia hospitalizations increased by 28 percent from $3.3 billion in 1992 to $4.2 billion in 2002. Payments in inflation-adjusted dollars declined by 30 percent over the same period. (Figure III.3).

• Average Medicare payment per pneumonia discharge increased by six percent from $6,070 to $6,408 from 1992 to 2002 (Appendix B, Table B.1-8). This increase was substantially less than the increase in payment for Medicare hospital discharges in general. Between 1993 and 1998 alone, the mean payment for all acute-care Medicare hospital stays increased by 21 percent (Health Care Financing Review 1995; 2000, Table 26).

• Total beneficiary payments for pneumonia hospitalizations—in the form of coinsurance and deductibles—increased by 35 percent over the period, from about $304 million in 1992 to $410 million in 2002 (see Appendix B, Table B.1-9).
Medicare payments for septicemia with pneumonia increased by 135 percent from $215 million to $506 million (unadjusted for inflation). Payments for respiratory failure with pneumonia increased by 216 percent from $295 million to $932 million. In constant dollar terms, these represent increases of 28 percent and 74 percent respectively (Figure III.4).

Average Medicare payment per discharge for septicemia with pneumonia increased by 39 percent from $8,301 to $11,574 from 1992 to 2002 (Appendix B, Table B.2-8). Payment per septicemia discharge increased by nearly 25 percent between 1998 and 2002.

Payment per discharge for respiratory failure with pneumonia increased by 25 percent from $16,227 in 1992 to $20,309 in 2002 (Appendix B, Table B.3-8).
State-level pneumonia discharge rates ranged from 14.0 per 1,000 beneficiaries to 29.1 per 1,000 beneficiaries in 2002 (Figure III.5).

Age/sex-adjusted pneumonia discharge rates increased most rapidly in Connecticut, New Jersey, Rhode Island, South Carolina, and Utah (Appendix B, Table B.1-4).

• Average length of stay declined for each of the three cohorts between 1992 and 2002. Average length of stay fell by 2.9 days for pneumonia, 2.9 days for septicemia with pneumonia, and 3.4 days for respiratory failure with pneumonia (Figure III.6).

• The sharpest reductions in the average length of stay occurred between 1992 and 1998. During this period, the average length of stay fell by about five percent per year for each of the three cohorts. The average length of stay was generally unchanged between 1998 and 2002.

• The reduction in the average length of stay for pneumonia and for septicemia with pneumonia was comparable to that for all Medicare hospital stays. Between 1993 and 1998, the average length of a Medicare acute-care stay fell by 27 percent (Medicare Statistical Supplement 1995; 2000). During those same years, the average length of a hospital stay fell by 29 percent for pneumonia and by 25 percent for septicemia with pneumonia. Average length of stay for respiratory failure with pneumonia fell more slowly, by 22 percent (Appendix B, Tables B.1-6, B.2-6, B.3-6).

• Average length of stay for pneumonia tended to be longer for blacks, for beneficiaries with end-stage renal disease (ESRD) and for residents of the

MQMS: Pneumonia
Northeast. Stays were shorter for beneficiaries living in the Midwest and in rural areas (see Appendix B, Table B.1-6).
Pneumonia discharge rates were uniformly lower in the Northeastern and Western United States than in the Midwestern and Southern states. In 2002, pneumonia discharge rates were 17.5 per 1,000 in the Northeast, 16.5 per 1,000 in the West, 19.2 per 1,000 in the Midwest, and 20.8 per 1,000 in the South. (Figure III.7).

Although the rates of hospital discharge for pneumonia increased in each of the four census regions, this increase was substantially lower in the West than in other regions. The rate of discharge increased by 4.3 percent in the West, 13.8 percent in the Northeast, 8.3 percent in the Midwest, and 11.7 percent in the South. (Appendix B, Table B.1-4).

The pneumonia discharge rate was consistently higher in rural than in urban areas throughout the period. In 2002, the discharge rate in rural areas exceeded that in urban areas by 13 percent (Appendix B, Table B.1-4).
Pneumonia discharge rates increased steadily and sharply with age. The discharge rate for beneficiaries aged 80-84 was approximately double that for those aged 70-74. The rate for beneficiaries aged 90-94 was approximately double that for those aged 80-84 (Figure III.8).

The pneumonia discharge rate was greater in the 0-54 and the 55-64 age groups (19 per 1,000 in 2002) than in the 65-69 and the 70-74 age groups (9 and 14 per 1,000, respectively, in 2002). This may be due to the generally poor health status of the Medicare-disabled population compared to the younger age categories in the Medicare-aged population (Appendix B, Table B.1-4).

The increase in pneumonia hospitalization rates was broadly based across age groups. Only among beneficiaries aged 95 and over did the hospitalization rates fail to increase (Appendix B, Table B.1-4).
The pneumonia discharge rate was far higher among dual-enrolled beneficiaries than among those not enrolled in Medicaid. In 2002, 38 per 1,000 dual-enrolled beneficiaries were hospitalized for pneumonia, compared to 16 per 1,000 Medicare-only beneficiaries. This difference may have been due to the high proportion of nursing-home residents among elderly dual-enrolled beneficiaries. Kaspar, Elias, and Lyons (2004) report that in 2000, nearly one-quarter of elderly dual eligibles were in nursing facilities. Just two percent of elderly non-dual beneficiaries were in nursing facilities (Figure III.9).

The rate of hospital discharge increased at a slower rate among the dual-enrolled population than among Medicare-only beneficiaries. The discharge rate increased by 4.0 percent for dual-enrolled beneficiaries and by 7.3 percent among beneficiaries not enrolled in Medicaid (Appendix B, Table B.1-4).
IV. READMISSION AFTER PNEUMONIA HOSPITALIZATION

Figure IV.1. 30-Day Readmission Rates for Pneumonia-Related Conditions, 1992-2002

- The rates of hospital readmission for pneumonia-related conditions increased between 1992 and 2002 for each of the three clinical cohorts. The increase was 28 percent for those hospitalized for pneumonia, 56 percent for those hospitalized with septicemia and pneumonia, and 27 percent for those hospitalized with respiratory failure and pneumonia.

- While 30-day readmission rates for septicemia and respiratory failure increased at a steady rate throughout the period, the readmission rate for pneumonia increased more rapidly between 1992 and 1997 than between 1997 and 2002. The readmission rate for pneumonia increased at an annual rate of 3.9 percent during the first period, but only by 1.1 percent during the second period (Appendix B, Table B.1-13).

- One-year readmission rates for pneumonia-related conditions increased by 12.8 percent for pneumonia, 29.8 percent for septicemia with pneumonia, and 19.9 percent for respiratory failure with pneumonia. (Appendix B, Tables B.1-13, B.2-13, and B.3-13).

MQMS: Pneumonia
Readmission for pneumonia-related conditions increased more rapidly for blacks than for whites between 1992 and 2002. The 30-day readmission rate for blacks increased by 37 percent from 37.6 per 1,000 to 51.6 per 1,000. The rate for whites increased by 27.1 percent from 36.3 per 1,000 to 46.1 per 1,000.

One-year readmission rates for pneumonia-related conditions increased by 17.3 percent for blacks and by 12.8 percent for whites (Appendix B, Table B.1-13).
The 30-day pneumonia readmission rates were substantially higher for dual-enrolled beneficiaries than for those enrolled in Medicare only. In 2002, the rate was 58 per 1,000 for dual-enrolled beneficiaries and 42 per 1,000 for Medicare-only beneficiaries (Figure IV.3).

The 30-day readmission rate for pneumonia-related conditions increased by 25.8 percent for dual-enrolled beneficiaries and by 23.1 percent for Medicare-only beneficiaries between 1992 and 2002 (Appendix B, Table B.1-13).

The one-year readmission rate increased by 8.9 percent for dual-enrolled beneficiaries and by 10.8 percent for Medicare-only beneficiaries between 1992 and 2001 (Appendix B, Table B.1-13).
Table IV.1. State Variation in 30-Day Pneumonia Readmission Rates

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- State-level pneumonia readmission rates increased from 1992 to 2002. The median state-level readmission rates increased by 27 percent from 36.6 per 1,000 to 46.5 per 1,000 (Table IV.1).

- The cross-state variability in pneumonia readmissions increased slightly between 1992 and 2002. The interquartile range increased from 7.9 in 1992 to 11.0 in 2002.
**V. MORTALITY AFTER PNEUMONIA HOSPITALIZATION**

**Figure V.1. 30-Day Mortality Rate Among Beneficiaries Admitted with Pneumonia-Related Conditions, 1992-2001**

- Mortality from pneumonia within 30 days of admission declined slightly from 116 per 1,000 in 1992 to 103 per 1,000 in 2002. The rate declined steadily by about 1.7 percent per year between 1992 and 1998 and was virtually unchanged thereafter (Figure V.1 and Appendix B, Table B.1-14).

- Mortality from septicemia with pneumonia within 30 days of admission was unchanged between 1992 and 1996, but it increased by 17 percent, from 264 per 1,000 to 308 per 1,000 between 1996 and 2002 (Appendix B, Table B.2-14).

- Mortality from respiratory failure with pneumonia within 30 days of admission was nearly unchanged over the period: it was 317 per 1,000 in 1992 and 324 per 1,000 in 2002 (Appendix B, Table B.3-14).
Mortality from pneumonia within 365 days of admission declined by about 3 percent from 315.7 per 1,000 to 306.8 per 1,000 between 1992 and 2001. Mortality from respiratory failure with pneumonia declined by just 1/2 of 1 percent from 602.7 per 1,000 to 599.3 per 1,000 (Figure V.2).

By contrast, 365-day mortality following hospitalization for septicemia with pneumonia increased by 9.6 percent, from 511.5 per 1,000 to 560.7 per 1,000. (Appendix B, Table B.2-14).

One-year mortality declined between 1992 and 1997 for both septicemia with pneumonia and respiratory failure with pneumonia. Between 1997 and 2001, 1-year mortality increased at an annual rate of 2.6 percent for septicemia and 0.9 percent for respiratory failure (Appendix B, Tables B.2-14 and B.3-14).
Figure V.3. 30-Day Age/Sex-Adjusted Mortality Rates Among Beneficiaries Admitted with Pneumonia, by State, 2000

- There was moderate state-to-state variation in mortality rates within 30 days of hospital admission for pneumonia (Appendix B, Table B.1-14.). Four states exhibited one-year mortality in excess of 140 per 1,000 beneficiaries hospitalized for pneumonia in 2000. In the same year, 6 states exhibited 30-day mortality rates of less than 110 per 1,000, a discrepancy of more than 25 percent. Pneumonia mortality tends to be lowest in rural northern and western states, though exceptions such as New York and Washington are evident in Figure V.3.

- Mortality following hospitalization for pneumonia declined in all but 6 states between 1992 and 2002. In only 2 states did the 30-day mortality rate increase by more than 5 percent (Appendix B, Table B.1-14).
Figure V.4. 30-Day and 365-Day Pneumonia Mortality Rates by Age Group, 1992 and 2001

- Mortality following pneumonia admission appeared to accelerate with age, particularly after age 80. The 1-year mortality rate was 251 per 1,000 for beneficiaries aged 65-69, 331 per 1,000 for beneficiaries aged 75-79, and 463 per 1,000 for beneficiaries aged 85-89 in 2001 (Figure V.4 and Appendix B, Table B.1-14).

- Reductions in mortality following admission for pneumonia occurred among the younger age groups. Thirty-day mortality increased for beneficiaries aged 90 and over. One-year mortality increased for beneficiaries aged 85 and over. (Figure V.4).
Both 30-day and 365-day mortality rates were somewhat higher for blacks than for whites. In 2001, the 365-day mortality rate was 16 percent higher for blacks (Figure V.5).

Between 1992 and 2002, the one-year mortality rate fell by 1.4 percent for blacks and by 3.2 percent for whites. The 30-day mortality rate fell by 12.5 percent for blacks and by 10.9 percent for whites. (Appendix B, Table B.1-14).
The evidence suggests a decline in 30-day mortality following pneumonia hospitalization as measured by state rates. Median state mortality fell by 7 percent, from 138 per 1,000 in 1992 to 128 per 1,000 in 2002. The maximum rate, the 25th, and 75th percentiles declined as well (Table V.1).

Cross-state variability in the 30-day mortality rate was roughly constant over the period. The interquartile range in mortality was 17 per 1,000 in 1992 and 17 per 1,000 in 2002.

### Table V.1. State Variation in 30-Day Mortality Following Pneumonia Hospitalization

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum</strong></td>
<td>100</td>
<td>95</td>
<td>100</td>
</tr>
<tr>
<td><strong>25th percentile</strong></td>
<td>129</td>
<td>120</td>
<td>119</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>138</td>
<td>133</td>
<td>128</td>
</tr>
<tr>
<td><strong>75th percentile</strong></td>
<td>146</td>
<td>142</td>
<td>134</td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>164</td>
<td>157</td>
<td>146</td>
</tr>
</tbody>
</table>
VI. DURATION TO DEATH OR ALL-PNEUMONIA READMISSION AFTER PNEUMONIA HOSPITALIZATION

Figure VI.1. Probability That Neither Death Nor All-Pneumonia Readmission Occurs Within Specified Times Following Pneumonia Hospitalization, 1992 and 2001

- The expected duration to death or all-pneumonia readmission following pneumonia hospitalization was virtually unchanged for beneficiaries hospitalized with pneumonia in 1992 and 2001. The probability of death or readmission within one year was 0.42 in 1992 and 0.41 in 2001. The probability of death or readmission within two years was 0.55 in 1992 and 0.51 in 2001 (Figure VI.1).

- The median time to death or all-pneumonia readmission was 590 days in 1992 and 631 days in 2001.
Figure VI.2. Probability That Neither Death Nor All-Pneumonia Readmission Occurs Within Specified Times Following Hospitalization for Septicemia with Pneumonia, 1992 and 2001

- The expected duration to death or pneumonia readmission declined for beneficiaries hospitalized for septicemia with pneumonia between 1992 and 2001. The probability of death or pneumonia readmission within 1 year was 0.57 in 1992 and 0.63 in 2001. The probability of death or pneumonia readmission within 2 years was 0.68 in 1992 and 0.70 in 2001.

- The median time to death or any pneumonia readmission declined 38 percent from 198 days in 1992 to 122 days in 2001.
The expected duration to death or pneumonia readmission changed only slightly for beneficiaries hospitalized for respiratory failure with pneumonia between 1992 and 2001. The probability of death or pneumonia readmission within one year was 0.68 in 1992 and 0.70 in 2001. The probability of death or pneumonia readmission within two years was 0.79 in 1992 and 0.77 in 2001 (Figure IV.3).

The median time to death or pneumonia readmission declined 13 percent from 100 days in 1992 to 87 days in 2001.
The mean duration to death or pneumonia readmission differed markedly for beneficiaries entitled to Medicaid under the aged, disabled, and ESRD benefits. In 2001, the probability of death or pneumonia readmission within 1 year of discharge for pneumonia was 0.42 for aged, 0.34 for disabled, and 0.58 for ESRD beneficiaries. At 2 years from discharge, the probabilities were 0.52, 0.42, and 0.71, respectively (Figure VI.4).

The median time to death or pneumonia readmission after a 2001 pneumonia hospitalization was 606 days for the aged and 272 days for beneficiaries with ESRD. For the disabled, the median time could not be computed, but was known to be greater than 730 days.
Adverse outcomes occurred more rapidly to dual-enrolled beneficiaries than to Medicare-only beneficiaries in 2001.

The median time to death or pneumonia-related readmission after a 2001 pneumonia hospitalization was 396 days for the dual-enrolled and more than 730 days for Medicare-only beneficiaries.
VII. DISCUSSION

Hospitalization of Medicare beneficiaries for pneumonia grew by nearly 11 percent between 1992 and 2002. The increase was broad-based and occurred in every census region, in both urban and rural areas, and for every age group of the Medicare population except the very oldest (95+). This increase was at least mildly surprising, occurring as it did during a period when the over-65 population was increasingly likely to be vaccinated against influenza and invasive pneumococcal infection (Centers for Disease Control 2002). Hospitalization for two related, but much rarer conditions – septicemia with pneumonia and respiratory failure with pneumonia – increased much more rapidly over the same period, by 54 and 135 percent, respectively.

Despite this increase in hospitalization and an increase of over 25 percent in pneumonia readmissions, mortality within 30 days of hospital discharge declined by about 12 percent over the period. Mortality within 365 days of admission declined by just 3 percent. Like the increase in hospitalizations, the decline in the mortality rate was broadly based, occurring in all but the oldest beneficiaries. No such reductions in mortality were observed for those hospitalized for septicemia with pneumonia or respiratory failure with pneumonia.

The Seventh Scope of Work of the Pneumonia Medicare Quality Improvement Project developed eight objectives, designed to decrease morbidity and mortality associated with pneumonia in Medicare beneficiaries: (1) increase the timeliness of antibiotic therapy; (2) increase the use of antibiotic therapy; (3) increase the collection of blood cultures within 24 hours of admission; (4) increase the collection of blood cultures before antibiotic use; (5) increase screening for influenza and pneumococcal immunization; (6) increase smoking cessation counseling; (7) increase arterial oxygenation assessment; and (8) increase statewide immunization rates for influenza and pneumococcal vaccines. Aside from statewide immunization rates, these measures are not available in claims data, which prevents easy investigation of the success of the effort or its relation to trends in readmission and mortality. However, a recent study by Jencks et al. (2003) showed improvement over a recent two-year period in four of the five quality measures examined.

The rapid increase in hospitalization for septicemia with pneumonia and respiratory failure with pneumonia, and the 17 percent increase in 30-day mortality following admission for septicemia with pneumonia remain a puzzle. This admission trend is consistent, however, with results reported by McBean and Rajamani (2001).

Because the incidences of pneumonia-related conditions, and of adverse outcomes associated with these conditions, are far higher among those who are already ill or debilitated, a comprehensive examination of trends and variations in pneumonia hospitalization and outcomes will require a more sophisticated approach to risk adjustment than was attempted in this study.

MQMS: Pneumonia
REFERENCES


### A. PNEUMONIA DISCHARGE RATES, LENGTH OF STAY, AND COST (M4)

| Measure                                                                 | Rate of discharges from short-stay hospitals for the following pneumonia cohorts:  
|                                                                        | 1) A principal diagnosis of pneumonia;  
|                                                                        | 2) A principal diagnosis of septicemia with a secondary diagnosis of pneumonia;  
| Case Definition                                                        | Pneumonia-cohort discharges are defined as claims with diagnosis or procedure codes as specified in Appendix C.  
|                                                                        | Claims that reflect transfers (within one day) from acute-care, short-stay hospitals to other acute-care, short-stay hospitals were combined with the claim for the original hospital admission, using the diagnosis codes from the later admission. |
| Population                                                             | Beneficiaries eligible for Medicare in January of each calendar year, enrolled in Part A for the full year, and not enrolled in Medicare managed care at any point in the year. Beneficiaries who died during the calendar year but who would have qualified otherwise are included. |
| Computation                                                            | Numerator:  
|                                                                        | \[\text{Discharge level: Number of pneumonia-cohort discharges}\]  
|                                                                        | \[\text{Beneficiary level: Number of beneficiaries with at least one pneumonia-cohort discharge}\]  
|                                                                        | Denominator: Number of beneficiaries in the population  
|                                                                        | Rates are expressed in thousands. |
| Rationale                                                              | Description of utilization for pneumonia |
| Data Sources                                                            | MedPAR File  
|                                                                        | Denominator File  
|                                                                        | CMS Cross-Reference File |
Appendix A: Pneumonia Specifications

| Exclusions                                                                 | Missing or invalid values for state, sex, race, Medicare status
| Discharges from all hospitals other than short-stay hospitals               | Duplicate records
| Discharges from stand-alone emergency rooms                                 | Discharges with invalid procedure codes
| Discharges for Medicare beneficiaries whose Health Insurance Claim Number (HICNO) does not have a match in CMS’s Cross-Reference File | Overlapping beneficiary acute-care, short-stay hospital claims

| Adjustment                                                                 | Rates are age-sex–adjusted by using the Medicare Part A FFS population as of July 1, 1999, as the standard population.
|                                                                             | National results are standardized with 18 age/sex groups using direct standardization. State results are standardized using indirect standardization due to smaller sample sizes. Both methods are described in Anderson et al. (1998). The direct standardization method computes the weighted sum of the mean outcomes across the age-sex cells, using the proportion of the standard population in each cell as the weights. The indirect method, which is necessary when some age-sex cells are empty, is a ratio estimate in which the mean for the group of interest is estimated by multiplying the standard population mean by the ratio of the observed outcome for the population of interest to the expected outcome. The expected outcome is the weighted sum of outcomes for the standard population across the age-sex cells, using the distribution of the population of interest as the weights. Given the use of two standardization methods, state results are not directly comparable to national results.
|                                                                             | The aged and disabled rates are not directly comparable because the ages of the two groups do not overlap; hence neither can be adjusted to the full age distribution. Rates for the aged and disabled groups were adjusted using the direct age-sex adjustment with all age groups, and then each rate was re-inflated by dividing by the proportion of the standard population over 65 and under 65, respectively.

| Period                                                                     | 1992–2002
### Stratifiers

<table>
<thead>
<tr>
<th>Measure</th>
<th>Average length of stay per pneumonia-cohort discharge in short-stay hospitals, measured in days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Definition</td>
<td>Pneumonia-cohort discharges are defined as claims with diagnosis or procedure codes as specified in Appendix C. Claims that reflect transfers (within one day) from acute-care, short-stay hospitals to other acute-care, short-stay hospitals were combined with the claim for the original hospital admission, using the diagnosis codes from the later admission.</td>
</tr>
<tr>
<td>Population</td>
<td>Beneficiaries eligible for Medicare in January of each calendar year, enrolled in Part A for the full year, and not enrolled in Medicare managed care at any point in the year and who had at least one pneumonia-cohort discharge. Beneficiaries who died during the calendar year but who would have otherwise qualified are included.</td>
</tr>
</tbody>
</table>

**Stratifiers**

- **Age** (0–54, 55–64, 65–69, 70–74, 75–79, 80–84, 85–89, 90–94, 95+) on July 1 of the reference year
- **Race** (white, black, other)
- **Sex**
- **Reason for Medicare eligibility** (aged without end-state renal disease [ESRD], disabled without ESRD, ESRD)
- **Dual enrollment** defined as enrolled in Medicare Part A and with Medicaid buy-in at least one month during the calendar year.*
- **Urban/rural** based on the metropolitan statistical area (MSA) and Bureau of Economic Analysis (BEA) State and County Crosswalk File developed for the CMS Prospective Payment System. All counties in an MSA are designated as urban; all other counties are considered rural.
- **Census region** of the beneficiary’s residence on March 31 of the year following the reference year
- **State** of the beneficiary’s residence on March 31 of the year following the reference year

* The Medicare data do not record true dual-enrollment status but only whether a state Medicaid program pays the beneficiary’s Medicare premiums, copayments, and deductibles. The payment of these Medicare expenses by Medicaid does not always translate into full Medicaid coverage. Nevertheless, the buy-in indicator in the Medicare data is a reasonably accurate indicator of beneficiary poverty.
## Computation
Numerator: Sum of days for pneumonia-cohort hospitalization, based on admission and discharge date, with a maximum of 90 days
Denominator: Number of pneumonia-cohort discharges in the population

## Rationale
Description of pneumonia utilization

## Data Sources
- MedPAR File
- Denominator File
- CMS Cross-Reference File

## Exclusions
- Missing or invalid values for state, sex, race, Medicare status
- Discharges from all hospitals other than short-stay hospitals
- Duplicate records
- Discharges from stand-alone emergency rooms
- Discharges with invalid procedure codes
- Discharges for Medicare beneficiaries whose Health Insurance Claim Number (HICNO) does not have a match in CMS’s Cross-Reference File
- Overlapping beneficiary acute-care, short-stay hospital claims

## Adjustment
Length of stay is age-sex–adjusted using the Medicare Part A FFS population as of July 1, 1999, as the standard population.

National results are standardized with 18 age/sex groups using direct standardization. State results are standardized using indirect standardization due to smaller sample sizes. Both methods are described in Anderson et al. (1998). The direct standardization method computes the weighted sum of the mean outcomes across the age-sex cells, using the proportion of the standard population in each cell as the weights. The indirect method, which is necessary when some age-sex cells are empty, is a ratio estimate in which the mean for the group of interest is estimated by multiplying the standard population mean by the ratio of the observed outcome for the population of interest to the expected outcome. The expected outcome is the weighted sum of outcomes for the standard population across the age-sex cells, using the distribution of the population of interest as the weights. Given the use of two standardization methods, state results are not directly comparable to national results.
The aged and disabled rates are not directly comparable because the ages of the two groups do not overlap; hence neither can be adjusted to the full age distribution. Rates for the aged and disabled groups were adjusted using the direct age-sex adjustment with all age groups, and then each rate was re-inflated by dividing by the proportion of the standard population over 65 and under 65, respectively.

<table>
<thead>
<tr>
<th>Period</th>
<th>1992–2002</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stratifiers</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>(0–54, 55–64, 65–69, 70–74, 75–79, 80–84, 85–89, 90–94, 95+) on July 1 of the reference year</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td>(white, black, other)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Reason for Medicare eligibility</strong></td>
<td>(aged without ESRD, disabled without ESRD, ESRD)</td>
</tr>
<tr>
<td><strong>Dual enrollment</strong></td>
<td>defined as enrolled in Medicare Part A and with Medicaid buy-in at least one month during the calendar year.*</td>
</tr>
<tr>
<td><strong>Urban/rural</strong></td>
<td>based on the metropolitan statistical area (MSA) and Bureau of Economic Analysis (BEA) State and County Crosswalk File developed for the CMS Prospective Payment System. All counties in an MSA are designated as urban; all other counties are considered rural.</td>
</tr>
<tr>
<td><strong>Census region</strong></td>
<td>of the provider state, based on the MedPAR provider ID</td>
</tr>
<tr>
<td><strong>State</strong></td>
<td>of the provider state, based on the MedPAR provider ID</td>
</tr>
</tbody>
</table>

* The Medicare data do not record true dual-enrollment status but only whether a state Medicaid program pays the beneficiary’s Medicare premiums, copayments, and deductibles. The payment of these Medicare expenses by Medicaid does not always translate into full Medicaid coverage. Nevertheless, the buy-in indicator in the Medicare data is a reasonably accurate indicator of beneficiary poverty.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Medicare and beneficiary payments for pneumonia-cohort discharges</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case Definition</strong></td>
<td>Pneumonia-cohort discharges are defined as claims with diagnosis or procedure codes as specified in Appendix C. Claims that reflect transfers (within one day) from acute-care, short-stay hospitals to other acute-care, short-stay</td>
</tr>
</tbody>
</table>

Appendix A: Pneumonia Specifications
hospitals were combined with the claim for the original hospital admission, using the diagnosis codes from the later admission.

| Population | Beneficiaries eligible for Medicare in January of each calendar year, enrolled in Part A for the full year, and not enrolled in Medicare managed care at any point in the year and who had a pneumonia-cohort discharge. Beneficiaries who died during the calendar year but who would have qualified otherwise are included. |
| Computation | Total Medicare payments: Sum of Medicare program payments for all pneumonia discharges in the population  
Total beneficiary payments: Sum of beneficiary coinsurance and deductible payments for all pneumonia discharges in the population  
Average Medicare payments per discharge:  
   Numerator: Sum of Medicare payments for pneumonia-cohort discharges in the population  
   Denominator: Number of pneumonia-cohort discharges in the population  
Note: In cases of hospital transfers, only payments from the second hospitalization are included in totals. |
| Rationale | Description of pneumonia utilization |
| Data Sources | MedPAR File  
Denominator File  
CMS Cross-Reference File |
| Exclusions | Missing or invalid values for state, sex, race, Medicare status  
Discharges from all hospitals other than short-stay hospitals  
Duplicate records  
Discharges from stand-alone emergency rooms  
Discharges with invalid procedure codes  
Discharges for Medicare beneficiaries whose Health Insurance Claim Number (HICNO) does not have a match in CMS’s Cross-Reference File  
Overlapping beneficiary acute-care, short-stay hospital claims |
| Adjustment | None |
## Appendix A: Pneumonia Specifications

**Period**  
1992–2002

| Stratifiers |  
|---|---|
| **Age** | (0–54, 55–64, 65–69, 70–74, 75–79, 80–84, 85–89, 90–94, 95+) on July 1 of the reference year  
**Race** | (white, black, other)  
**Sex** |  
**Reason for Medicare eligibility** | (aged without ESRD, disabled without ESRD, ESRD)  
**Dual enrollment** | defined as enrolled in Medicare Part A and with Medicaid buy-in at least one month during the calendar year.*  
**Urban/rural** | based on the metropolitan statistical area (MSA) and Bureau of Economic Analysis (BEA) State and County Crosswalk File developed for the CMS Prospective Payment System. All counties in an MSA are designated as urban; all other counties are considered rural.  
**Census region** | of the provider state, based on the MedPAR provider ID, for Medicare Payments, and of the beneficiary state, as of March 31 of the year following the reference year, for beneficiary payments  
**State** | of the provider state, based on the MedPAR provider ID, for Medicare payments, and of the beneficiary state, as of March 31 of the year following the reference year, for beneficiary payments  

* The Medicare data do not record true dual-enrollment status but only whether a state Medicaid program pays the beneficiary’s Medicare premiums, copayments, and deductibles. The payment of these Medicare expenses by Medicaid does not always translate into full Medicaid coverage. Nevertheless, the buy-in indicator in the Medicare data is a reasonably accurate indicator of beneficiary poverty.

## Measure

| Measure | Average number of pneumonia discharges among beneficiaries with at least one pneumonia-cohort discharge |

## Case Definition

Pneumonia-cohort discharges are defined as claims with diagnosis or procedure codes as specified in Appendix C. Claims that reflect transfers (within one day) from acute-care, short-stay hospitals to other acute-care, short-stay hospitals were combined with the claim for the original hospital admission, using the diagnosis codes from the later admission.
| **Population** | Beneficiaries eligible for Medicare in January of each calendar year, enrolled in Part A for the full year, and not enrolled in Medicare managed care at any point in the year and who had a pneumonia-cohort discharge. Beneficiaries who died during the calendar year but who would have qualified otherwise are included. |
| **Computation** | Numerator:  
*Pneumonia cohort*: Number of pneumonia-cohort (i.e., pneumonia, septicemia with pneumonia, and respiratory failure with pneumonia as separate cohorts) discharges in reference year  
*All-cause*: Number of all discharges in reference year  
Denominator: Number of pneumonia-cohort beneficiaries in the population |
| **Rationale** | Description of pneumonia utilization |
| **Data Sources** | MedPAR File  
Denominator File  
CMS Cross-Reference File |
| **Exclusions** | Missing or invalid values for state, sex, race, Medicare status  
Discharges from all hospitals other than short-stay hospitals  
Duplicate records  
Discharges from stand-alone emergency rooms  
Discharges with invalid procedure codes  
Discharges for Medicare beneficiaries whose Health Insurance Claim Number (HICNO) does not have a match in CMS’s Cross-Reference File  
Overlapping beneficiary acute-care, short-stay hospital claims |
| **Adjustment** | None |
| **Period** | 1992–2002 |
| **Stratifiers** | Age (0–54, 55–64, 65–69, 70–74, 75–79, 80–84, 85–89, 90–94, 95+) on July 1 of the reference year  
Race (white, black, other)  
Sex |
<table>
<thead>
<tr>
<th>Reason for Medicare eligibility</th>
<th>(aged without ESRD, disabled without ESRD, ESRD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dual enrollment</strong> defined as enrolled in Medicare Part A and with Medicaid buy-in at least one month during the calendar year.*</td>
<td></td>
</tr>
<tr>
<td><strong>Urban/rural</strong> based on the metropolitan statistical area (MSA) and Bureau of Economic Analysis (BEA) State and County Crosswalk File developed for the CMS Prospective Payment System. All counties in an MSA are designated as urban; all other counties are considered rural.</td>
<td></td>
</tr>
<tr>
<td><strong>Census region</strong> of the beneficiary residence, as of March 31 of the year following the reference year</td>
<td></td>
</tr>
<tr>
<td><strong>State</strong> of the beneficiary residence, as of March 31 of the year following the reference year</td>
<td></td>
</tr>
</tbody>
</table>

* The Medicare data do not record true dual-enrollment status but only whether a state Medicaid program pays the beneficiary’s Medicare premiums, copayments, and deductibles. The payment of these Medicare expenses by Medicaid does not always translate into full Medicaid coverage. Nevertheless, the buy-in indicator in the Medicare data is a reasonably accurate indicator of beneficiary poverty.
## B. SPECIFICATIONS FOR READMISSION RATES (M5)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Beneficiary and discharge-level readmission rates following discharges for pneumonia, septicemia with pneumonia, and respiratory failure with pneumonia, by days from discharge (30 and 365)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Definition</td>
<td>Pneumonia-cohort discharges are defined as claims with diagnosis or procedure codes as specified in Appendix C. Claims that reflect transfers (within one day) from acute-care, short-stay hospitals to other acute-care, short-stay hospitals were combined with the claim for the original hospital admission, using the diagnosis codes from the later admission.</td>
</tr>
<tr>
<td>Population</td>
<td>Medicare beneficiaries eligible for Medicare in January of each calendar year and enrolled in Part A and FFS for the full calendar year and who had a pneumonia-cohort discharge. Beneficiaries who died during the calendar year but who would have qualified otherwise are included.</td>
</tr>
</tbody>
</table>
| Computation | **Beneficiary:**  
  Numerator: Number of beneficiaries hospitalized for pneumonia-related conditions within 30 and 365 days of first pneumonia-cohort discharge in the reference year  
  Denominator: Number of beneficiaries with at least one pneumonia-cohort discharge  
  **Discharge:**  
  Numerator: Number of beneficiaries hospitalized for pneumonia-related conditions within 30 and 365 days of each index pneumonia-cohort discharge in the reference year  
  Denominator: Number of pneumonia-cohort discharges in the reference year  
  Rates are expressed in thousands. Rates with numerators of 25 or less are suppressed in tables.  
  Beneficiary rates use the first pneumonia cohort admission as the index admission; discharge rates use each pneumonia-cohort admission as an index admission.  
  Readmissions include same-day readmissions to the same facility.  
  Rates do not include beneficiaries who entered managed care or died within the window follow-up period.  
  Readmissions are classified by the state of the index admission.
<table>
<thead>
<tr>
<th><strong>Rationale</strong></th>
<th>Description of pneumonia outcomes</th>
</tr>
</thead>
</table>
| **Data Sources** | MedPAR File  
Denominator File  
CMS Cross-Reference File |
| **Exclusions** | Missing or invalid values for state, sex, race, Medicare status  
Discharges from all hospitals other than short-stay hospitals  
Duplicate records  
Discharges from stand-alone emergency rooms  
Discharges with invalid procedure codes  
Discharges for Medicare beneficiaries whose Health Insurance Claim Number (HICNO) does not have a match in CMS’s Cross-Reference File  
Overlapping beneficiary acute-care, short-stay hospital claims |
<p>| <strong>Adjustment</strong> | Rates are age-sex-adjusted using the Medicare Part A FFS population as of July 1, 1999, as the standard population. National results are standardized with 18 age/sex groups using direct standardization. State results are standardized using indirect standardization due to smaller sample sizes. Both methods are described in Anderson et al. (1998). The direct standardization method computes the weighted sum of the mean outcomes across the age-sex cells, using the proportion of the standard population in each cell as the weights. The indirect method, which is necessary when some age-sex cells are empty, is a ratio estimate in which the mean for the group of interest is estimated by multiplying the standard population mean by the ratio of the observed outcome for the population of interest to the expected outcome. The expected outcome is the weighted sum of outcomes for the standard population across the age-sex cells, using the distribution of the population of interest as the weights. Given the use of two standardization methods, state results are not directly comparable to national results. The aged and disabled rates are not directly comparable because the ages of the two groups do not overlap, so neither can be adjusted to the full age distribution. Rates for both groups were adjusted using the direct age-sex adjustment with all age groups, and then each rate was re-inflated by dividing by the proportion of the standard population over 65 and under 65, respectively. |</p>
<table>
<thead>
<tr>
<th>Period</th>
<th>1992-2002</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stratifiers</strong></td>
<td>Age (0-54, 55–64, 65–69, 70–74, 75–79, 80–84, 85–89, 90–94, 95+) on July 1 of the reference year</td>
</tr>
<tr>
<td></td>
<td>Race (white, black, other)</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
</tr>
<tr>
<td></td>
<td><strong>Reason for Medicare eligibility</strong> (aged without ESRD, disabled without ESRD, ESRD)</td>
</tr>
<tr>
<td></td>
<td><strong>Dual enrollment</strong> defined as enrolled in Medicare Part A and with Medicaid buy-in at least one month during the calendar year.*</td>
</tr>
<tr>
<td></td>
<td><strong>Urban/rural</strong> based on the metropolitan statistical area (MSA) and Bureau of Economic Analysis (BEA) State and County Crosswalk File developed for the CMS Prospective Payment System. All counties in an MSA are designated as urban; all other counties are considered rural.</td>
</tr>
<tr>
<td></td>
<td><strong>Census region</strong> of the provider state, based on the MedPAR provider ID</td>
</tr>
<tr>
<td></td>
<td><strong>State</strong> of the provider state, based on the MedPAR provider ID</td>
</tr>
<tr>
<td></td>
<td>* The Medicare data do not record true dual-enrollment status but only whether a state Medicaid program pays the beneficiary’s Medicare premiums, copayments, and deductibles. The payment of these Medicare expenses by Medicaid does not always translate into full Medicaid coverage. Nevertheless, the buy-in indicator in the Medicare data is a reasonably accurate indicator of beneficiary poverty.</td>
</tr>
</tbody>
</table>
### C. SPECIFICATIONS FOR MORTALITY RATES (M6)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mortality rates among beneficiaries with a hospitalization for pneumonia-related conditions.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case Definition</strong></td>
<td>Pneumonia-cohort discharges are defined as claims with diagnosis or procedure codes as specified in Appendix C. Claims that reflect transfers (within one day) from acute-care, short-stay hospitals to other acute-care, short-stay hospitals were combined with the claim for the original hospital admission, using the diagnosis codes from the later admission.</td>
</tr>
<tr>
<td><strong>Population</strong></td>
<td>Medicare beneficiaries eligible for Medicare in January of each calendar year and enrolled in Part A and FFS for the full calendar year and who had a pneumonia-cohort hospitalization. Beneficiaries who died during the calendar year but who would have qualified otherwise are included.</td>
</tr>
</tbody>
</table>
| **Computation** | Numerator: Number of beneficiaries who died within 30 and 365 days from the day of the first (index) admission for pneumonia in the year  
Denominator: Number of beneficiaries with pneumonia discharges in the reference year  
Rates are expressed in thousands. Rates with numerators of 25 or less are suppressed in tables.  
Rates do not include beneficiaries who switched to managed care within the window follow-up period. |
| **Rationale** | Description of pneumonia outcomes |
| **Data Sources** | MedPAR File  
Denominator File  
CMS Cross-Reference File |
| **Exclusions** | Missing or invalid values for state, sex, race, Medicare status  
Discharges from all hospitals other than short-stay hospitals  
Duplicate records  
Discharges from stand-alone emergency rooms  
Discharges with invalid procedure codes  
Discharges for Medicare beneficiaries whose Health Insurance Claim Number (HICNO) does not have a match in CMS’s Cross-Reference File  
Overlapping beneficiary acute-care, short-stay hospital claims |
Appendix A: Pneumonia Specifications

**Adjustment**
Rates are age-sex-adjusted using the Medicare Part A FFS population as of July 1, 1999, as the standard population.

National results are standardized with 18 age/sex groups using direct standardization. State results are standardized using indirect standardization due to smaller sample sizes. Both methods are described in Anderson et al. (1998). The direct standardization method computes the weighted sum of the mean outcomes across the age-sex cells, using the proportion of the standard population in each cell as the weights. The indirect method, which is necessary when some age-sex cells are empty, is a ratio estimate in which the mean for the group of interest is estimated by multiplying the standard population mean by the ratio of the observed outcome for the population of interest to the expected outcome. The expected outcome is the weighted sum of outcomes for the standard population across the age-sex cells, using the distribution of the population of interest as the weights. Given the use of two standardization methods, state results are not directly comparable to national results.

The aged and disabled rates are not directly comparable because the ages of the two groups do not overlap; hence neither can be adjusted to the full age distribution. Rates for the aged and disabled groups were adjusted using the direct age-sex adjustment with all age groups, and then each rate was re-inflated by dividing by the proportion of the standard population over 65 and under 65, respectively.

**Period**
1992–2002

**Stratifiers**

<table>
<thead>
<tr>
<th>Stratifiers</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>(0–54, 55–64, 65–69, 70–74, 75–79, 80–84, 85–89, 90–94, 95+) on July 1 of the reference year</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td>(white, black, other)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Reason for Medicare eligibility</td>
<td>(aged without ESRD, disabled without ESRD, ESRD)</td>
</tr>
<tr>
<td>Dual enrollment</td>
<td>defined as enrolled in Medicare Part A and with Medicaid buy-in at least one month during the calendar year.*</td>
</tr>
<tr>
<td>Urban/rural</td>
<td>based on the metropolitan statistical area (MSA) and Bureau of Economic Analysis (BEA) State and County Crosswalk File developed for the CMS Prospective Payment System. All counties in an MSA are designated as</td>
</tr>
</tbody>
</table>
urban; all other counties are considered rural.

**Census region** of the provider state, based on the MedPAR provider ID

**State** of the provider state, based on the MedPAR provider ID

* The Medicare data do not record true dual-enrollment status but only whether a state Medicaid program pays the beneficiary’s Medicare premiums, copayments, and deductibles. The payment of these Medicare expenses by Medicaid does not always translate into full Medicaid coverage. Nevertheless, the buy-in indicator in the Medicare data is a reasonably accurate indicator of beneficiary poverty.

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**Appendix A: Pneumonia Specifications**