

The Impact of Pneumonia Guidelines and Core Measures on Patient-Oriented Outcomes

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Over the past decade, evidence-based guidelines have led to the development of national core measures for the management of pneumonia. Although it does not signify causation, implementation of these standards strongly correlates with a decrease in the incidence of pneumonia and with decreasing death rates from pneumonia.

Pneumonia, together with influenza, has caused a great burden of suffering throughout history. It ranked as the leading cause of death in the early 1900s and was still among the top 10 causes of death in 2011 [1-5]. Indeed, pneumonia remains the most common cause of infection-related mortality in the United States. More than 50,000 persons died of pneumonia or influenza in 2010, and 1,700 of those deaths occurred in North Carolina [2]. The age-adjusted death rate in the United States in 2010 for pneumonia and influenza combined was 15.1 deaths per 100,000 population [2].

The 1-year mortality rate for Medicare patients who have been hospitalized with community-acquired pneumonia is as high as 40% [6]. In the United States in 2010, pneumonia was listed as the first diagnosis on hospital discharge for nearly 1.3 million persons, for a rate of 36.6 discharges per 10,000 population [7]; in 2006, that rate was 41.3 per 10,000 population [5]. In 2006 the rate of discharge for patients with pneumonia as the first diagnosis was 189.0 per 10,000 population among patients older than 65 years, 33.4 per 10,000 population for those aged 45-64 years, and 8.5 per 10,000 population for those aged 15-44 years [5].

The estimated annual economic burden of pneumonia and influenza in the United States exceeded \$40 billion in 2005, with more than \$34 billion in direct costs and \$6 billion in indirect costs [5]. The economic burden from community-acquired pneumonia alone is estimated to exceed \$17 billion annually, including costs for approximately 4.2 million ambulatory visits [8].

Pneumonia Guidelines

The Infectious Diseases Society of America (IDSA) and the American Thoracic Society (ATS) issued consensus guidelines on the management of community-acquired pneumonia in 2007 [9]. These guidelines and previous updates have been the basis for the implementation of a number of core measures in health care systems around

the country. For example, our institution—New Hanover Regional Medical Center in Wilmington, North Carolina—has the following goals: that antibiotics be administered to patients with pneumonia within 6 hours of their arrival at the hospital; that blood cultures be obtained prior to administration of the first dose of antibiotics; and that the initial antibiotic selection be based on current evidence and local epidemiology. Similar standards have been established by the Centers for Medicare & Medicaid Services and The Joint Commission, both of which accredit health care organizations and programs. In 2005 the IDSA and the ATS issued consensus guidelines on the management of health care-associated pneumonia, which includes hospital-acquired pneumonia and ventilator-associated pneumonia [10].

Both sets of guidelines make recommendations regarding treatment of patients after they acquire pneumonia and also recommend various measures to decrease the incidence of pneumonia. Frequently recognized standards from the health care-associated pneumonia guidelines include elevating the head of the bed for patients with pneumonia and giving mechanically ventilated patients daily “sedation vacations” in order to prevent pneumonia. The community-acquired pneumonia guidelines advocate counseling on smoking cessation for all smokers admitted to the hospital, and they encourage vaccination against influenza and pneumococcal disease in appropriate patients, per the recommendations of the Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC), with a goal of 90% adherence.

The IDSA goal is that the strongest recommendations be carried out for the majority of patients. Clinicians may reasonably decide to deviate from these guidelines, and it is not expected that every patient will receive the same exact care. Nevertheless, hospital guidelines and core measures provide a systematic approach to the management of pneumonia, and they may enhance reimbursement as pay-for-performance becomes a reality. An early review of

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evidence-based algorithms for the treatment of pneumonia in other countries showed decreases in 30-day mortality, in-hospital mortality, and hospital length of stay [11]. As health care systems in the United States implement these types of guidelines, we do not yet know how adherence to the guidelines will impact long-term outcomes at the local and national levels.

Patient-Oriented Outcomes

Over the past decade, most measures of pneumonia morbidity and mortality have shown improvement, coinciding with the widespread use of clinical guidelines and the establishment of core measures for the treatment and prevention of pneumonia. Interestingly, the incidence of pneumonia among black individuals appears to be decreasing, despite the fact that this group has traditionally faced a number of health disparities.

In terms of hospitalizations, the total number of persons with pneumonia listed as the first diagnosis on hospital discharge actually increased slightly among white patients (from 786,000 to 787,000) between 1996 and 2006, but it decreased for black patients during that same period, from 149,000 to 116,000; the incidence of pneumonia among all other races also decreased, from 49,000 to 41,000 [5]. Between 1996 and 2006, the rate of pneumonia as the first-listed diagnosis at hospital discharge increased slightly for those aged 45–64 years—from 32.3 to 33.4 per 10,000 population—but this rate decreased for all other age groups. For those younger than 15 years, the rate decreased from 33.0 to 28.3 per 10,000 population; for those aged 15–44 years, it decreased from 11.8 to 8.5 per 10,000 population; and for those older than 65 years, it decreased from 206.3 to 189.0 per 10,000 population [5].

When comparing annual death rates for pneumonia and influenza for various years, it is important to keep in mind that the population standard for calculating age-adjusted death rates changed in 1999. The new standard places more weight on death rates at older ages and less weight on death rates at younger ages. Because the incidence of lung diseases increases with age, death rates for pneumonia and influenza are higher when calculated using the new standard [5]. Another important change, which also took place in 1999, occurred when the International Classification of Diseases, 10th Revision (ICD-10) implemented the direct sequel rule for selecting the underlying cause of death, which mandated that causes of death be listed beginning with the most proximate cause and working back to the condition initiating the chain of events that led to death. Therefore, the underlying disease is listed as the cause of death, not pneumonia. Because pneumonia is often a final consequence of another chronic or acute condition, such as chronic obstructive pulmonary disease, pneumonia mortality statistics are particularly affected by this rule. The result of this change is that the death rate appears to have decreased sharply between 1998 and 1999 (from 34.6 deaths to 23.5 per 100,000 popu-

lation), but much of this drop is likely due to the shift from ICD-9 to ICD-10 [12]. Because of these changes, it is difficult to draw conclusions when comparing data from 1998 and prior years with data from subsequent years [11, 12]. However, tracking of pneumonia outcomes since 1999 has been consistent.

Beginning with death rates compiled under the new standard in 1999 and comparing those more recent mortality statistics, pneumonia death rates have decreased significantly. Between 1999 and 2010, age-adjusted death rates for pneumonia and influenza decreased 35%, from 23.4 deaths per 100,000 [5] to 15.1 per 100,000 population [2]. Between 1999 and 2006, the age-adjusted death rate for white men fell from 27.7 to 20.9 per 100,000 population, and for white women it fell from 20.8 to 15.5 per 100,000 population [5]. For black men, the rate decreased from 32.4 to 24.4 per 100,000 population, and for black women it decreased from 21.3 to 16.7 per 100,000 population [5].

Vaccinations

Adherence to guidelines for health care-associated and community-acquired pneumonia has improved, particularly with regard to influenza vaccination rates. In the last quarter of 2003, the percentage of adults aged 50–64 years who had received an influenza vaccination in the previous 12 months was 36.8%; by 2011 that rate had increased to 42.7% [13]. The vaccination rate also increased among persons aged 18–49 years, from 16.4% in 2003 to 27.2% in 2011. The vaccination rate among patients aged 65 years or older was relatively unchanged during this period, at 65.5% in 2003 and 67% in 2011. This is unfortunate, given that elderly individuals are at higher risk for complications from respiratory infections. Fortunately, influenza vaccination rates for some high-risk groups have improved; for example, the percentage of adults with asthma who received an influenza vaccination increased from 40.4% in 2003 to 45.6% in 2008 [5].

Although the percentage of elderly patients receiving influenza vaccine has remained consistent, the rate of pneumococcal vaccination in elderly individuals has increased dramatically over the past decade or so. The ACIP recommends the 23-valent pneumococcal polysaccharide vaccine (PPSV23, or Pneumovax) for all adults aged 65 years or older [14]. In 2004 the National Nursing Home Survey, which is conducted by the CDC, addressed compliance with pneumococcal vaccination recommendations. The CDC reported that only 45.4% of nursing home residents had been vaccinated, while 36.8% had not been vaccinated; the vaccination status of 17.7% of residents was unknown [15]. According to the National Health Interview Survey, persons age 65 year or older—including persons who were not nursing home residents—yielded a similar pneumococcal vaccination rate of 42.6% in 1997 [16]. Since this stagnant period (1997–2004), the percentage of elderly patients receiving PPSV23 has improved, reaching 62.7% in 2011 [13]. Even with this significant increase in vaccination rates, most pop-

ulation studies reveal that immunization rates still fall far short of the IDSA goal of 90% [17].

Discussion

Over the past decade, the overall incidence of pneumonia has decreased significantly, and the death rates from pneumonia are also decreasing. The total number of cases of pneumonia also decreased despite an increase in the size of the US population. Although racial and ethnic disparities still exist, pneumonia outcomes appear to be improving for most groups. While a small increase in the incidence of pneumonia was observed for white persons, the death rate from pneumonia decreased in all racial groups (including whites). Similarly, people aged 45–64 years experienced a slight increase in the incidence of pneumonia, but death rates dropped for all age groups.

As described above, rates of vaccination with PPSV23 have improved. Although there is conflicting evidence regarding the effectiveness of PPSV23 [14], the vaccine is generally believed to decrease the incidence and severity of invasive pneumococcal disease. The use of the 13-valent pneumococcal conjugate vaccine (PCV13) in children may also have indirect beneficial effects in the future. The encouraging news is that more patients for whom pneumococcal vaccine is appropriate are being vaccinated; however, many eligible patients are still being missed. Fortunately, North Carolina's immunization process has resulted in vaccination rates for most diseases that are consistently above the national average [18].

Over the past 15 years, guidelines for the management and prevention of pneumonia in the community and in health care settings have been developed and subsequently updated. Core measures have also been developed by health care organizations, and both the incidence of pneumonia and death rates from pneumonia have decreased. It is extremely important to remember that correlation does not imply causation and that the improvement in pneumonia outcomes is likely due to multiple factors. Indeed, there are myriad factors other than the practice guidelines and core measures for pneumonia that could explain these improved outcomes.

Past studies of the epidemiology of pneumonia have not distinguished between community-acquired pneumonia and health care-associated pneumonia; hypothetically, if it were determined that most of the improvement in pneumonia outcomes was related to the latter rather than the former, then advances in technology and critical care medicine might deserved the credit. However, comparing current hospital data with outpatient data is not sufficient to distinguish between health care-acquired and community-acquired pneumonia, because some patients with community-acquired pneumonia are hospitalized. However, future assessments might be able to use billing and coding data to allow the 2 different types of pneumonia to be tracked separately or together.

Regardless of what we discover or what we may never

know about pneumonia, a health care system that is seeing an increase in chronic diseases should welcome guidelines that seem to be correlated with improved outcomes for a disease that is a major cause of morbidity and mortality, both in North Carolina and in the rest of the nation. **NCMJ**

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References

1. National Center for Health Statistics, Centers for Disease Control and Prevention (CDC). Leading Causes of Death, 1900-1998. CDC Web site. http://www.cdc.gov/nchs/data/dvs/lead1900_98.pdf. Accessed July 2, 2012.
2. Murphy SL, Xu J, Kochanek KD. Deaths: final data for 2010. *Natl Vital Stat Rep*. 2013;61(4):1-167. Hyattsville, MD: National Center for Health Statistics; 2013. http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_04.pdf. Accessed August 8, 2013.
3. Hoyert DL, Xu J. Deaths: preliminary data for 2011. *Natl Vital Stat Rep*. 2012;61(6):1-51. Hyattsville, MD: National Center for Health Statistics; 2012. http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_06.pdf. Accessed August 9, 2013.
4. Centers for Disease Control and Prevention (CDC). FastStats. Pneumonia. CDC Web site. <http://www.cdc.gov/nchs/fastats/pneumonia.htm>. Last updated April 5, 2013. Accessed July 1, 2013.
5. American Lung Association, Research and Program Services, Epidemiology and Statistics Unit. Trends in pneumonia and influenza morbidity and mortality. April 2010. <http://www.lung.org/finding-cures/our-research/trend-reports/pi-trend-report.pdf>. Accessed July 1, 2013.
6. Watkins RR, Lemonovich TL. Diagnosis and management of community-acquired pneumonia in adults. *Am Fam Physician*. 2011;83(11):1299-1306.
7. Mandell LA, Wunderink RG, Anzueto A, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *Clin Infect Dis*. 2007;44(suppl 2):S27-S72.
8. American Thoracic Society; Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. *Am J Respir Crit Care Med*. 2005;171(4):388-416.
9. Capelastegui A, España PP, Quintana JM, et al. Improvement of process-of-care and outcomes after implementing a guideline for the management of community-acquired pneumonia: a controlled before-and-after design study. *Clin Infect Dis*. 2004;39(7):955-963.
10. Kaplan V, Clermont G, Griffin MF, et al. Pneumonia: still the old man's friend? *Arch Intern Med*. 2003;163(3):317-323.
11. Centers for Disease Control and Prevention (CDC). CDC/NCHS National Hospital Discharge Survey, 2010. Number and rate of discharges from short-stay hospitals and days of care, with average length of stay and standard error, by selected first-listed diagnostic categories: United States, 2010. CDC Web site. http://www.cdc.gov/nchs/data/nhds/2average/2010ave2_firstlist.pdf. Accessed July 1, 2013.
12. Anderson RN, Miniño AM, Hoyert DL, Rosenberg HM. Comparability of cause of death between ICD-9 and ICD-10: preliminary estimates. *Natl Vital Stat Rep*. 2001;49(2):1-32. Hyattsville, MD: National Center for Health Statistics; 2001. http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49_02.pdf. Accessed July 4, 2013.
13. Centers for Disease Control and Prevention. Early Release of Selected Estimates Based on Data from the 2011 National Health Interview Survey. http://www.cdc.gov/nchs/data/nhis/earlyrelease/earlyrelease_201206.pdf. Published June 19, 2012. Accessed September 18, 2013.
14. Centers for Disease Control and Prevention (CDC); Advisory Committee on Immunization Practices. Updated recommendations for prevention of invasive pneumococcal disease among adults using

the 23-valent pneumococcal polysaccharide vaccine (PPSV23). *MMWR Morb Mortal Wkly Rep.* 2010;59(34):1102-1106.

15. Centers for Disease Control and Prevention. Nursing Home Current Residents. June 2008. http://www.cdc.gov/nchs/data/nnhsd/Estimates/nnhs/Estimates_Diagnoses_Tables.pdf. Accessed September 18, 2013.
16. Centers for Disease Control and Prevention. Influenza and pneumococcal vaccination coverage among persons aged ≥ 65 years—United States, 2004–2005. *MMWR Morb Mortal Wkly Rep.* 2006;55(39):1065-1068. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5539a2.htm>. Accessed September 18, 2013.
17. Adams PF, Kirzinger WK, Martinez ME. Summary health statistics for the US population: National Health Interview Survey, 2011. Data from the National Health Interview Survey. *Vital Health Stat* 10(255). Hyattsville, MD: National Center for Health Statistics; 2012. http://www.cdc.gov/nchs/data/series/sr_10/sr10_255.pdf. Accessed August 8, 2013.
18. North Carolina Immunization Branch. The North Carolina Immunization Registry (NCIR). North Carolina Department of Health and Human Services Web site. <http://www.immunize.nc.gov/providers/ncir.htm>. Accessed August 8, 2013.

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