

Changes in diagnostic coding may affect data that indicate decline in pneumonia hospitalizations

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Although data indicate that between 2003-2009 there was a substantial decline in the U.S. in hospitalizations for pneumonia and inpatient deaths, analysis suggests that trends in documentation and diagnostic coding, rather than improvements in actual outcomes, may explain much of the observed changes, according to a study in the April 4 issue of *JAMA*.

Pneumonia is a leading cause of illness and death among U.S. adults, resulting in more than 1 million annual [hospital admissions](#) and accounting for more than \$10.5 billion in aggregate costs. "Given its public health significance, [pneumonia](#) has been the target of quality improvement activities for nearly 2 decades," according to background information in the article.

Recent reports suggest that the mortality rate of patients hospitalized with pneumonia has steadily declined. While this may be the result of advances in clinical care or improvements in quality, it may also represent an [artifact](#) of changes in diagnostic coding, in which the most severe [cases of pneumonia](#) are, over time, increasingly receiving alternative principal diagnoses, the authors write.

Peter K. Lindenauer, M.D., M.Sc., of Baystate Medical Center, Springfield, Mass., and colleagues analyzed trends in [hospital](#) admissions and outcomes for patients with pneumonia, as well as for patients with

[sepsis](#) or respiratory failure combined with pneumonia. The researchers compared results using alternative approaches for defining pneumonia: one that depends on the principal diagnosis of pneumonia and another that also includes patients with the principal diagnoses of sepsis or respiratory failure when combined with a secondary diagnosis of pneumonia. For comparison, they also evaluated changes in hospitalization and [mortality rates](#) among patients with a set of conditions they hypothesized would be less susceptible to changes in coding. For the analysis, the researchers used data from the 2003-2009 releases of the Nationwide Inpatient Sample (NIS), the largest all-payer, publicly available, national hospital database. The NIS contains a 20 percent stratified sample of all short-term, nonfederal, nonrehabilitation hospitals. Over the study period, the number of cases in the NIS data set ranged from 7.81 million (in 2009) to 8.16 million (in 2008).

Analysis of the data indicated that from 2003 to 2009 the hospitalization rate of patients with a principal diagnosis of pneumonia decreased from 5.5 to 4.0 per 1,000, an overall decline of 27.4 percent. Over this same period, the hospitalization rate for patients with a principal diagnosis of sepsis and a secondary diagnosis of pneumonia increased 177.6 percent from 0.4 to 1.1 per 1,000. The hospitalization rate of patients with a principal diagnosis of respiratory failure and secondary diagnosis of pneumonia rose 9.3 percent, from 0.44 to 0.48 per 1,000. The annual hospitalization rate decreased 12.5 percent, from 6.3 to 5.6 per 1,000, when the 3 diagnosis groups were combined to reduce the potential effect of changes in coding practices.

Regarding inpatient mortality, the researchers found that this rate decreased for each of the diagnosis groups between 2003 and 2009. Among patients with a principal diagnosis of pneumonia, age- and sex-adjusted inpatient mortality declined from 5.8 percent in 2003 to 4.2 percent in 2009 (relative risk reduction [RRR], 28.2 percent). For patients with a principal diagnosis of sepsis and a secondary diagnosis of

pneumonia, the adjusted inpatient mortality decreased from 25.1 percent in 2003 to 22.2 percent in 2009 (RRR, 12 percent). The adjusted inpatient mortality rate declined from 25.1 percent to 19.2 percent (RRR, 23.7 percent) among patients with a principal diagnosis of respiratory failure. "However, within the combined group, the adjusted mortality increased from 8.3 percent in 2003 to 8.8 percent in 2009 (RR increase, 6.0 percent)," the authors write. "Further, the combined group demonstrated a small decline in inpatient mortality (8.3 percent to 7.8 percent; RRR, 6.3 percent) instead of the modest increase observed without comorbidity adjustment."

The authors note that when the 3 groups were combined, the annual pneumonia hospitalization rate showed a more modest decline, and there was little change in the inpatient mortality rate, varying from a small increase to a small decline depending on the approach to risk adjustment.

"These findings have important implications. They suggest that attempts to measure the outcomes of patients with pneumonia by studying only those who receive a principal diagnosis of pneumonia will be biased toward increasingly less severe cases. This is especially problematic in the context of longitudinal studies that are subject to the effects of temporal trends in coding practice. Furthermore, ongoing efforts to measure and compare the performance of hospitals, such as those currently being carried out by the Centers for Medicare & Medicaid Services, may also be biased if there is variation across hospitals in their use of the sepsis and respiratory failure codes," the researchers write.

The authors add that although their study "was not designed to identify the cause of changes in the choice of principal diagnosis for patients with pneumonia, increased documentation and coding of sepsis may have been driven by guidelines that defined a broader set of sepsis signs and symptoms, a national campaign focused on the early recognition and

treatment of sepsis, and the higher hospital reimbursement rates associated with sepsis and [respiratory failure](#)."

"In conclusion, changing patterns in diagnostic coding provide reason to doubt that improvements in the mortality of [patients](#) with a principal diagnosis of pneumonia accurately reflect trends in pneumonia outcomes. Without taking into account the broader range of principal and secondary diagnosis combinations that can be used to assign codes to a patient with pneumonia, efforts to examine trends in outcomes or to compare hospital performance may produce biased results."

Mary S. Vaughan Sarrazin, Ph.D., and Gary E. Rosenthal, M.D., of the Iowa City VA Medical Center, Iowa City, comment on the findings of this study in an accompanying editorial.

"The increasing availability of administrative data, of algorithms for identifying specific diseases and comorbid conditions, and of user-friendly statistical software has made it easier to use administrative data in assessing health care delivery and quality of care. Moreover, enhancements to diagnosis coding (e.g., introduction of the International Classification of Diseases, Tenth Revision, Clinical Modification taxonomy to provide greater specificity and the adoption of present-on-admission codes) hold great promise for improving the validity of analyses of administrative data. Nevertheless, the potential for misleading interpretation of findings based on naive analysis of administrative data and a lack of appreciation of the nuances in diagnostic coding will continue to be a problem. Such factors will hinder the ability to find 'pure and simple' truths from administrative data."

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