

# Interpreting Hospital Mortality Data

## The Role of Clinical Risk Adjustment

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This study uses national Medicare data as well as data that were abstracted to calibrate the Medicare Mortality Predictor System to assess the usefulness of a risk adjustment system in interpreting hospital mortality rates. The majority of variation in annual hospital death rates for the four conditions studied (stroke, pneumonia, myocardial infarction, and congestive heart failure) is chance variability that results from the relatively small numbers of patients treated in most hospitals in a year. For hospitals in the highest and lowest quartiles of observed death rates, the difference between observed rates and those predicted by the Medicare Mortality Predictor System is not quite one third smaller than the difference between observed rates and unadjusted national rates. Risk adjustment methods do not show whether the unexplained difference in mortality rates results from differences in effectiveness of care or unmeasured differences in patient risk at the time of admission. Risk-adjusted mortality rates, therefore, should be supplemented by review of the actual care rendered before conclusions are drawn regarding effectiveness of care.

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**THE PURPOSE** of this article is to help physicians and hospital managers assess what hospital death rates reveal about effectiveness of care. In a companion article<sup>1</sup> we describe the Medicare Mortality Predictor System (MMPS), a microcomputer-based system that was created to help hospitals interpret death rates. The MMPS uses clinical

See also pp 3617 and 3625.

data abstracted from medical records to estimate the likelihood of death within 30 days of hospital admission for patients older than 64 years of age who are admitted with stroke, pneumonia, myocardial infarction, and congestive heart failure. In this article we provide a set of analyses intended to help users of hospital mortality data decide when and how a system such as the MMPS might be

useful in interpreting death rates.

Figure 1 shows an excerpt from *Medicare Hospital Mortality Information 1986* from the Health Care Financing Administration (HCFA).<sup>2</sup> This publication provides death rates for 17 diagnostic categories for every hospital that treated Medicare patients. It also provides, for each reported rate, a predicted range that is defined so that about 5% of hospitals are expected to fall outside the range by "chance." Others may fall outside the range because of a systematic tendency to treat unusual patients or to provide unusually effective or ineffective care. The publication's user must decide whether the relation of the observed death rate to the predicted range raises sufficient concern about effectiveness of care to warrant further study.

The ranges are adjusted for patient risk using Medicare administrative data, but these data contain no clinical information beyond diagnoses and procedures. The MMPS was created to let hospitals compare actual death rates with predictions based on such clinical admission data as vital signs, laboratory findings, and ability to walk. Table 1 shows a report produced by the MMPS for one condition in a simulated hospital. The report gives the hospital's actual mortality rate, a predicted rate based

on clinical data, the difference, and the probability that a difference this large or larger would occur by chance. The goal of this article is to help the reader understand what a report like that in Table 1 means and when it would be useful. To do this we address four questions: (1) What is the role of unpredictable or chance variations in hospital death rates? (2) Are death rates easier to interpret when averaged over patients with different conditions? (3) How much of the observed variations in death rates among hospitals does the MMPS predict? (4) Does MMPS provide a clinically reasonable way to screen cases for clinical review?

The common theme of these questions is that variation in hospital mortality rates has three sources: the underlying average risk the hospital's patients carry on admission; the underlying average effectiveness of the care the hospital renders; and unpredictable or chance variation in the risk that individual patients carry, the effectiveness of the care they receive, and the outcomes they experience. These sources of variation interact in complex ways; eg, patients with similar illnesses may respond differently to the same treatment, and physicians might choose different treatments for reasons that are difficult to measure. Because mortality rates are measurable only through the survival or death of individual patients, a large number of patients is necessary to determine a hospital's underlying death rate accurately. Although a hospital might have a relatively stable underlying death rate for a condition, the observed annual rate may fluctuate substantially because of chance variation. If a hospital's underlying mortality rate was 20% and the hospital treated 100 patients each year for 100 years, we would expect by chance alone that the mortality rate would be greater than 24% or less than 12% in about five years.

### METHODS

#### Database

We used two sources of data for this analysis. The first (the national database) was a file of all discharges in the

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