High Hospital Admission Rates And Inappropriate Care

Does inappropriate use of hospital care explain much of the small-area variation in admission rates?

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ABSTRACT: This study tests whether the rate of inappropriate hospital admissions is high in areas with high medical admission rates. Seventy small geographic areas were formed by grouping Massachusetts ZIP codes by similarity of hospital use. Appropriateness of hospital admission was measured both by applying the Appropriateness Evaluation Protocol and by applying physicians’ judgment to the medical records of patients age sixty-five and older who were admitted for treatment of a medical condition in 1990-1992. No relationship between hospital admission rate and inappropriate admission rate was found, which calls into question the common assumption that areas with higher hospital use have more inappropriate use of hospital care.

Many studies have reported large differences in age- and sex-adjusted population-based hospital admission rates across small geographic areas. John Wennberg and others have postulated that various factors influence these differences: “practice style,” “threshold for admissions,” and “discretionary admissions” (which in turn have been postulated to be the result of differences in the supply of health care resources such as hospital beds). The implication is that in areas with high admission rates, many hospitalized patients could be treated outside of the hospital without sacrificing quality of care, because admissions are occurring for which hospital-level care is not medically justified. We use the term inappropriate to refer to those admissions that could be treated adequately on an outpatient basis.

Whether inappropriateness explains much of the variation in admission rates is an important issue for public policy and for the cost containment programs of third-party payers. If it does, popula-
tion-based area utilization rates, which can be identified from routinely collected sources such as claims data, could be used to help identify areas with high rates of inappropriate admissions without the need for expensive reviews. In addition, to the extent that inappropriateness explains variations, there is evidence that helps to answer the question, “Which rate is right?” Thus, a rationale is created for interventions to reduce admissions in high-rate areas. As stated in Sherman Folland and Miron Stano’s review of small-area variation studies, “[F]or some it would be a small step from the small area claims to proposals that would establish norms, whether regulatory or voluntary. Others may argue for even more widesweeping changes in health care delivery as a result of the inefficiencies and inequities implicit in the small area claims.”

Previous studies. Evidence of a relationship between inappropriateness and hospitalization rates is mixed. One study of nonelderly patients admitted for medical and surgical conditions found no relation between inappropriate admissions and the overall rate of admissions across large areas, while a similar study of patients of all age groups did find a relation. Another study that investigated the relation between variations in admissions for three procedures (coronary angiography, upper gastrointestinal endoscopy, and carotid endarterectomy) among Medicare beneficiaries and indications of their appropriateness found that when the data were analyzed across large areas, high-use areas had more inappropriate procedures. Although significant, inappropriateness did not contribute much to explaining the large differences in procedure admission rates. When data from one state were analyzed at the small-area (county) level, the relationship was statistically significant for coronary angiography but not for the other two procedures.

These studies are limited in two important ways. First, with one exception, they analyzed data by large geographic area. Thus, they may have diluted the impact of local practice patterns and cannot shed light on the factors underlying variations in admission rates across small areas, which have been the focus of most scientific and policy-related studies and are most amenable to local interventions. Second, they either focused on admissions for procedures or combined medical and surgical admissions. Therefore, they can provide only limited insight into the factors influencing medical admission rates and medical practice, which may differ from factors influenc-
ing surgical admissions and surgeons’ practice styles.

The purpose of our study is to fill an important gap in current knowledge by examining the relationship between hospital admission rates and inappropriateness across small geographic areas for medical (not surgical) admissions. In particular, we test whether, among persons age sixty-five and older who were admitted for treatment of a medical condition, the rate of inappropriate admissions is higher in areas with high medical admission rates.

**Methods**

**Development of small areas.** All acute care hospitals in Massachusetts submit electronic files of hospital discharge abstract data to the state annually. For each discharge, the data consist of the patient’s age, sex, admission and discharge dates, diagnosis and procedure codes, diagnosis-related group (DRG), and ZIP code of residence. We applied Wards clustering algorithm to 1990 data for patients age sixty-five and older (a database of approximately one million discharges) to form seventy small geographic areas. The algorithm grouped Massachusetts ZIP codes that exhibited similar patterns in the distribution among hospitals of discharges of patients age sixty-five and older (that is, ZIP codes whose residents are hospitalized at the same hospitals are grouped together in a small area). We examined only elderly patients to ensure that our study population was similar with respect to health insurance status, an important factor in use of hospital care. In addition, the elderly are the focus of small-area variations analyses used by states’ peer review organizations.

**Measurement of admission rates.** As numerators for calculating admission rates in each of the seventy areas, we used the number of admissions among patients age sixty-five and older in 1990-1992 whose stays were classified into medical DRGs. As denominators, we used the number of persons age sixty-five and older by sex and five-year age category based on the 1990 census and on population projections for 1991 and 1992. To adjust for age and sex differences, we used indirect standardization to calculate an expected number of admissions in each area. Our focus was the observed number of admissions ($O$) and the expected number ($E$), expressed as a percentage of expected admissions (that is, $(O-E)/E$), a ratio we refer to as the “relative hospitalization rate.”

**Measurement of admission appropriateness.** To determine appropriateness rates for each area, we used the 3 percent random sample of all Medicare admissions reviewed by the Massachusetts Peer Review Organization (MassPRO). MassPRO nurse reviewers use the Appropriateness Evaluation Protocol (AEP) to review the
appropriateness of admissions and refer cases that fail to meet the criteria to a physician reviewer. MassPRO conducts an internal quality control process that involves ongoing training and monitoring of all reviewers to ensure the reliability of review decisions.

We used two measures of the appropriateness of admissions. The first was the MassPRO nurse reviewers’ application of the AEP, the most widely used, public domain hospital appropriateness criteria set. Admissions that failed to meet one or more of the clinical indicators for acute hospitalization contained in the AEP criteria set were referred by reviewers to a MassPRO physician for a final decision. The second method to measure appropriateness was the clinical judgment of the physician reviewers.

The AEP was originally developed by Paul Gertman and Joseph Restuccia in the late 1970s and was updated in the mid-1980s. It consists of a set of explicit criteria that indicate the need for acute hospital care on the basis of the patient’s condition and the services delivered to the patient. The AEP has several strengths: It has been extensively tested for reliability and validity; it is generic rather than diagnosis- or procedure-specific; it is relatively easy to apply; the information it requires is well documented in many medical records; it can be applied retrospectively to medical records; and it is widely used and accepted by both researchers and practitioners as a valid screening measure of appropriateness of hospital care. As a screening instrument, the AEP is designed to indicate a high probability that an admission is inappropriate but does not yield a definitive conclusion regarding appropriateness. However, the primary focus of our findings is on relative differences in rates of potential inappropriateness among areas, rather than on absolute rates of inappropriateness among areas.

For each small area, we calculated the percentage of cases from the 3 percent random sample that were inappropriate admissions. To adjust for the greater instability of rates from areas with fewer cases reviewed, we used empirical Bayes techniques to calculate improved estimates of “underlying” inappropriateness rates for both the AEP and physician review measures.

Results

The empirical Bayes estimated rate of inappropriate admissions based on the AEP criteria averaged 12.4 percent and ranged among the seventy small areas from 6.0 percent to 17.9 percent (Exhibit 1). As can be seen in Exhibit 1 and as is reflected by a small, nonsignificant correlation coefficient (Pearson r = 0.16) there was no relationship between the inappropriateness rates and the relative hospitalization rates for the seventy small areas.
The average inappropriate admission rate determined by physician review was 2.3 percent across the small areas, and the range was from 0.4 percent to 4.8 percent (Exhibit 2). This rate was moderately correlated with the AEP-based inappropriateness rate (Pearson $r = 0.43$) but showed no relationship to the relative hospitalization rate (Pearson $r = 0.04$).

Discussion

The lack of relationship between admission rate and inappropriate admission rate by small area calls into question a key assumption about the policy implications of small-area analyses. To the extent that areas with high or low hospital use have similar rates of inappropriateness, the usefulness of small-area analyses in targeting cost containment interventions is in doubt.

Other studies that have investigated the relationship between inappropriate utilization and total utilization have focused on only a few procedures or a few large geographic areas. In contrast, this study examines all medical conditions for variations among market area-defined small areas. The population base of the study includes more than 800,000 residents age sixty-five and older in a moderately large state over a three-year time span. Medical patients constitute the majority of hospital admissions, and the population age sixty-
Physician-Based Inappropriateness Rate Versus Relative Hospitalization Rate

**EXHIBIT 2**

**Source:** Authors' study of hospital admission rates.

Five and older accounts for about one-third of admissions. The fact that the AEP does not evaluate the need for procedures means that the rate of inappropriate cases screened by the instrument is lower than if procedure-specific appropriateness criteria were also applied. However, this limitation applies to few medical patients; in our study population of 781,393 admissions, only 26,891 (3.4 percent) had a nonsurgical procedure.

Limitations in this study include use of a single state and only older medical patients. Furthermore, both measures of inappropriateness considered here are limited. As previously mentioned, the AEP does not question the need for services delivered and is a screening instrument to identify cases that likely could be treated outside of the acute hospital. Use of physician judgment helps to address the second limitation to the AEP but is more subject to unreliability because of lack of agreement among physicians as to what constitutes appropriate hospitalization. In addition, our measures of inappropriateness are not totally independent, because only cases screened as probable inappropriate admissions were subjected to physician review. A more important limitation is that the AEP reflects medical practices of the mid-1980s, when it was last updated; thus, when applied to 1990-1992 hospital admissions it may not be able to identify all admissions that would be considered inappropriate (that is, not requiring hospital care) by more recent practice standards.

The most important criterion for measuring inappropriateness is reliability, and the AEP has been shown to be a highly reliable measurement instrument. Thus, even if the AEP over- or underestimates
inappropriate use (depending upon the practice style deemed appropriate), the focus of our study is the relative rates of inappropriateness among different populations of hospitalized patients. An emphasis on comparison among groups mitigates concerns about systematic bias that might occur when the AEP is used to estimate absolute rates of inappropriate admissions. The physician-based measure also adds confidence to our finding of no relationship between admission rate and inappropriate admission rate by small geographic area.

It is important to emphasize that inappropriateness is not postulated as a fundamental cause of high admission rates. Supply factors, practice style, or a variety of other factors might be fundamental causes. Whatever the causes, they result in patients being hospitalized even though the patients could be treated appropriately on an outpatient basis or in a nonacute health care facility. This is precisely what the AEP is designed to measure. The combination of variations in inappropriateness (from 6.0 to 17.9 percent, even after empirical Bayes adjustment) and the lack of a relationship between high inappropriateness rates and high admission rates suggest both the value of utilization review and that small-area analyses cannot be substituted for such review.

Furthermore, our findings fail to support the use of norms or other measures based solely on small-area variations to alter the practice of health care delivery. Small-area analyses still may be useful to focus attention on the causes of differences in utilization rates among areas—for example, to determine if they are associated with differences in patient outcomes. In addition, further research is warranted to investigate whether a more sensitive instrument than the AEP would detect a relationship between small-area variations and the need for hospitalization.

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NOTES


5. Fisher et al., “Prioritizing Oregon’s Hospital Resources.”


10. Ibid.


14. The empirical Bayes estimate is a weighted average of the overall inappropriate rate and the areaspecific rate, with more weight given to areaspecific rates where the number of cases reviewed is larger. We also considered using empirical Bayes techniques to estimate relative hospitalization rates. However, there was almost no difference between the raw rates and the empirical Bayes estimated rates. Thus, we report raw relative hospitalization rates.
