

Accuracy of Claims-Based Measures of Severity of Childhood Illnesses

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ABSTRACT

BACKGROUND: The use of electronic health records to conduct comparative effectiveness studies requires accurate measure of severity of patients' illness.

OBJECTIVES: This brief report provides data on relative accuracy of claims-based severity indices for childhood diseases.

MEASURES: We compared the accuracy of All Patient Refined Diagnosis-Related Groups (APR-DRG), All Payer Severity-adjusted Diagnosis-Related Groups (APS-DRG), Alemi and Walters Severity across Episodes of Illness, and count of diagnoses.

METHODS: The accuracy of each measure was calculated using the percent of deviance explained in mortality and percent of variation explained in length of stay (a surrogate measure of resource utilization).

SUBJECTS: Data were obtained from the 2006 Kid's Inpatient Database of the Healthcare Cost and Utilization Project of the Agency for Healthcare Research and Quality. We examined data on 3.1 million patients across 38 states.

RESULTS: Alemi and Walters' formula-based severity score explained 34% of variation in length of stay and 32% of variation in mortality. This index was more accurate than other indices, especially in predicting mortality, where it was 5-fold more accurate than APS-DRG and 3-fold more accurate than APR-DRG. The difference in accuracy was not only statistically significant but also large enough that it could change conclusions of comparative effectiveness studies.

KEYWORDS: Administrative data; Electronic health records; Length of stay; Pediatric illness; Resource utilization; Risk assessment

There is growing interest in conducting comparative effectiveness studies through electronic health records, where data on interventions and outcomes are readily available. An accurate measure of severity is a first step to conducting such studies. Data in electronic health records are not randomized, and more severely ill patients may be more likely to seek newer interventions that provide them with hope

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of relief. Inaccurate measurement of severity will inadvertently lead to the conclusion that the new interventions are associated with poorer outcomes, a case of blaming the fireman for the fire. This report is intended to help investigators be more informed about the relative accuracy of different claims-based severity indices for pediatric illnesses.

We contrast the accuracy of 4 different claims-based measures of severity of illness for children's diseases. Most claims-based measures of severity were developed for adult populations, and their utility in measuring outcome of children's illnesses has not been reported, although exceptions exist.¹

Title IV of the Children's Health Insurance Program Reauthorization Act of 2009 required the establishment of a Pediatric Quality Measures Program. The Centers for Medicare and Medicaid Services and Agency for Healthcare Research and Quality have interpreted this requirement to mean the need to develop new measures of quality that are specific to children's conditions (eg, number of prenatal visits for pregnant patients or the annual number of emergency room visits for asthmatic children who are at least 1 year old and who have at least one asthma-related emergency department visit). Claims-based measures of severity of illness allow examination of risk-adjusted health care outcomes and therefore, can serve as an alternative to or in conjunction with the Pediatric Quality Measures.

METHODS

Methods of Measurement of Claims-based Severity

We examine the accuracy of 4 methods of predicting patient outcomes: All Patient Refined Diagnosis-Related Groups (APR-DRG);²⁻⁵ All Payer Severity-adjusted Diagnosis-Related Groups (APS-DRG);^{5,6} count of diagnoses;⁷ and Alemi and Walters' Severity across Episodes of Illness.⁸ The APR-DRG assigns 3 descriptors to each case: 1) the "base APR-DRG"; 2) the severity of illness class; and 3) the risk of mortality class. These determinations are based on the medical diagnostic group of the primary diagnoses, presence of specific secondary diagnoses, age, and selected operating and nonoperating room procedures. The APR-DRG is in use in both adult and pediatric populations.⁹

The second approach we examine is the APS-DRG. This approach classifies patients into groups that have homogenous resource use and outcomes. It uses diagnoses, procedures, and status at discharge to accomplish this task. More than 7 million patient records were examined to establish the APS-DRGs. A clinical team reviews results for logical consistency and reasonableness; when problems appear to exist because of small cell sizes, scores are imputed. The APS-DRG is in widespread use among payers for both adult and pediatric services.

The third approach is a crude measure of severity of illness based on count of the diagnoses. This measure of severity has proven more accurate than some of the other measures of prognosis, such as the Charlson Comorbidity Index, and can serve as a lower threshold for expected performance of severity indices.⁸

The fourth approach we examine is the Alemi and Walters severity index. This is a patented algorithm that assigns severity scores to a combination of diagnoses/procedure codes. In contrast to the APR-DRG or APS-DRG, no attempt is made to classify diagnoses into broad categories of disease. Each diagnostic code is scored based on its own properties, leading to approximately 14,000 variables to create the overall severity index. In the first step, codes are classified into primary and secondary or comorbidity codes. The primary diagnosis is the first diagnosis, which was the reason for admission. The remaining 4, 9, or 14 codes are the comorbidity codes during the admission. The average severity for "n" cases with primary diagnosis "p," comorbidity "c," and discharge status "d," is calculated using the following formula:

$$A_{p,c,d} = \frac{\sum_i^n A_i}{n} \{i | p_i = p, c \in C_i, D_i = d\}$$

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