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Clinical Study

Limitations of administrative databases in spine research: a study in obesity

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Abstract

BACKGROUND CONTEXT: The use of national inpatient databases for spine surgery research has been increasing. Unfortunately, without firsthand knowledge of each specific database, it can be difficult to judge the validity of such studies. Large databases that rely on administrative data, such as *International Classification of Diseases*, *Ninth Revision* (*ICD-9*) codes, may misrepresent patient information and could thus affect the results of studies that use these data.

PURPOSE: The present study uses obesity, an easily quantified and objective variable, as an example comorbidity to assess the accuracy of *ICD-9* codes in the setting of their continued use in spine database studies.

STUDY DESIGN/SETTING: A cross-sectional study at a large academic medical center.

PATIENT SAMPLE: All patients spending at least one night in the hospital as an inpatient between April 1, 2013 and April 16, 2013. Obstetrics and gynecology, psychiatry, and pediatric patients were excluded.

OUTCOME MEASURES: Proportion of patients for whom *ICD-9* obesity diagnosis codes assigned at hospital discharge match chart-documented body mass index (BMI).

METHODS: The medical record was reviewed for each patient, and obesity *ICD-9* codes were directly compared with documented BMI.

RESULTS: The study included 2,075 patients. Of 573 ''obese'' patients (calculated BMI 30–39.9), only 109 received the correct code (278.00), giving this *ICD-9* code a sensitivity of 0.19. Of 174 ''morbidly obese'' patients (calculated BMI >40), only 84 received the correct code (278.01), giving this *ICD-9* code a sensitivity of 0.48.

CONCLUSIONS: Using obesity as an example, this study highlights the potential errors inherent to using *ICD-9*–coded databases for spine surgery research. Should a study based on such data use ''obesity'' as a variable in any analyses, the reader should interpret these results with caution. We further suggest that obesity is likely not the only comorbidity to which these results apply. As database research continues to represent an increasing proportion of publications in the field of spine surgery, it is important to realize that study outcomes can be skewed by data accuracy, and, thus, should not be blindly accepted simply by virtue of large sample sizes.

Keywords: Spine; Database; *ICD-9*; Body mass index; Obesity; Morbid obesity

FDA device/drug status: Not applicable.

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No known conflicts of interest exist for this study.

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EVIDENCE & METHODS

Context
Data integrity and measurement error in reporting are increasing concerns, especially as researchers rely more often on *Big Data* to make determinations that can affect patient management and health care policy. The authors performed an evaluation related to determinations for the administrative reporting of obesity, specific to their institution.

Contribution
All patients (with certain exclusions) admitted to a single institution over a 16-day period were evaluated. The authors maintain that ICD-9 codes for obesity had sensitivities of only 19%-48% at their institution.

Implications
This study addresses measurement error and miscoding, two potential sources of information bias that are inherent to investigations relying on large administrative datasets. The authors wish to draw corollaries between their findings and those of the Nationwide Inpatient Sample (NIS) and similar registries. It should be recognized that the authors' results are limited to a sample of 573 obese patients at a single center over slightly more than a two-week period. This presents a ''real life'' example of how information bias and measurement error can occur. The findings cannot be considered representative of data submission to the NIS or other datasets that employ disparate methodologies to obtain patient-centered metrics. Furthermore, the NSQIP maintains markedly different means of data acquisition (specific to each center) and undergoes internal validation which has been reported to have high degrees of reproducibility in independent analyses.

—*The Editors*

Introduction

Recently, the use of large national inpatient databases for spine surgery research has increased significantly. These databases frequently contain information derived from hospital reimbursement claims in the form of *International Classification of Diseases*, *Ninth Revision* (*ICD-9*) codes. Unfortunately, without a working knowledge of each major database, it can be difficult for the practicing physician to discern whether a given study presents valid results to the specific questions being asked.

Many *ICD-9*–coded databases are currently available, including the Nationwide Inpatient Sample (NIS), the National Hospital Discharge Survey, and the Nationwide Emergency Department Sample, in addition to private insurance claim databases. Several databases have reached tremendous size. The NIS reports that each year of data consists of approximately 8 million hospital stays from over 1,000 hospitals [1]. Other databases, including the National Surgical Quality Improvement Program, are instead built from direct chart data acquisition rather than from *ICD-9* coding; however, this method is currently used less often for assembling national databases.

The widespread availability of databases has generated a new avenue by which to address a multitude of spine surgery research questions. The large sample sizes dwarf what could otherwise be obtained by any single hospital system or study group, creating an attractive resource for estimating disease prevalence, health-care utilization, and outcomes from across the nation. Additionally, these tremendous sample sizes permit the study of rare conditions, uncommon treatments, and subset populations [1].

However, *ICD-9* data are generally abstracted from medical provider notes for reimbursement purposes, a system that oftentimes does not accurately represent the entire patient [2,3]. Moreover, significant heterogeneity can exist among large databases because of variations in unknown patient variables. A recent meta-analysis found that because of this heterogeneity, 20% to 40% of all observational database studies could swing from being statistically significant in one direction to being statistically significant in the opposite direction, purely based on choice of database [4].

Several previous studies have noted the inaccuracies of *ICD-9* codes [5–14]. A 2012 study in obstetric patients compared multiple *ICD-9* codes with patient chart data and found widely variable coding accuracies among comorbidities such as hemorrhage, infection, and obesity [7]. For obesity, *ICD-9* codes correctly identified just 15% of obese patients. Similarly, three studies have examined the difficulties of diagnosing obesity in a pediatric population that include, but are not limited to, body mass index (BMI) cutoffs that change both with age and gender [11–13]. These studies found *ICD-9* codes for pediatric obesity to be only 7.0% to 8.3% accurate.

Although these studies have identified the potentially poor sensitivity of various *ICD-9* codes, they were conducted in specialized patient populations that may have their own inherent considerations not readily generalizable to adult spine surgery populations. Moreover, *ICD-9* coding issues were largely examined either as secondary outcomes or as one of many other questions being addressed.

Although previous studies provide a valuable foundation, there is a clear need to directly analyze how *ICD-9* codes relate to clinical reality. The present study uses obesity to present a single illustrative example that we anticipate will be widely applicable to many comorbidities commonly documented in national inpatient databases. Obesity was chosen because it is an easily quantifiable continuous variable with established BMI categories. Furthermore, it is used ubiquitously in large spine surgery database research, both as a comorbidity in multivariable analyses and as a predictor of clinical outcomes [15–18].

The present study examines a large inpatient population at a single institution to explore the accuracy of assigned