

Limitations Associated with the Analysis of Data from Administrative Databases

To the Editor:—It is with great interest that I read the article entitled “Trends and Outcomes of Malignant Hyperthermia in the United States, 2000 to 2005” by Rosero *et al.*¹ This study is an example of how nationally representative databases designed for administrative purposes can be used to provide insight into otherwise difficult-to-study, low-incidence clinical events and outcomes, and the authors should be commended for their work. In this article, data collected for the National Inpatient Sample (NIS) are analyzed, leading to the conclusion that the incidence of malignant hyperthermia (MH) has increased in recent years and is higher than previously reported. However, while information extracted from nonclinical databases can be of tremendous value, it cannot be stressed enough that their design has to be carefully taken into account when interpreting study results.

In this context, Rosero *et al.* have pointed out some of the limitations associated with the use of NIS data for the study of clinical topics. However, a number of important caveats remain unaddressed and need to be considered strongly for appropriate interpretation of their data as they pertain to trends and outcomes of MH.

Using the International Classification of Diseases-9 coding system, it is not possible to determine with certainty if a particular diagnosis was made during the hospitalization of record or if a patient carries a history of such a diagnosis. Thus, patients with a history of MH but no in-hospital event during the admission for which data were collected, may have been included in the analysis. This scenario may lead to overestimation of MH events, as it is not possible to track one particular patient over multiple hospitalizations in the NIS.

A NIS entry is equivalent to one hospitalization. One patient may therefore contribute multiple entries if hospitalized more than once within the study period. Thus, it is possible that a patient had an MH event in one hospital and then was transferred to another hospital, where the diagnosis was recorded again. Therefore it is possible that the same case may have been recorded more than once and may erroneously even have had different outcomes, *i.e.*, transfer to another facility during one entry and potentially death in another. This scenario would only unfold if both hospitals were in the sampling universe of the NIS. Alternatively, a transfer to a nonparticipating hospital and a potential death there may therefore not have been recorded at all with such an outcome. The fact that a significant number of entries in Rosero's study were not routine hospital admissions (50.7%) makes this a point of concern, as transfers between hospitals may represent a significant number of cases. Although speculative, some emergency room admissions may represent transfers from anesthesia-providing

nonhospital facilities, thus potentially creating a coding conflict (emergency room *vs.* other facility). While scenarios like these may be speculative and causal relationships cannot be answered with data available in the NIS, it is important to point them out, as only a few possible cases may have a big impact on data surrounding this low-incidence event.

Because the NIS collects only a 20% actual sample, weights are provided to generate national estimates from the entries as pointed out by the authors.* Depending on if weighted or unweighted values are used for analysis, this can have a substantial statistical impact on results. While frequencies expressed in percent of the total sample tend to be similar for weighted and unweighted data, confidence intervals and standard errors tend to be significantly narrower/smaller with the use of the larger weighted sample giving an increased impression of certainty of the statements. The approach taken should be considered when interpreting results.

It should also be mentioned that the issue of disparities among patients of different race that was discussed by Rosero *et al.*¹ could potentially be analyzed with information included in the NIS. However, the race category has a very high missing entry rate, thus pointing out a further limitation.

The issue of reporting a valuable denominator has to be pointed out and was touched on by Rosero *et al.*¹ An MH rate per number of hospitalizations is burdened by the fact that this approach includes patients who were never exposed to an anesthetic. Without knowledge of how many hospital admissions included an exposure to a trigger agent or to surrogate events such as a surgical procedures (and thus anesthesia), this information remains of limited value. The NIS contains information on procedure types and categories performed in its Clinical Classification Software for Services and Procedures.† Given the relatively small number of actual entries with the diagnosis of MH (approximately 20% of the weighted estimate of 2,553), it may be possible to examine how many entries also included a surgical procedure. In the future, anesthesiology-related research may be able to take advantage of the fact that recently a category for anesthesia procedures was added to the Clinical Classification software.

In summary, national databases such as the NIS are extremely useful tools to address questions surrounding low-frequency events and outcomes that would otherwise escape study on a nationally representative level. However, caution has to be used when interpreting results, as they are subject to a number of limitations. Authors of such studies bear the responsibility of pointing out details and limitations of their analysis to the readers, as they may not be familiar with the complex design and many caveats.

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Reference

1. Rosero EB, Adesanya AO, Timaran CH, Joshi GP: Trends and outcomes of malignant hyperthermia in the United States, 2000 to 2005. *ANESTHESIOLOGY* 2009; 110:89–94

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* HCUP Databases. Healthcare Cost and Utilization Project (HCUP). July 2008 Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/nisoverview.jsp. Accessed January 6, 2009.

† HCUP CCS Services and Procedures. Healthcare Cost and Utilization Project (HCUP). May 2008 Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/toolssoftware/ccs_svcsproc/ccsvsproc.jsp. Accessed January 6, 2009.