

## Effect of occurrence of infection-related never events on length of stay and hospital charges in patients undergoing radical neck dissection for head and neck cancer

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**Objective.** To estimate the impact of infection-related never events (postoperative pneumonia, *Clostridium difficile* infection, infection with microorganisms resistant to penicillin, postoperative infections, and decubitus ulcers) following radical neck dissections for head and neck cancers.

**Study Design.** The 2008 Nationwide Inpatient Sample was used to select hospitalizations with HNC that underwent radical neck dissections. Predictor variables were occurrence of never events and other patient- and hospital-level factors. Outcome variables were hospitalization charges and length of stay (LOS). Regression analyses were used to measure the association between predictors and outcomes.

**Results.** Among 10,660 hospitalizations, prevalence of never events ranged from 0.2% to 5.0%. Mean hospitalization charge and LOS were \$75,654 and 6.8 days, respectively. Never events were associated with 5.6-10.0 longer LOS and \$49,153-\$124,057 excess charges.

**Conclusion.** Occurrence of never events was associated with at least 5.6 longer hospital days and \$49,153 charge compared with hospitalizations without a never event. (Oral Surg Oral Med Oral Pathol Oral Radiol 2013;116:147-158)

The Institute of Medicine in its landmark report provided estimates of potentially preventable adverse events and medical errors in hospitalized patients and attributed close to 45,000 deaths annually in hospital settings to these events.<sup>1</sup> Several of these presumably avoidable adverse events have been identified as "never events," and the Center for Medicare Services (CMS) will no longer reimburse hospitals for the cost of managing these events.<sup>2</sup> Hence it would be important to determine the costs associated with the occurrence of these never events to anticipate their financial impact. While several of these never events (including wrong site surgery, accidentally leaving foreign bodies during

surgery, and postoperative falls and hip fractures) can be correctly attributed to the deficiencies in process of care delivery at hospitals, there are several other designated never events (such as postoperative pneumonia, *Clostridium difficile* infection, infection with microorganisms resistant to penicillin, postoperative infections, and decubitus ulcers) which could occur due to the immunocompromised nature of the patient or any other patient level attribute rather than an obvious deficiency in the care process at the hospital.<sup>1,3,4,5</sup>

As previously reported, radical neck dissections were conducted in 10,660 hospitalizations with head and neck cancers (HNC) in the year 2008.<sup>6</sup> Mean age of each hospitalization was 61.6 years (standard error of mean [SEM] = 0.3). Males constituted close to 69% of all hospitalizations. A majority (89.5%) of the radical neck dissection procedures were done on an elective basis. Private insurance plans were the major payer accounting for 45.2% of all hospitalizations followed by Medicare plans (40.2%). Whites comprised most (82.7%) of hospitalizations, whereas Blacks (5.7%),

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### Statement of Clinical Relevance

Never events in hospitalizations undergoing radical neck dissection for head and neck cancer were associated with prolonged length of stay and excess charges. Never events may be preventable by improving processes of care and reduce burden of delivering health care.

Hispanics (6.2%), Asian/Pacific Islanders (2.7%), and others (2.3%) accounted for the rest. Unilateral radical neck dissection was conducted in 81% of hospitalizations while bilateral radical neck dissection was conducted in 15.6% of hospitalizations and the type of radical neck dissection was unspecified in 3.4% of hospitalizations. Metastatic cancer was found in 38% of hospitalizations. Teaching hospitals performed 78.3% of all procedures. The prevalence estimates of the 5 never events examined were 5.0% for postoperative pneumonia, 0.3% for *C. difficile* infection, 0.2% for infection with microorganisms resistant to penicillin, 1.6% for postoperative infections, and 1.4% for decubitus ulcers.<sup>6</sup>

The objective of the current study is to quantify the effect of occurrence of 5 never events (including postoperative pneumonia, *C. difficile* infection, infection with microorganisms resistant to penicillin, postoperative infections, and decubitus ulcers) on 2 outcomes of interest (length of stay [LOS] in hospital and hospitalization charges). We hypothesize that each of these 5 never events is associated with a prolonged LOS in hospital and excess hospitalization charges. The specific aims of this project were to: 1) estimate LOS and hospital charges for subjects admitted for radical neck dissections 2) estimate prevalence (frequencies) of the 5 never events, 3) develop a multivariable regression model to identify factors associated with excess LOS and hospitalization charges, and 4) compare LOS and hospital charges for subjects who experienced 1 or more of the 5 never events to those who had no never events.

## MATERIALS AND METHODS

### Study design

This study is a cross-sectional analysis of a sample derived from the Nationwide Inpatient Sample (NIS) for the year 2008. The NIS database is sponsored by the Agency for Healthcare Research and Quality (AHRQ) and is a component dataset of the Healthcare Cost and Utilization Project.<sup>6,7</sup> The NIS database for the year 2008 provides hospitalization data on close to 38 million weighted hospitalization visits in the United States. The NIS is nationally representative of all hospitalizations occurring in the United States. For the current study, all hospitalizations with a diagnosis of HNC that underwent radical neck dissections (bilateral, unilateral, and unspecified radical neck dissection procedures) were selected for analysis.

### Data user agreement with AHRQ

The current study is a retrospective analysis of the largest publically available hospital-based database in the United States. One of the authors (V.A.) completed

a data user agreement with AHRQ prior to conducting the study. As part of the data user agreement, any individual cell counts less than or equal to a sample size of 10 cannot be presented so as to preserve patient confidentiality. As per this agreement, such small estimates are not presented.

### Study variables

*Predictor.* The primary independent variables of interest were the occurrence of each of the 5 never events: postoperative pneumonia, *C. difficile* infection, infection with microorganisms resistant to penicillin, postoperative infections, and decubitus ulcers.

*Outcomes.* The main outcome variables of interest in the current study include hospitalization charges (in year 2008 in dollars [\$]) and duration of stay in hospital (in days).

*Other variables.* The other variables of interest included socio-demographic characteristics (age, gender, race/ethnicity), type of admission (elective or emergency/urgent), insurance status (Medicare, Medicaid, private insurance, uninsured, and other insurance plans), type of radical neck dissection (unilateral, bilateral, and unspecified), and the presence of comorbid conditions based on the NIS disease severity measurement files for risk adjustment. Hospital-related factors (geographic region and hospital teaching status) were also examined.

### Data analyses

The associations between the outcome variables and independent variables were examined by bivariate and multivariable linear regression analyses. Two separate multivariable models were used for the 2 outcomes, hospital charges and LOS. Since the hospital charge and LOS were highly skewed and not normally distributed, they were log transformed. The log transformed hospital charges and LOS data were used as outcome variables in the 2 multivariable linear regression models. In order to obtain charges in dollars and LOS in days, the estimates obtained from the regression models were exponentiated, and change in hospital charges and LOS from the mean values were computed. In both the regression models, the confounding effects of patient and hospital level factors were simultaneously controlled. Each hospitalization was the unit of analysis. The NIS hospital stratum was used as the stratification unit. Since each hospital could be treating several cases, there is a possibility of introducing biases attributed to the effects of clustering of outcomes within hospitals. In the current study, the effects of clustering of outcomes within hospitals were adjusted in both the regression models. All statistical tests were 2-sided and a *P* value of  $<.05$  was set *a priori* to be deemed statistically significant. All statistical analyses were performed using SAS version

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