Successful linking of the Society of Thoracic Surgeons Database to Social Security data to examine the accuracy of Society of Thoracic Surgeons mortality data

Jeffrey P. Jacobs, MD,[a] Sean M. O'Brien, PhD,[b] David M. Shahian, MD,[c] Fred H. Edwards, MD,[d] Vinay Badhwar, MD,[e] Rachel S. Dokholyan, MPH,[b] Juan A. Sanchez, MD,[f] David L. Morales, MD,[g] Richard L. Prager, MD,[h] Cameron D. Wright, MD,[c] John D. Puskas, MD,[i] James S. Gammie, MD,[j] Constance K. Haan, MD, MS,[d] Kristopher M. George, MD,[k] Shubin Sheng, PhD,[b] Eric D. Peterson, MD,[b] Cynthia M. Shewan, PhD,[l] Jane M. Han, MSW,[l] Phillip A. Bongiorno, BA,[l] Courtney Yohe, MPP,[l] William G. Williams, MD,[m] John E. Mayer, MD,[n] and Frederick L. Grover, MD[o]

Objectives: The Society of Thoracic Surgeons Adult Cardiac Surgery Database has been linked to the Social Security Death Master File to verify ''life status'' and evaluate long-term surgical outcomes. The objective of this study is explore practical applications of the linkage of the Society of Thoracic Surgeons Adult Cardiac Surgery Database to Social Securtiy Death Master File, including the use of the Social Securtiy Death Master File to examine the accuracy of the Society of Thoracic Surgeons 30-day mortality data.

Methods: On January 1, 2008, the Society of Thoracic Surgeons Adult Cardiac Surgery Database began collecting Social Security numbers in its new version 2.61. This study includes all Society of Thoracic Surgeons Adult Cardiac Surgery Database records for operations with nonmissing Social Security numbers between January 1, 2008, and December 31, 2010, inclusive. To match records between the Society of Thoracic Surgeons Adult Cardiac Surgery Database and the Social Security Death Master File, we used a combined probabilistic and deterministic matching rule with reported high sensitivity and nearly perfect specificity.

Results: Between January 1, 2008, and December 31, 2010, the Society of Thoracic Surgeons Adult Cardiac Surgery Database collected data for 870,406 operations. Social Security numbers were available for 541,953 operations and unavailable for 328,453 operations. According to the Society of Thoracic Surgeons Adult Cardiac Surgery Database, the 30-day mortality rate was 17,757/541,953 = 3.3%. Linkage to the Social Security Death Master File identified 16,565 cases of suspected 30-day deaths (3.1%). Of these, 14,983 were recorded as 30-day deaths in the Society of Thoracic Surgeons database (relative sensitivity = 90.4%). Relative sensitivity was 98.8% (12,863/13,014) for suspected 30-day deaths occurring before discharge and 59.7% (2120/3551) for suspected 30-day deaths occurring after discharge.

Conclusions: Linkage to the Social Security Death Master File confirms the accuracy of data describing ''mortality within 30 days of surgery'' in the Society of Thoracic Surgeons Adult Cardiac Surgery Database. The Society of Thoracic Surgeons and Social Security Death Master File link reveals that capture of 30-day deaths occurring before discharge is highly accurate, and that these in-hospital deaths represent the majority (79% [13,014/16,565]) of all 30-day deaths. Capture of the remaining 30-day deaths occurring after discharge is less complete and needs improvement. Efforts continue to encourage Society of Thoracic Surgeons Database participants to submit Social Security numbers to the Database, thereby enhancing accurate determination of 30-day life status. The Society of Thoracic Surgeons and Social Security Death Master File linkage can facilitate ongoing refinement of mortality reporting. (J Thorac Cardiovasc Surg 2013;145:976-83)

From the Johns Hopkins Children's Heart Surgery,[a] All Children's Hospital and Florida Hospital for Children, St Petersburg, Tampa, and Orlando, Fla; Duke Clinical Research Institute,[b] Duke University Medical Center, Durham, NC; Massachusetts General Hospital,[c] Harvard Medical School, Boston, Mass; Shands Jacksonville,[d] University of Florida College of Medicine–Jacksonville, Jacksonville, Fla; University of Pittsburgh Medical Center,[e] Pittsburgh, Pa; University of Connecticut Health Center,[f] Farmington, Conn; Texas Children's Hospital,[g] Baylor College of Medicine, Houston, Tex; University of Michigan,[h] Ann Arbor, Mich; Division of Cardiothoracic Surgery,[i] Emory University, Atlanta, Ga; University of Maryland Medical Center,[j] Baltimore, Md; Cardiac Surgical Associates of Florida,[k] Orlando, Fla; The Society of Thoracic Surgeons,[l] Chicago, Ill, and Washington DC; Hospital for Sick Children,[m] Toronto, Ontario, Canada; Children's Hospital Boston,[n] Harvard University Medical School, Boston, Mass; and University of Colorado Denver,[o] School of Medicine, Aurora, Colo.

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Address for reprints: Jeffrey P. Jacobs, MD, All Children's Hospital Heart Center, Thoracic and Cardiovascular Surgeon, Johns Hopkins Children's Heart Surgery, All Children's Hospital and Florida Hospital for Children, Department of Surgery, University of South Florida, 625 Sixth Ave South, Suite 475, St Petersburg, FL 33701 (E-mail: JeffJacobs@msn.com).

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Abbreviations and Acronyms

HHS	= Health and Human Services
NCHS	= National Center for Health Statistics
RDC	= Research Data Center
SSA	= Social Security Administration
SSDMF	= Social Security Death Master File
SSN	= Social Security number
STS	= Society of Thoracic Surgeons
STS–ACSDB	= Society of Thoracic Surgeons Adult Cardiac Surgery Database

The Society of Thoracic Surgeons (STS) Database is the largest clinical cardiothoracic surgical database in North America.[1] The STS Adult Cardiac Surgery Database (STS–ACSDB) was established in 1989, and by 2012, it had accumulated records from 4,713,928 cardiac surgical operations performed between 1990 and 2011 inclusive.

Accurate and consistent measurement of outcomes is a central pursuit of the STS, and operative mortality is the single most important metric.[2] Operative mortality is defined in all STS Databases as (1) all deaths, regardless of cause, occurring during the hospitalization in which the operation was performed, even if after 30 days (including patients transferred to other acute care facilities); and (2) all deaths, regardless of cause, occurring after discharge from the hospital, but before the end of the 30th postoperative day.[2]

In regard to the latter criterion, the accuracy of life status information between discharge and 30 days after surgery varies among institutions, and addressing this variability is a major goal of the STS. Thirty-day mortality data (both before and after discharge) clearly are a critical component of operative mortality. On January 1, 2008, in compliance with the Health Insurance Portability and Accountability Act of the United States, the STS Database began collecting unique patient identifiers, including Social Security numbers (SSNs).[1] In 2008, the STS purchased access to the Social Security Death Master File (SSDMF), which complements the STS Database by providing accurate short- and long-term survival information. Linking STS data to SSDMF thus allows for both the ascertainment and the verification of "life status."

Although short- and long-term mortality is only one measure of cardiac surgery quality, it is widely accepted and used as a health care performance metric. Several countries have identified the value of tracking mortality data longitudinally in combination with disease-specific epidemiologic surveillance programs. For example, by linking its Central Cardiac Audit Database to its national death registry, the United Kingdom has been able to better define health policy goals and priorities for patients with heart disease.[3] Regional experience using the SSDMF to assess long-term mortality after coronary artery bypass graft surgery has already proven the feasibility of linking a multi-institutional cardiac surgical registry to the SSDMF.[4] Successful linkage of STS adult cardiac surgery data to the SSDMF has been accomplished on both a single-institution level[5-8] and a multi-institutional level.[9]

This study has the following goals: (1) to confirm the feasibility of linking the STS Database to the SSDMF and (2) to examine the accuracy of STS 30-day mortality data for all deaths before the end of the 30th postoperative day, stratified by whether they occurred before or after hospital discharge.

MATERIALS AND METHODS

Institutional Review Board Approval

The Duke University Health System Institutional Review Board approved the study and provided a waiver of informed consent. Although the data used in the analysis contain direct patient identifiers, they were originally collected for nonresearch quality improvement purposes, and the risk to patients was deemed to be minimal.[10]

Society of Thoracic Surgeons Database

As of December 31, 2011, the STS–ACSDB had 1051 participants who represented 1054 hospitals in the United States. An STS Database Participant is a "practice group of cardiothoracic surgeons" or, uncommonly, an individual cardiothoracic surgeon. In the majority of instances, an STS Database Participant is a hospital cardiac surgery program. Several categories of relationships between STS Database Participants and hospitals exist: (1) some hospitals have more than 1 STS Database Participant, (2) some STS Database Participants practice at more than 1 hospital, and (3) some hospitals and STS Database Participants have exclusive one-to-one relationships. The 2008 American Hospital Association Annual Survey reported that 1088 hospitals perform cardiac surgery in adults in the United States[11]; therefore, the STS believes that current STS-participating hospitals represent more than 90% of hospitals that provide adult cardiac surgery in the United States.

Although this demonstration project is performed using the STS–ACSDB, the methodology will eventually be applied to the STS General Thoracic Surgery Database and the STS Congenital Heart Surgery Database (Table 1). The STS–ACSDB captures detailed clinical data on adults undergoing cardiac surgical procedures performed by participating surgeons throughout the United States. The collection and analysis of data over a 22-year period have been shown to improve patient outcomes.[12] Feedback provided by center-specific reports allows participants to evaluate their own local results and to compare these results with contemporary national risk-adjusted benchmarks. By using risk-adjusted data from the STS–ACSDB, the STS has created risk models with end points of mortality and morbidity for several common cardiac surgical operations.[13-15] The STS Database also has served as the basis for the development of numerous performance measures that have been endorsed by the National Quality Forum.[16]

Society of Thoracic Surgeons Cohort

On January 1, 2008, the STS–ACSDB began collecting SSNs in its new version 2.61. The SSN is manually entered into the STS–ACSDB. This study includes all STS–ACSDB records for operations with nonmissing SSNs between January 1, 2008, and December 31, 2010, inclusive. The SSN field was considered to be nonmissing if it contained 9 numeric characters that were not all zeros.

Social Security Death Master File

The SSDMF is a public-use national database of death records maintained by the US Social Security Administration (SSA) as part of their Numerical Identification Database called "NUMIDENT." The SSDMF was created in 1980 by the SSA subsequent to a lawsuit brought by an