Supplementary Online Content

Tosoian JJ, Hicks CW, Cameron JL, et al. Tracking early readmission after pancreatectomy to index and nonindex institutions: a more accurate assessment of readmission. *JAMA Surg*. Published online December 23, 2014. doi:10.1001/jamasurg.2014.2346.

eMethods. Supplemental Methods
eTable 1. *ICD-9* Diagnosis Codes for Comorbid Diseases
eTable 2. *ICD-9* Diagnosis Codes for Readmission Diagnostic Groups

This supplementary material has been provided by the authors to give readers additional information about their work.

eMethods. Supplemental Methods

Data Sources

We used records from the Institutional Review Board-approved Johns Hopkins Pancreatic Resection Database (PRD) for this analysis. The PRD is an Institutional Review Board-approved database that includes prospectively collected data for each pancreatectomy performed at our institution since January 1970. This database includes patient demographics, clinical presentation, pathological findings, hospital course, readmissions to our institution, and overall survival (obtained via the National Social Security Death Index).[1] A de-identified form of the PRD was used for all analysis herein.

Information provided by the PRD was supplemented by the HSCRC Non-Confidential Inpatient Discharge data set (NCID). The NCID is a statewide database that collects quarterly data for all inpatient admissions in the state of Maryland. Each record includes patient demographics, hospital identification code, 30-day readmission status, and inpatient procedures and diagnoses (identifiers and other sensitive information removed by St. Paul Computing, Inc.). The Data Use Agreement for the NCID was signed and followed, and this study was approved by the Institutional Review Board at the Johns Hopkins Medical Institutions.

Study Population and Creation of a Novel Database

We aimed to account for readmissions to other Maryland hospitals by supplementing our records with statewide data from the NCID. Because patients who reside outside of Maryland are more likely to present for readmission outside of the state, we included only Maryland residents in this study. We also excluded cases prior to 2005 in order to account for temporal trends in care,[2] and limited inclusion through 2010 in order to allow for analysis of extensive patient-level factors that have since been reduced in these databases. Thus, the eligible study population consisted of Maryland residents admitted to the Johns Hopkins Hospital for pancreatic resection between January 2005 and December 2010.

Subject records meeting inclusion criteria (n=624) were identified in the PRD. We aimed to link these records with the corresponding admission record in the NCID. Because the datasets lack unique identifiers, we queried the NCID using patient-level factors contained in both sets, including: year of admission, quarter of admission, hospital, procedure type, readmission status, and patient age, sex, and zip code. A unique record consistent with these factors was identified in the NCID for 623 cases and represented the index admission. Based on the record-specific factors from the index admission, the query was then repeated to identify readmission to any Maryland hospital within 30 days of the index admission. These records were retained and linked to the corresponding index admission, yielding a comprehensive record of the index surgical admission and associated readmissions.

Assessment and Validation of Novel Data Linking Technique

Our method of probabilistic matching to identify all-hospital readmissions carries two risks which could threaten the accuracy of these data: the possibility of 1) failing to identify a readmission (i.e. reporting a false negative) or 2) incorrectly attributing a readmission to a subject who was not readmitted (i.e. reporting a false positive). In order to assess the reliability of our methods, we compared the status of readmission to our institution (i.e. JHH readmission) obtained using the NCID query against the status contained in the PRD, which is regularly updated and 100% accurate for JHH readmissions. The accuracy of these methods in identifying JHH readmission status among the 595 subjects included: 98 correctly identified JHH readmissions (i.e. true positives), 483 correctly identified JHH non-readmissions (i.e. true negatives), 7 JHH non-readmissions which were classified as readmissions (i.e. false positives), and 7 JHH readmissions which were classified as non-readmissions (i.e. false negatives). Overall, these methods facilitated identification of readmissions with 93.3% sensitivity and 98.6% specificity.

eReferences

1. Social security death index (SSDI). http://search.ancestry.com/search/db.aspx?dbid=3693. Accessed 3/10, 2011.
2. McPhee JT, Hill JS, Whalen GF, et al. Perioperative mortality for pancreatectomy: A national perspective. *Ann Surg*. 2007;246(2):246-253.

eTable 1. *ICD-9* Diagnosis Codes for Comorbid Diseases

Diagnosis	ICD-9 Diagnosis Codes
Hypertension	401.0, 401.9, 403.90, 403.91, 405.99
Diabetes Mellitus	250.00, 250.01, 250.02, 250.11, 250.12, 250.50, 250.51, 250.60, 250.80, 250.82
Dyslipidemia	272.0, 272.4, 272.8,
Obesity	278.00, 278.01, 278.02
Ischemic Heart Disease	410.71, 412, 413.9, 414.00, 414.01, 414.8, 414.9
Liver Disease	070.1, 070.22, 070.30, 070.54, 070.70, 571.1, 571.2, 571.3, 571.4, 571.5, 571.6, 571.8, 572.0, 572.3, 572.8, 573.3, 573.8, 573.9

eTable 2. *ICD-9* **Diagnosis Codes for Readmission Diagnostic Groups**

Diagnostic Group	ICD-9 Diagnosis Codes
Gastrointestinal/Nutritional	008.45, 261, 276.51, 289.59, 535.00, 536.49, 536.8, 537.0, 552.29, 560.89, 560.9, 562.11, 562.12, 569.62, 574.31, 576.8, 577.0, 588, 789.00, 789.02, 789.09, 789.5, 997.4, 998.4
Surgical Infection	038.9, 572.0, 780.6, 780.62, 790.7, 996.59, 996.61, 996.62, 997.99, 998.32, 998.51, 998.59
Vascular Problem	434.11, 442.83, 452, 453.41, 997.2, 998.11
Genitourinary Problem	584.9, 599.0
Cardiac Problem	398.91, 411.89, 428.0
Pulmonary Problem	415.11, 415.19, 507.0
Other	250.00, 250.02, 250.22, 280.0, 283.9, 296.33, 527.2, 733.13, 780.2, 790.92, 996.49