

# LDI *Issue Brief*

Volume 12, Number 4  
February 2007

Leonard Davis Institute of Health Economics

Jeffrey H. Silber, MD, PhD  
LDI Senior Fellow,  
Professor of Pediatrics,  
Anesthesiology and Critical Care,  
and Health Care Systems  
The University of Pennsylvania  
Director, Center for Outcomes  
Research  
The Children's Hospital of  
Philadelphia

## *Time Under: Hospital and Patient Characteristics Affecting Anesthesia Duration*

Editor's note: One aspect of the quality of surgical care is the length of the time patients spend in the operating room and under anesthesia. It is generally believed that the longer a surgical procedure, the greater the chance of a complication. But because obtaining procedure and anesthesia times usually involves a direct review of medical records, few large-scale studies are able to examine procedure times. This Issue Brief summarizes new work that validates the use of Medicare billing data as a proxy for anesthesia times, and illustrates how these data can shed light on hospital and patient characteristics that affect procedure duration and surgical quality.

### *Anesthesia time is important, but understudied*

Procedure times are important variables that often are included in studies of hospital quality and efficiency. However, little is known about how and why procedure times vary across hospitals.

- For a given procedure, longer duration has been associated with more complications, including higher rates of infection.
- Many factors can influence the length of a surgical procedure, including the initial severity of the patient's condition and the presence of training physicians.
- Since 1994, Medicare has reimbursed anesthesiologists based on a formula that includes procedure length. Anesthesia time is billed in units calculated to the nearest 1.5 minutes. If these bills accurately reflect anesthesia time as recorded in the patient's chart, Medicare billing records could facilitate large-scale studies of procedure time across patients and hospitals.

### *Anesthesia time on Medicare bills can be used as a proxy for anesthesia and surgical times in the patient's medical record*

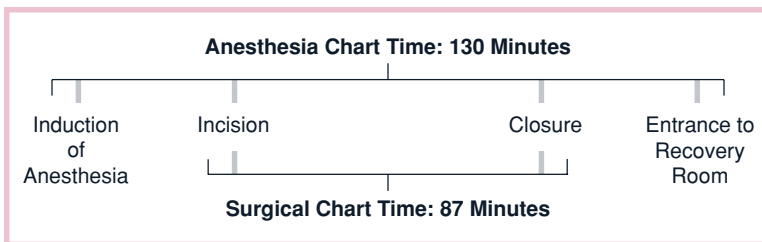
To validate information from the Medicare bill, Silber and colleagues compared information from Medicare claims data with information from anesthesia and surgical times as recorded in the charts of 1,931 Medicare patients who underwent general and orthopedic surgical procedures in Pennsylvania from 1995-1996. The authors abstracted information on time of anesthesia induction

*Continued on next page.*

---

and entrance to the recovery room (“anesthesia chart time”) and the time from incision to closure (“surgical chart time”). The authors then compared the abstracted information with Medicare bills that included the time in minutes for the anesthesia service.

- The median anesthesia chart time was 130 minutes, from induction of anesthesia to entrance in the recovery room. The median surgical chart time was 87 minutes, from incision to closure (see figure below).
- More than 80% of the variation in anesthesia time can be explained by the surgical time.
- Medicare anesthesia claims predicted anesthesia chart time well, usually coming within five minutes of the charted time. Claims data predicted surgical chart time slightly less well, usually coming within 14 minutes of the charted time. Results were similar across procedure type, comorbidities, and hospital type.



- These findings indicate that anesthesia chart time can be well estimated using Medicare claims, thereby facilitating large studies with much lower costs of data collection.

---

***Anesthesia time varies by patient characteristics, including race and obesity***

Having validated the Medicare bill as a good proxy for anesthesia chart time, Silber and colleagues studied the influence of patient and hospital characteristics on anesthesia times in a large group of patients. They obtained Medicare claims on all patients aged 65-85 years who underwent general surgical and orthopedic surgical procedures in 183 hospitals in Pennsylvania in 1995-1996.

- The study consisted of 77,638 patients, 31,472 of whom had general surgery and 46,166 of whom underwent orthopedic procedures. As indicated by claims data, the median anesthesia time for general surgery was 133 minutes, and for orthopedic surgery it was 146 minutes.
- Adjusting for the specific hospital, procedure, and physiologic severity, the following factors were associated with increased anesthesia time: multiple procedures on same day (+18.3 minutes); transfer in from another acute care facility (+6.7 minutes); black race (+5.5 minutes); coagulation disorders (+4.9 minutes); paraplegia (+4.5 minutes).
- The authors also looked at the influence of obesity on anesthesia time in a subset of 1,931 patients in which body-mass index was available. Being obese added 17 minutes to a typical procedure.

---

***Teaching hospitals are slower on average, but times among teaching hospitals vary greatly***

Because longer operative times have been associated with the presence of a surgical training program, Silber and colleagues looked at differences in anesthesia procedure lengths between hospitals with and without a training program.

---

- The typical procedure in hospitals with training programs was about six minutes longer than those performed in hospitals without these programs.
- However, the presence of a training program does not explain the magnitude of differences in procedure length among hospitals. Procedure times varied as much as 1.5 hours among individual hospitals.
- Teaching hospitals disproportionately serve black patients. About 74% of black patients in Pennsylvania were operated on in teaching hospitals, compared to 46% of white patients.

***Lower-income black patients have surgery in hospitals with longer procedure times***

The authors took a closer look at differences by race and income across hospitals. They divided study patients into three equal groups of income, based on the median household income in the patient’s zip code.

- Lower-income black patients had significantly longer procedure times than lower-income white patients (+29 minutes). After adjusting for the individual hospital, this difference decreased to seven minutes, and continued to be highly statistically significant.
- Higher-income black patients had significantly longer procedure times than higher-income white patients (+12 minutes). However, after adjusting for the individual hospital, this difference disappeared.

	Compared to low income white patients	Compared to high income black patients	Compared to high income white patients
Low income black Adjusted for hospital	+ 29 + 7	+ 15 + 9	+ 27 + 8
Low income white Adjusted for hospital		- 14 + 2	- 2 + 1
High income black Adjusted for hospital			+ 12 0

**Race, income, and procedure time** (black-white in minutes)

- As a group, the 15 hospitals with the largest black surgical patient populations had longer procedure times than other hospitals. Compared to white patients at other hospitals, procedure times in these 15 hospitals were 24 minutes longer for white patients and 41 minutes longer for black patients.
- Five of the 15 hospitals had significant differences in procedure lengths for black versus white patients, ranging from 10 to 16 minutes.

***POLICY IMPLICATIONS***

These studies illustrate how Medicare claims data can be used to study anesthesia time differentials in a large sample of patients among many hospitals. These claims data have the potential to provide new insights into the practice of anesthesiology and surgery and variations among hospitals, providers, and their patients undergoing surgical procedures.

*Continued on back.*

---

## **POLICY IMPLICATIONS**

### *Continued*

- These findings suggest that black patients go to hospitals with very different procedure lengths than white patients. When examining the overall difference between black and white patients, the difference across hospitals explains far more than within hospitals.
- Reducing procedure length in teaching hospitals may benefit both black and white patients, but produce a disproportionate benefit for black patients since they disproportionately utilize these hospitals.
- Further research is needed to understand why hospitals where black patients undergo surgery (often large urban teaching hospitals) require so much longer procedure times for both black and white patients. Differences in procedure lengths might also reflect differences in underlying disease severity that are not captured by other statistical adjustments.

---

*This Issue Brief is based on the following articles: J.H. Silber, P.R. Rosenbaum, X. Zhang, O. Even-Shoshan. Estimating anesthesia and surgical procedure times from Medicare anesthesia claims. Anesthesiology, February 2007, vol. 106, pp. 346-355; J.H. Silber, P.R. Rosenbaum, X. Zhang, O. Even-Shoshan. Influence of patient and hospital characteristics on anesthesia time in Medicare patients undergoing general and orthopedic surgery. Anesthesiology, February 2007, vol. 106, pp. 356-364.*

---

*Published by the Leonard Davis Institute of Health Economics, University of Pennsylvania, 3641 Locust Walk, Philadelphia, PA 19104-6218. Janet Weiner, MPH, Associate Director for Health Policy, Editor (215-573-9374) David A. Asch, MD, MBA, Executive Director*

Visit us on the web at [www.upenn.edu/ldi](http://www.upenn.edu/ldi)

---

*Issue Briefs synthesize the results of research by LDI's Senior Fellows, a consortium of Penn scholars studying medical, economic, and social and ethical issues that influence how health care is organized, financed, managed, and delivered in the United States and internationally. The LDI is a cooperative venture among Penn schools including Dental Medicine, Medicine, Nursing and Wharton, and the Children's Hospital of Philadelphia. For additional information on this or other Issue Briefs, contact Janet Weiner (e-mail: [weinerja@mail.med.upenn.edu](mailto:weinerja@mail.med.upenn.edu); 215-573-9374).*

---

© 2007 Leonard Davis Institute

Published by the  
Leonard Davis Institute  
of Health Economics  
University of Pennsylvania

## *Issue Brief*



3641 Locust Walk  
Philadelphia, PA 19104-6218  
215.898.5611  
fax 215.898.0229  
ADDRESS CORRECTION REQUESTED

Nonprofit Organization  
U.S. Postage  
**PAID**  
Permit No. 2563  
Philadelphia, PA 19104