# Which Patients Require More Care after Hospital Discharge? An Analysis of Post-Acute Care Use among Elderly Patients Undergoing Elective Surgery

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**BACKGROUND:** The use of post-acute care is common among the elderly and accounts for $62 billion in annual Medicare expenditures. However, little is known about post-acute care use after surgery.

**STUDY DESIGN:** Data were merged between the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) and Medicare claims for 2005 to 2008. Post-acute care use, including skilled nursing facilities (SNF), inpatient rehabilitation facilities (IRF), and home health care (HHC) were analyzed for 3 operations: colectomy, pancreatectomy, and open abdominal aortic aneurysm repair. Controlling for both preoperative risk factors and the occurrence of postoperative complications, we used multinomial logistic regression to estimate the odds of use for each type of post-acute care after elective surgery compared with home discharge.

**RESULTS:** Post-acute care was used frequently for patients undergoing colectomy (40.0%; total n = 10,932), pancreatectomy (46.0%; total n = 2,144), and open abdominal aortic aneurysm (AAA) repair (44.9%; total n = 1,736). Home health was the most frequently reported post-acute care service for each operation (range 23.2% to 31.5%) followed by SNF (range 12.0% to 15.0%), and then by IRF (range 2.5% to 5.4%). The majority of patients with at least 1 inpatient complication were discharged to post-acute care (range 58.6% for open AAA repair to 64.4% for colectomy). In multivariable analysis, specific preoperative risk factors, including advanced age, poor functional status, and inpatient complications were significantly associated with increased risk-adjusted odds of discharge to post-acute care for each operation studied.

**CONCLUSIONS:** Among elderly patients, post-acute care use is frequent after surgery and is significantly associated with several preoperative risk factors and postoperative inpatient complications. Further work is needed to ensure that post-acute care services are used appropriately and cost-effectively. (J Am Coll Surg 2015;220:1113−1121. © 2015 by the American College of Surgeons)

Post-acute care services represent a range of health care services that aim to optimize patients' recovery after a hospital stay. Over the past 2 decades, while hospital length of stay has decreased, there has been a corresponding and substantial increase in the use of post-acute care (PAC), including skilled nursing facilities (SNF), inpatient rehabilitation facilities (IRF), and home health care (HHC).[1-3] Nearly half of hospitalized Medicare patients use PAC after discharge, accounting for more than $62 billion in 2012 expenditures.[4,5] As a result, the Centers for Medicare and Medicaid Services (CMS) is developing payment policies aimed at reducing costs and ensuring appropriate use of PAC.

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**Abbreviations and Acronyms**

AAA = abdominal aortic aneurysm
DVT = deep vein thrombosis
HHC = home health care
IRF = inpatient rehabilitation facility
PAC = post-acute care
SNF = skilled nursing facility
SSI = surgical site infection

Each form of PAC offers a unique set of services with varying levels of clinician availability and oversight. The IRFs deliver intensive physical and occupational therapy for at least 3 hours a day,[6] while SNFs offer less strenuous rehabilitation programs, but provide at least 8 hours of daily nursing care and have a nurse or physician available 24 hours a day.[7] Home health care provides in-home nursing care for patients under physician supervision.[8] Aside from these loosely defined criteria, no guidelines exist to help providers determine which patients would benefit most from each form of PAC.[4]

Little is known regarding current use of PAC services for surgical patients. The objective of this study was therefore to describe PAC use patterns using a dataset that links data from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) with Medicare data. We aimed to identify clinical factors associated with PAC use, including preoperative risk factors and postoperative complications. Our intent was to provide guidance for the eventual development of best practices and payment policies regarding use of PAC services for surgical patients.

## METHODS

### Data sources and study sample

For this study, we used a merged dataset: Medicare inpatient claims data linked to the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) for years 2005 to 2008. The details of this dataset, the linkage procedure, and the linkage validation have been described elsewhere.[9] In brief, patient records from the 100% Medicare provider analysis and review file (MedPAR) were linked to ACS-NSQIP records using indirect identifiers and a deterministic linkage algorithm. The ACS-NSQIP is an institution-based, multispecialty, clinical registry for patients undergoing surgery. Data collected include preoperative risk factors, type of operation performed, and details on more than a dozen postoperative complications, including mortality.

Using CPT codes (Appendix 1, online only), we identified patients undergoing colectomy, pancreatectomy, and open abdominal aortic aneurysm (AAA) repair. These procedures are frequently performed, represent a range of surgical specialties, and fit our a priori assumption of high PAC needs based on high complication rates. Patients who were admitted from a chronic care facility (transitional care unit, sub-acute hospital, skilled nursing home, or unskilled facility) before the operation were excluded because it was not possible to distinguish new use of PAC from a return to their facility of origin. Because we were interested in identifying risk factors for PAC use after elective surgery, we excluded patients who were American Society of Anesthesiologists (ASA) class 5, those who underwent emergent surgery, or those who were entirely functionally dependent (n = 2,714 for colectomy, n = 49 for pancreatectomy, n = 479 for open AAA repair). We also excluded patients with missing data for discharge destination (n = 479 for colectomy, n = 53 for pancreatectomy, n = 84 for open AAA repair).

### Outcomes

Our primary outcome of interest was the postoperative discharge destination. This was identified from a hospital-reported variable in Medicare inpatient claims. Line item billing data were available from SNFs and IRFs; however, these data capture only PAC use for which Medicare was the primary payer for these services. Discharge destination was coded as a categorical variable: SNF, IRF, HHC, and discharge to home, the last of which was used as the reference category. To control for the effects of patient death before discharge and to further stabilize our standard errors, inpatient death was included in the categorical outcomes variable. However, because this outcome is not central to our investigation, the results for the mortality category are not presented in detail here.

### Covariates

We conceptualized the use of PAC as determined by 2 patient level metrics—health status at the time of the operation and health status at the time of discharge, the latter accounting for deterioration in health during the postoperative hospital stay. Preoperative condition was characterized by the following variables, all obtained from ACS-NSQIP: age, sex, admission source (home, acute care facility, other), American Society of Anesthesiologists class, functional status (independent, partially dependent, fully dependent), number of comorbidities (0, 1, 2, $\geq$3), wound class (clean/clean-contaminated, contaminated, dirty), emergency case, and the indication for operation. In order to characterize changes in health during the hospitalization, we included the occurrence of inpatient complications as recorded by ACS-NSQIP: surgical site infection (superficial, deep/organ-space), wound dehiscence, pneumonia,