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Emergency Department Use after Outpatient Surgery Among Dually-Enrolled VA and Medicare Patients

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Abstract

Background: Emergency department (ED) use following outpatient surgery may be associated with a surgery-related patient safety problem. We characterized ED use within 7 days of general, urology, orthopedic, ear/nose/throat and podiatry surgeries and assessed factors associated with these visits by specialty.

Methods: We calculated the 2011-2013 postoperative ED visit rate for Veterans >65 dually-enrolled in the Veterans Health Administration (VA) and Medicare, examined diagnoses and used logistic regression to model patient, procedure and facility factors associated with ED care.

Results: Among 63,279 outpatient surgeries, 2,778 (4.4%) resulted in an ED visit within 7 days; 23% of these were to non-VA facilities. Rates varied from >5% for urology and ear/nose/throat, to <3% for orthopedic and podiatry specialties. Genitourinary symptoms and surgical complications were common diagnoses across specialties. No patient, procedure or facility factors were associated with ED use for every specialty.

Conclusion: A small proportion of VA outpatient surgeries result in ED use. Notably, 1/4 of postoperative ED visits may be missed by the VA because they occur in non-VA facilities. ED visits for urinary issues or surgical complications may be preventable; however, factors

associated with ED use vary by specialty suggesting different approaches may be needed to improve outcomes.

Keywords

VA Health Care System; Ambulatory/Outpatient Care; Surgery; Quality of Care/Patient Safety (Measurement)

Background

Emergency department (ED) use following outpatient surgery may be associated with a surgery-related patient safety problem.¹ As a result, the Centers for Medicare and Medicaid Services (CMS) recently added ED visits within 7 days of an outpatient surgery as a measure of quality.² As many as 70% of CMS-financed surgeries and 80% of Veterans Health Administration (VA) surgeries were performed outpatient,^{3,4} and rates of postoperative ED use range from 4% – 8%, depending on the types of outpatient surgeries included in the denominator.^{1,2,5–7} Prior work found that of these ED visits, as many as 46% constituted a postoperative adverse event.^{8,9} Many adverse events are potentially preventable complications including urinary retention, wound dehiscence, hematoma and urinary tract infections.⁹ Despite the high prevalence of outpatient surgery within the VA, little is known about postoperative ED visits, particularly with respect to associated patient, procedure and facility characteristics.²

There are few studies of patient safety in VA outpatient surgery. An assessment of outpatient surgical adverse events in the VA found patients with postoperative admissions or ED visits had higher odds of an adverse event.¹⁰ A separate study of factors associated with postoperative admission following outpatient surgery in the VA found age, overall disease burden, distance to the nearest hospital, type of surgery/anesthesia and facility complexity played a role in hospital use.¹¹ This study also measured the admission rate to non-VA hospitals in a population of dually enrolled VA and Medicare patients over age 65 who were able to use care in either VA or non-VA settings. The authors found 20% of outpatient surgeries had an observation stay or admission up to 7 days postoperatively and only 1% of these were to non-VA hospitals.

Our purpose was to measure the rate of ED use after VA outpatient surgery in a similar population of dually enrolled VA-Medicare patients over age 65 and assess whether a similar set of patient, procedure and facility characteristics were associated with ED use as with admissions. We also measure the rates of ED visits in non-VA facilities, compare rates and factors across five high-volume specialties [general surgery, urology, orthopedics, ear/nose/throat (ENT) and podiatry] and examine the primary reason for the visit. This information can be helpful in determining whether postoperative ED visits may be related to patient safety problems from the outpatient surgery and can identify potential opportunities to improve outcomes.

Methods

Study Population:

Our sample included VA outpatient surgeries from Oct. 1, 2011- Dec. 17, 2013 performed on CMS and VA dually-enrolled patients over age 65.¹¹ Dually enrolled patients were identified using the VA Information Resource Center's VA/CMS data repository to identify VA patients with CMS enrollment.¹²

We distinguished outpatient surgeries from all outpatient procedures in the following way. First, we isolated all outpatient procedures in the VA Corporate Data Warehouse (CDW)'s Outpatient Visits table if the associated Current Procedure Terminology (CPT) code fell in the surgery category between 10021 - 69990.¹³ Next, we matched CPT codes with the annually published CMS Relative Value Unit (RVU, a measure of the work and expense associated with the healthcare service and used to calculate Medicare payments) to measure the complexity of the procedure for the given year of the outpatient encounter.¹⁴ If the outpatient encounter had no RVUs > 0 we did not consider these surgical cases and if the encounter included multiple CPT codes, we used the highest RVU CPT as the primary procedure. To further eliminate procedures that did not meet our definition of surgery, we removed outpatient encounters if the CPT code was not considered surgery by the Agency for Healthcare Research and Quality (AHRQ)'s Healthcare Cost and Utilization Program (HCUP)'s 2014 Surgery Flag Software.¹⁵ The Surgery Flag Software was developed and validated by surgeon experts to distinguish CPT codes for procedures likely provided by a surgeon that involved invasive therapeutic services as opposed to routine diagnostic care within minimal complexity. To increase the reliability of the identification of outpatient surgical encounters, we further refined our sample of to exclude CPT codes if they were classified by the VA National Surgery Office as inpatient-only in fiscal year 2014,^{16,17} or by CMS as non-billable services if performed outside the hospital inpatient setting.¹⁸ The final list of CPT codes defining outpatient surgery is available in Appendix 1.

The VA Boston Healthcare System Institutional Review Board approved this research with a waiver of informed consent.

Postoperative Emergency Department Use

We examined the rate of 0-7 day postoperative visits to EDs in both VA and non-VA facilities. We assessed and reported whether the patient was admitted to the hospital from the ED; as these types of postoperative visits were captured in previous work on postoperative admissions, we excluded them from our analysis.¹¹ If the patient had an observation stay following their outpatient surgery and went on to have an ED visit within 7 days postoperatively, we counted these patients as having an ED visit. The VA provides emergency care in either emergency or urgent care departments and we included both settings in our analysis; we did not define same day primary care visits as emergency visits.

To identify ED use in non-VA facilities we used VA Information Resource Center's VA/CMS data repository of private sector visits for VA patients.¹² We distinguished ED visits from all outpatient visits in the CMS data based on a previously established method using emergency outpatient care revenue centers or Healthcare Common Procedure Coding

System used for Medicare billing.¹⁹ Some patients may have had ED visits in both CMS and VA datasets; we assigned patients to the first ED visit that occurred and did not double count visits (i.e., a same day ED visit with another visit, regardless of facility, would not be counted twice).

Reasons for Postoperative Emergency Department Use

For ED visits to the VA, we assessed the reason for the ED visit based on the principal International Classification of Diseases, Clinical Modification, Ninth Edition (ICD-9-CM) diagnosis code documented in the VA CDW Outpatient Visits Table. For CMS ED use, the principal visit reason was given as either an ICD-9 code or a CPT code. For ED visits with an ICD-9 code, we matched the diagnosis code to the associated diagnosis grouping defined by the AHRQ Clinical Classification Software (CCS).²⁰ CCS diagnosis groups have been used to identify reasons for postoperative healthcare use, including surgical complications, in previous work.^{21,22} We aggregated CCS codes and CPT codes to create a list of the top 20 most frequent ED visit reasons within each surgical specialty.

Factors Potentially Associated with Postoperative Emergency Department Use

We identified several patient, procedure and facility factors potentially associated with postoperative ED visits based on the previous study of VA postoperative admissions following outpatient surgery.¹¹ We identified patient characteristics including age, race and marital status from the VA CDW Patient table. Patient health status was measured by the number of outpatient visits in the six months before surgery, recorded in the VA CDW Outpatient Visit data, and the AHRQ Risk Adjustment Software's comorbid health condition categories captured in secondary diagnosis fields of VA CDW Outpatient Visits 12 month before surgery.²³ The 28 disease categories have been used to measure patient comorbidities in previous work.¹¹ We also used a comorbidity summary score if we had insufficient data to assess each comorbidity individually.²⁴ Patient's access to care was measured as the distance from the patient's primary residence to the nearest VA medical center using addresses for the patient and the facility from the VA CDW. We measured procedure characteristics as the RVU associated with the procedure's CPT code, the clinician-determined American Society of Anesthesia risk score recorded in the VA CDW Surgery table, and whether the patient remained at the facility for an observation period up to 48 hours based on the CDW Inpatient data. Lastly, we considered facility characteristics based on whether the procedure was performed in a VA facility classified as either an ambulatory surgery center (ASC) or a hospital outpatient department by the VA National Surgery Office.²⁵

Analysis

Our analysis included measures of ED visit rates by specialty, timing of the ED visit up to 7 days postoperatively, and an assessment of factors associated with ED use. As a sensitivity analysis, we examined the change in ED visit rates for each specialty if CMS data were not included or if ED visits were counted regardless of whether the ED visit resulted in admission. We also measured the time to ED visit following the surgery based on date of procedure and date of visit. We conducted chi-square and t-tests as appropriate to compare factors for the outpatient surgeries with 0-7 day ED visits to surgeries with no postoperative ED use for each specialty.

We estimated five logistic regression models to assess the relationship between patient, procedure and facility factors and postoperative ED visits to VA or non-VA facilities for each specialty in our sample: general surgery, orthopedic, urology, ENT and podiatry. Continuous variables (age, distance to nearest VA hospital, number of prior visits, and RVUs) were converted to quintiles; we used the lowest quintile as the omitted category in our models. We created dichotomous variables for sex, marital status and minority race (African American, American Indian, Asian/Pacific Islander, mixed race). We maintained a ratio of 10 ED visit events per factor in our logistic regression models according to guidance from Peduzzi et al.²⁶ For specialties with smaller sample sizes and fewer outcomes, we only retained variables with a significant association with ED visits in chi-square or t-test results. Analyses were performed using SAS 9.2 Proc Logistic.²⁷

Results

Postoperative Emergency Department Use Rates and Timing

There were 63,279 outpatient surgeries in our sample of VA patients over age 65 dually enrolled in Medicare and VA healthcare. ED rates varied across specialties: 2.4% of podiatry surgeries were followed by an ED visit compared to 5.4% of urology surgeries (see Table 1). Approximately 23% of ED visits occurred outside the VA, changing the overall rate from 3.4% using VA data alone to 4.4% when non-VA care was considered. In addition to the 2,778 outpatient surgeries with ED visits only, 426 (0.67%) surgeries led to admissions after their ED visits.

The ED visit rate over time varied by specialty. From day 0 to day 1 ED visit rates increased for general surgery, urology and ENT surgeries; however, over the same time period rates decreased for podiatry surgeries (the rate of ED use was the same in the first 48 hours for orthopedic surgeries). After the first 48 hours ED rates declined for all specialties (see Figure 1).

Reasons for Postoperative Emergency Department Use

The top 20 diagnosis groups, based on ICD-9 or CPT codes, varied by surgical specialty and explained between 49% (podiatry) and 76% (urology) of the ED visits (see Table 2). In all specialties, complications of surgical procedures or medical care accounted for 5% of ED visits overall, ranging from 2% (urology) to 8% (general surgery). Other potentially preventable reasons for ED visits in the top 20 list for all specialties included urinary tract infections, nausea and vomiting and device complications. Collectively, these accounted for 5% of all ED visits. Genitourinary symptoms and insertion of a temporary bladder catheter were the reasons for 26%, 13% and 11% of ED visits for urology, general surgery and ENT surgeries, respectively, and 16% of ED visits overall. Other non-traumatic joint disorders were the reasons for 11% and 10% of ED visits following orthopedic and podiatry surgeries, respectively. Nearly 10% of the ED visits had non-specific ICD-9 diagnosis groups or CPT codes (i.e., “Other aftercare” or “Emergency room visit”).

Significant Factors Associated with Postoperative Emergency Department Use

We included as many relevant factors as we could given sample size limitations in the separate logistic regression models for each surgical specialty (see Table 3). Model fit based on c-statistic varied from 0.62 (urology) to 0.67 (orthopedics) but was only 0.60 for ENT; in the logistic regression model for ENT, only the intercept was significantly associated with the outcome.

In general surgery and urology specialties, we observed significantly higher odds of a postoperative ED visits in older patients and in more complex surgeries based on higher RVUs, higher anesthesia risk assessments, and whether the patient had a postoperative observation stay. Female sex was so rare in our population we could not include it as a variable in any model. We observed no significant relationship between marital status and ED use for general surgery, urology or orthopedic surgeries and we did not include this factor in our models for ENT or podiatry due to small samples. Race emerged as a significant factor for orthopedics with higher odds of an ED visit for minority race patients compared to white race patients. As the distance between the patient's home and the nearest VA medical center increased, the odds of a postoperative ED visit in either a VA or non-VA facility decreased in general surgery, orthopedic and podiatry specialties.

There were several comorbid conditions related to ED use within specialties: patients with comorbid drug abuse or psychoses had higher odds of an ED visit after general surgery, while patients with lymphoma or non-cancerous tumors were associated with lower odds. Patients with metastatic cancer had higher odds of an ED visit after urology surgery and those with renal failure had higher odds of an ED visit after orthopedic surgery. There were too few cases to model individual comorbidities in podiatry surgery; however, a higher comorbidity summary score was not associated with ED use in podiatry.

With respect to facility characteristics, surgeries performed in ASCs had lower odds of a postoperative ED visit than those in hospital outpatient departments for urology surgeries only.

Discussion

Among VA dually enrolled patients age 65 and older, we observed variation across surgical specialties in rates and timing of ED use, reasons for ED use, and patient, procedure and facility characteristics associated with ED use. Overall, 4.4% of outpatient surgeries resulted in an ED visit only and 23% of these were to non-VA facilities. Genitourinary symptoms, complications of surgical procedures or devices, urinary tract infections and nausea/vomiting accounted for 1/4 of all ED visits; these visits may represent preventable surgical quality problems. Older patients, patients retained on observation status following outpatient surgery, those with an ASA class over 2, or those undergoing complex procedures may be good candidates for quality improvement efforts to reduce postoperative healthcare utilization.

In many respects, our study findings confirmed existing research on postoperative healthcare use up to 7 days after surgery. Like postoperative admission rates ranging from 5%

(podiatry) to 28% (urology), we found postoperative ED rates were lowest for podiatry and highest for urology VA surgeries (3.3% and 6.6%, respectively). These ED visit rate differences between urology and podiatry were also reported in the literature following non-VA surgeries.^{2,28} Admissions and ED visits occurred most frequently within 48 hours of surgery and admissions and ED use were commonly diagnosed as complications of surgical or medical care.¹¹ Among the most frequent reasons for postoperative ED visits, genitourinary symptoms, complications of surgical procedures or medical care, urinary tract infections and nausea/vomiting have been reported as potentially preventable adverse surgical outcomes in prior research.^{21,22,29}

There were several new findings in this analysis that make important contributions to the literature. We found that the farther the patient lived from the nearest VA hospital, regardless of whether non-VA EDs were available in their area, the lower the odds the patient would use any ED services following their surgery. Notably, we were not able to assess the extent to which rates of ED use were related to the availability of ED care. Distance to facility is an important predictor of postoperative ED use in the literature.³⁰ Future work should examine whether lower rates of postoperative ED use constitute access of care problems.

We also discovered new information about outpatient surgery when considering postoperative ED use as opposed to admissions. Approximately 1% of outpatient surgeries in our sample had an ED visit and an admission, highlighting the importance of looking at both types of outcomes to assess potential safety problems. Furthermore, CMS data was considerably more important for 7-day postoperative ED use among VA patients than for admissions.¹¹ Nearly one quarter of all postoperative ED visits were to non-VA facilities whereas only 1% of postoperative admissions were outside the VA. Our rate of ED use following VA outpatient surgeries is consistent with the literature.^{1,2,5-7} While we examined a Veteran population dually enrolled in VA and Medicare in order to more comprehensively assess postoperative ED use, it is likely that other studies of VA surgery will need to consider the postoperative use of non-VA ED care, particularly given the increased access of community care authorized by the VA MISSION Act of 2018.³¹

We observed a significant relationship between postoperative ED use and patient's disease burden in specialties where we had enough cases to examine comorbidities. Our analysis of leading reasons for postoperative ED visits showed a mix of diagnoses and CPT codes related to patient's overall disease burden as opposed to visit diagnoses that could reflect potential surgical quality problems. Prior work based on chart review to detect adverse events in outpatient surgery found less than half of patients with an ED visit had a surgical complication and the other half were admitted for other medical concerns.^{8,9} In our study, a history of drug abuse and psychoses were significantly associated with ED visits after general surgery. Nationally, as many as 1 in 8 ED visits may be due to a mental health or substance abuse issue,³² and a study of VA patients' ED use found mental illness and requests for opioid prescriptions were frequent causes.³³ Given this, regulations designed to improve outpatient surgical care by measuring postoperative ED use should consider adjusting for risk of certain medical conditions.

Our study has both strengths and limitations. We used a large sample of national VA data to examine a variety of outpatient surgeries and patient, procedure and facility characteristics related to postoperative ED use in five surgical specialties. Our sample included both VA and non-VA ED use following outpatient surgery. We identified the leading diagnoses and procedure codes attributable to the ED visit. Lastly, the logistic regression models we estimated identified significant factors that support existing literature and point to new directions for future research.

With respect to limitations, our VA sample may not generalize well to non-VA patients because of differences in the availability of ED care and the coverage for ED costs in the private insurance market. We also found many ED visit diagnosis or CPT codes were too vague to meaningfully interpret whether the visit may have been associated with surgery or an unrelated medical issue. In addition, the relatively weak c-statistic in our model suggests there is a great deal of randomness to ED use across specialties and this further emphasizes the need to examine surgical care within specialties and use risk adjustment when examining postoperative ED visits in quality measurement.

Conclusions

In summary, while ED use after outpatient surgery was relatively infrequent, more than 25% of these visits were for complications reflecting potentially preventable surgical quality problems such as postoperative infections and nausea/vomiting. Our study shows that common factors including patient's disease burden and the complexity of the surgical procedure may increase the odds of a postoperative ED visit; however, factors associated with ED use varied suggesting different approaches for each surgical specialty may be needed to improve outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References:

1. Fox JP, Vashi AA, Ross JS, Gross CP. Hospital-based, acute care after ambulatory surgery center discharge. *Surgery*. 2014;155(5):743–753. [PubMed: 24787100]
2. Centers for Medicare and Medicaid Services. 2016 Measure Updates and Specifications Report: Hospital Visits after Hospital Outpatient Surgery Measure (Risk-Standardized Hospital Visits within 7 Days After Hospital Outpatient Surgery Measure), Version 1.1. 2016.
3. Department of Veterans Affairs. VHA DIRECTIVE 2011-037, Facility Infrastructure Requirements to Perform Invasive Procedures in an Ambulatory Surgery Center. Available at: www.va.gov/vhapublications/ViewPublication.asp?pub_ID=2452. In:2011.

4. Cullen KA, Hall MJ, Golosinskiy A. Ambulatory surgery in the United States, 2006. *Natl Health Stat Report*. 2009(11):1–25.
5. Mezei G, Chung F. Return hospital visits and hospital readmissions after ambulatory surgery. *Ann Surg*. 1999;230(5):721–727. [PubMed: 10561098]
6. Mull HJ, Borzecki AM, Hickson K, Itani KM, Rosen AK. Development and Testing of Tools to Detect Ambulatory Surgical Adverse Events. *J Patient Saf*. 2013.
7. Steiner CA, Maggard-Gibbons M, Raetzman SO, Barrett ML, Sacks GD, Owens PL. Return to Acute Care Following Ambulatory Surgery. *JAMA*. 2015;314(13):1397–1399. [PubMed: 26441186]
8. Mull HJ, Borzecki AM, Hickson K, Itani KM, Rosen AK. Development and testing of tools to detect ambulatory surgical adverse events. *J Patient Saf*. 2013;9(2):96–102. [PubMed: 23370221]
9. Mull HJ, Itani KMF, Pizer SD, et al. Development of an Adverse Event Surveillance Model for Outpatient Surgery in the Veterans Health Administration. *Health Serv Res*. 2018, in press.
10. Mull HJ, Itani KMF, Pizer SD, et al. Development of an Adverse Event Surveillance Model for Outpatient Surgery in the Veterans Health Administration. *Health Serv Res*. 2018.
11. Mull HJ, Rosen AK, O'Brien WJ, et al. Factors Associated with Hospital Admission after Outpatient Surgery in the Veterans Health Administration. *Health Serv Res*. 2018.
12. VA Information Resource Center. VIREC Medicare Data Documentation for Medicare Data in the VA/CMS Data Repository. U.S. Dept. of Veterans Affairs, Health Services Research and Development Service. <http://www.virec.research.va.gov/VACMS/Medicare/Documentation.htm>. Accessed May 9, 2013.
13. Noël PH, Copeland L. Using VA Corporate Data Warehouse for Health Services Research. 2012.
14. Centers for Medicare and Medicaid Services. Physician Fee Schedule Relative Value Files 2013; <http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/PFS-Relative-Value-Files.html#>. Accessed March 19, 2015.
15. Healthcare Cost and Utilization Project (HCUP). Surgery Flag Software. 2015; <https://www.hcup-us.ahrq.gov/toolssoftware/surgflags/surgeryflags.jsp>. Accessed May 6, 2015.
16. VA National Surgery Office (NSO). Surgical Services Homepage. 2015; <http://vaww.dushom.va.gov/surgery/index.asp>. Accessed June 10, 2015.
17. Centers for Medicare and Medicaid Services. Ambulatory Surgical Center Payment- Proposed Rule, Regulation No. CMS-1601-P. 2014.
18. Centers for Medicare and Medicaid Services. Hospital Outpatient Prospective Payment, Regulation No. CMS-1601-FC2014; <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalOutpatientPPS/Hospital-Outpatient-Regulations-and-Notices-Items/CMS-1601-FC-.html?DLPage=1&DLSort=2&DLSortDir=descending>. Accessed June 16, 2016.
19. Durham S, Barosso G, Merriman K, Caldwell D. How to Identify Hospital Claims for Emergency Room Visits in the Medicare Claims Data. 2015; <https://www.resdac.org/resconnect/articles/144>. Accessed Dec 6, 2017.
20. Healthcare Cost and Utilization Project (HCUP). Clinical Classifications Software (CCS) for ICD-9-CM. 2015; <https://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>. Accessed May 6, 2015.
21. Fry DE, Pine M, Jones BL, Meimban RJ. Adverse outcomes in surgery: redefinition of postoperative complications. *Am J Surg*. 2009;197(4):479–484. [PubMed: 19246026]
22. Mull HJ, Graham LA, Morris MS, et al. Association of Postoperative Readmissions With Surgical Quality Using a Delphi Consensus Process to Identify Relevant Diagnosis Codes. *JAMA surgery*. 2018.
23. Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. *Med Care*. 1998;36(1):8–27. [PubMed: 9431328]
24. Thompson NR, Fan Y, Dalton JE, et al. A New Elixhauser-based Comorbidity Summary Measure to Predict In-Hospital Mortality. *Medical care*. 2015;53(4):374–379. [PubMed: 25769057]
25. Department of Veterans Affairs. VHA HANDBOOK 1102.01, National Surgery Office, Available at: http://www.va.gov/vhapublications/ViewPublication.asp?pub_ID=2861.. In: 2013
26. Peduzzi P, Concato J, Kemper E, Holford TR, Feinstein AR. A simulation study of the number of events per variable in logistic regression analysis. *J Clin Epidemiol*. 1996;49(12):1373–1379. [PubMed: 8970487]

27. SAS Institute Inc. SAS/STAT® 9.2 User's Guide: The GLIMMIX Procedure. 2009; <https://support.sas.com/documentation/cdl/en/statuglmmix/61788/PDF/default/statuglmmix.pdf>. Accessed Sept. 1, 2016.
28. Coley KC, Williams BA, DaPos SV, Chen C, Smith RB. Retrospective evaluation of unanticipated admissions and readmissions after same day surgery and associated costs. *Journal of clinical anesthesia*. 2002;14(5):349–353. [PubMed: 12208439]
29. Mull HJ, Itani KMF, Charns MP, et al. The Nature and Severity of Adverse Events in Select Outpatient Surgical Procedures in the Veterans Health Administration. *Qual Manag Health Care*. 2018;27(3):136–144. [PubMed: 29944625]
30. Neuman MD, David G, Silber JH, Schwartz JS, Fleisher LA. Changing access to emergency care for patients undergoing outpatient procedures at ambulatory surgery centers: evidence from Florida. *Med Care Res Rev*. 2011;68(2):247–258. [PubMed: 20675344]
31. Department of Veterans Affairs. VA MISSION Act and New Veterans Community Care Program Fact Sheet. 618, 2018; https://www.va.gov/COMMUNITYCARE/docs/pubfiles/factsheets/FactSheet_20-13.pdf. Accessed April 24, 2019.
32. Owens PL, Mutter R, Stocks C. Mental Health and Substance Abuse-Related Emergency Department Visits among Adults, 2007: Statistical Brief #92. In: *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2006.
33. Doran KM, Raven MC, Rosenheck RA. What drives frequent emergency department use in an integrated health system? National data from the Veterans Health Administration. *Annals of emergency medicine*. 2013;62(2):151–159. [PubMed: 23582617]

Figure 1.

Rate of Postoperative Emergency Department Use within 7 days of Outpatient Surgery by Surgical Specialty Over Time

Note: Data from Oct. 2011 – Dec. 2013 VA outpatient surgeries among CMS and VA dually-enrolled patients age 65 and older.

Table 1.
Rate of Various Types of Postoperative Emergency Department Use within 7 days of Outpatient Surgery by Surgical Specialty

	General Surgery	Urology	Orthopedics	ENT	Podiatry	Total
Total Surgeries	23,113	16,564	15,253	4,526	3,823	63,279
ED use, no admission, within 7 days VA and CMS	1,091 (4.72%)	917 (5.54%)	450 (2.95%)	228 (5.04%)	92 (2.41%)	2,778 (4.39%)
ED use within 7 days - VA only	882 (3.82%)	673 (4.06%)	374 (2.45%)	173 (3.82%)	72 (1.88%)	2,174 (3.44%)
ED use within 7 days - CMS only	209 (0.9%)	244 (1.47%)	76 (0.5%)	55 (1.22%)	20 (0.52%)	604 (0.95%)
ED use and admission within 7 Days	175 (0.76%)	152 (0.92%)	51 (0.33%)	25 (0.55%)	23 (0.6%)	426 (0.67%)

Note: Data from Oct. 2011 – Dec. 2013 VA outpatient surgeries among CMS and VA dually-enrolled patients age 65 and older.

Table 2.

Top 20 Clinical Classification Software Diagnostic Categories for Emergency Department Use within 7 days of Outpatient Surgery by Surgical Specialty

Clinical Classification Code	General Surgery	Urology	Orthopedics	ENT	Podiatry	Total
Total ED Visits	1,091	917	450	228	92	2,778
Genitourinary symptoms and ill-defined conditions; CPT 51702 for inserting temporary bladder catheter	143 (13%)	262 (29%)	23 (5%)	25 (11%)	3 (3%)	456 (16%)
Complications of surgical procedures/medical care	87 (8%)	20 (2%)	20 (4%)	12 (5%)	6 (7%)	171 (6%)
CPTs: 99281-4 for emergency room care	57 (5%)	76 (8%)	14 (3%)	19 (8%)	5 (5%)	145 (5%)
Other non-traumatic joint disorders	14 (1%)	11 (1%)	44 (10%)	2 (1%)	10 (11%)	117 (4%)
Other gastrointestinal disorders	74 (7%)	23 (3%)	13 (3%)	7 (3%)		112 (4%)
Administrative/social admission	38 (3%)	43 (5%)	21 (5%)	7 (3%)	3 (3%)	96 (3%)
Other aftercare	42 (4%)	14 (2%)	27 (6%)	10 (4%)	3 (3%)	91 (3%)
Abdominal hernia	88 (8%)	1 (0%)	1 (0%)	1 (0%)		84 (3%)
Abdominal pain	61 (6%)	20 (2%)	2 (0%)	1 (0%)		81 (3%)
Residual codes; unclassified	28 (3%)	19 (2%)	21 (5%)	10 (4%)	3 (3%)	81 (3%)
Hyperplasia of prostate	30 (3%)	35 (4%)	8 (2%)	5 (2%)		78 (3%)
Urinary tract infections	15 (1%)	44 (5%)	2 (0%)	4 (2%)		65 (2%)
Other nervous system disorders	15 (1%)	4 (0%)	33 (7%)	6 (3%)	3 (3%)	61 (2%)
Other connective tissue disease	13 (1%)	4 (0%)	33 (7%)	1 (0%)	4 (4%)	55 (2%)
Other male genital disorders	21 (2%)	31 (3%)	1 (0%)			53 (2%)
Complication of device; implant or graft	7 (1%)	37 (4%)	3 (1%)	3 (1%)		50 (2%)
Skin and subcutaneous tissue infections	21 (2%)	4 (0%)	9 (2%)	4 (2%)	2 (2%)	40 (1%)
Nausea and vomiting	17 (2%)	8 (1%)	8 (2%)	2 (1%)	2 (2%)	37 (1%)
Other diseases of bladder and urethra	2 (0%)	33 (4%)	1 (0%)			36 (1%)
Other lower respiratory disease	12 (1%)	7 (1%)	5 (1%)	9 (4%)	1 (1%)	34 (1%)
Total in Top 20 (% of All ED Visits)	785 (72%)	696 (76%)	289 (64%)	128 (56%)	45 (49%)	1,943 (70%)

Note: Data from Oct. 2011 – Dec. 2013 VA outpatient surgeries among CMS and VA dually-enrolled patients age 65 and older.

Table 3. Patient, Procedure and Facility Characteristics Associated with Emergency Department Use within 7 days of VA Outpatient Surgery

Factors	General Surg OR (95% CI)	Urology OR (95% CI)	Orthopedics OR (95% CI)	ENT OR (95% CI)	Podiatry OR (95% CI)
Patient Demographics					
Single/Widowed/Divorced (ref)					
Married	1.02 (0.9-1.15)	0.92 (0.8-1.05)	0.86 (0.71-1.04)		
White race (ref)					
Minority race	1 (0.83-1.21)	1.18 (0.97-1.43)	1.38 (1.05-1.81)		
Age 65-66 years (ref)					
67-68 years	1.08 (0.87-1.33)	0.94 (0.72-1.23)	0.88 (0.66-1.17)	0.92 (0.6-1.42)	1.08 (0.61-1.91)
69-72 years	1.19 (0.97-1.47)	1.07 (0.83-1.38)	0.93 (0.7-1.24)	1.33 (0.89-1.99)	0.69 (0.35-1.34)
73-79 years	1.3 (1.06-1.6)	1.22 (0.96-1.55)	1.06 (0.78-1.43)	1.08 (0.69-1.67)	1.52 (0.84-2.74)
80-100 years	1.47 (1.19-1.81)	1.47 (1.16-1.85)	1.4 (1.02-1.92)	1.41 (0.92-2.17)	0.93 (0.41-2.1)
Distance from Nearest VAMC:					
0.6 - 8 miles (ref)					
9-19 miles	0.78 (0.65-0.94)	0.83 (0.68-1.01)	0.87 (0.65-1.16)	0.88 (0.59-1.32)	0.39 (0.19-0.79)
20-35 miles	0.8 (0.67-0.96)	0.78 (0.63-0.96)	1.06 (0.81-1.4)	0.83 (0.56-1.25)	0.94 (0.54-1.65)
36-59 miles	0.66 (0.55-0.8)	0.74 (0.6-0.92)	0.71 (0.52-0.97)	0.76 (0.5-1.17)	0.68 (0.37-1.26)
>60 miles	0.55 (0.45-0.68)	0.83 (0.67-1.03)	0.57 (0.41-0.79)	0.76 (0.49-1.17)	0.55 (0.28-1.07)
Patient Comorbidities					
Comorbidity Score 5 (ref)					
Comorbidity Score >5					0.58 (0.32-1.03)
Alcohol abuse	0.85 (0.65-1.13)	1 (0.73-1.37)	0.91 (0.6-1.37)		
Deficiency Anemias	0.99 (0.82-1.2)	0.91 (0.75-1.11)	1.16 (0.86-1.54)		
Rheumatoid arthritis/collagen vas	0.71 (0.46-1.1)	0.75 (0.45-1.22)	1.01 (0.62-1.64)		
Chronic blood loss anemia	0.94 (0.29-3.06)	0.99 (0.4-2.49)			
Congestive heart failure	1.02 (0.8-1.3)	1.09 (0.85-1.39)	1.14 (0.77-1.69)		
Chronic pulmonary disease	1.1 (0.95-1.28)	1 (0.85-1.17)	1.22 (0.98-1.53)		
Coagulopathy	1.28 (0.91-1.81)	1.18 (0.81-1.73)	1.11 (0.62-1.99)		
Depression	0.89 (0.74-1.08)	1.07 (0.88-1.3)	1.17 (0.91-1.5)		

Factors	General Surg OR (95% CI)	Urology OR (95% CI)	Orthopedics OR (95% CI)	ENT OR (95% CI)	Podiatry OR (95% CI)
Diabetes w/o chronic complications	0.93 (0.79-1.09)	1.03 (0.88-1.21)	0.85 (0.67-1.09)		
Diabetes w/ chronic complications	1 (0.79-1.27)	1.12 (0.9-1.4)	0.9 (0.66-1.24)		
Drug abuse	1.74 (1.21-2.5)	0.83 (0.47-1.46)	1.14 (0.63-2.06)	1.8 (0.85-3.83)	0.58 (0.32-1.03)
Hypertension	1.05 (0.91-1.22)	0.96 (0.81-1.14)	0.86 (0.69-1.08)		
Hypothyroidism	1.05 (0.84-1.3)	0.93 (0.73-1.2)	0.96 (0.68-1.36)		
Liver disease	0.86 (0.59-1.27)	1.28 (0.83-1.96)	1.34 (0.78-2.29)		
Lymphoma	0.44 (0.22-0.9)	1.09 (0.59-2.03)	1.33 (0.57-3.1)		
Fluid and electrolyte disorders	1.03 (0.81-1.31)	1.02 (0.8-1.3)	0.91 (0.61-1.36)		
Metastatic cancer	0.63 (0.38-1.04)	1.47 (1.03-2.12)	1.24 (0.49-3.12)	1.58 (0.91-2.75)	
Other neurological disorders	1.05 (0.82-1.34)	0.88 (0.67-1.14)	1.06 (0.73-1.54)		
Obesity	0.86 (0.71-1.04)	0.92 (0.76-1.12)	0.9 (0.7-1.15)		
Paralysis	1.41 (0.82-2.42)	1.07 (0.64-1.79)	0.72 (0.26-1.99)		
Peripheral vascular disease	0.97 (0.79-1.17)	1.04 (0.86-1.26)	0.9 (0.65-1.24)		
Psychoses	1.28 (1.02-1.6)	1.05 (0.81-1.35)	1.1 (0.81-1.49)	1.18 (0.75-1.85)	
Pulmonary circulation disease	0.96 (0.62-1.5)	1.05 (0.68-1.63)	0.8 (0.37-1.74)	0.69 (0.21-2.24)	
Renal failure	0.92 (0.74-1.14)	0.87 (0.71-1.07)	1.55 (1.13-2.12)		
Solid tumor w/out metastasis	0.74 (0.62-0.87)	0.92 (0.79-1.07)	0.91 (0.68-1.2)	0.89 (0.64-1.23)	
Valvular disease	0.99 (0.76-1.28)	1.3 (1-1.7)	0.79 (0.49-1.3)		
Weight loss	0.95 (0.7-1.28)	0.9 (0.62-1.31)	1.18 (0.66-2.12)		
Prior Healthcare Utilization					
0-12 outpatient visits in prior 6 mo (ref)					
13-16 visits	1.11 (0.91-1.35)	0.92 (0.71-1.2)	1.06 (0.75-1.49)	0.62 (0.38-1.01)	
17-22 visits	1.11 (0.92-1.35)	0.9 (0.7-1.14)	1.43 (1.04-1.96)	0.83 (0.54-1.26)	
23-32 visits	1.24 (1.02-1.51)	1 (0.79-1.26)	1.49 (1.08-2.05)	1.01 (0.67-1.52)	
33-263 visits	1.54 (1.24-1.9)	0.97 (0.76-1.25)	1.81 (1.29-2.53)	0.96 (0.63-1.48)	
Procedure Characteristics					
1-3 RVUs (ref)					
4-5 RVUs	1.27 (0.91-1.76)	1.65 (1.31-2.08)	1.28 (0.9-1.84)	0.72 (0.44-1.17)	
6-7 RVUs	1.69 (1.34-2.12)	1.95 (1.49-2.55)	1.33 (0.91-1.95)	1.11 (0.74-1.67)	

Factors	General Surg OR (95% CI)	Urology OR (95% CI)	Orthopedics OR (95% CI)	ENT OR (95% CI)	Podiatry OR (95% CI)
8-9 RVUs	1.86 (1.54-2.26)	1.93 (1.38-2.7)	2.58 (1.76-3.77)	0.78 (0.45-1.35)	
10-24 RVUs	1.65 (1.33-2.05)	2.17 (1.69-2.78)	2.48 (1.73-3.55)	0.96 (0.63-1.47)	
ASA 1 or 2 (ref)					
ASA 3-5	1.18 (1.02-1.37)	1.14 (0.95-1.36)	1.06 (0.85-1.33)		
Observation Stay after Surgery	1.21 (1.02-1.45)	1.22 (1.03-1.43)	1.07 (0.74-1.56)	1.14 (0.83-1.58)	
Facility Characteristics					
Hospital Outpatient Dept (ref)					
Ambulatory Surgery Center	0.8 (0.61-1.06)	0.61 (0.41-0.91)	0.86 (0.58-1.26)	0.64 (0.28-1.48)	0.57 (0.26-1.26)
Model Characteristics					
# of Surgeries	23,113	16,564	15,253	4,526	3,823
# of ED visits	1,091	917	450	228	92
Intercept	-3.6 (0.15)	-3.36 (0.18)	-4.05 (0.25)	-2.76 (0.29)	-3.23 (0.27)
C-statistic	0.635	0.62	0.672	0.602	0.633

Note: Data from Oct. 2011 – Dec. 2013 VA outpatient surgeries among CMS and VA dually-enrolled patients age 65 and older. Blank cells were not included in the surgery specific models due to small sample sizes.

Bolded cells indicate significance at alpha=0.05. OR=odds ratio, CI=confidence interval, ASA=Anesthesia Risk Assessment, RVU=relative value unit