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Differences in Colonoscopy Quality Among Facilities: Development of a Post-Colonoscopy Risk-Standardized Rate of Unplanned Hospital Visits

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BACKGROUND & AIMS: Colonoscopy is a common procedure, yet little is known about variations in colonoscopy quality among outpatient facilities. We developed an outcome measure to profile outpatient facilities by estimating risk-standardized rates of unplanned hospital visits within 7 days of colonoscopy. **METHODS:** We used a 20% sample of 2010 Medicare outpatient colonoscopy claims (331,880 colonoscopies performed at 8140 facilities) from patients ≥65 years or older, and developed a patient-level logistic regression model to estimate the risk of unplanned hospital visits (ie, emergency department visits, observation stays, and inpatient admissions) within 7 days of colonoscopy. We then used the patient-level risk model variables and hierarchical logistic regression to estimate facility rates of risk-standardized unplanned hospital visits using data from the Healthcare Cost and Utilization Project (325,811 colonoscopies at 992 facilities), from 4 states containing 100% of colonoscopies per facility. **RESULTS:** Outpatient colonoscopies were followed by 5412 unplanned hospital visits within 7 days (16.3/1000 colonoscopies). Hemorrhage, abdominal pain, and perforation were the most common causes of unplanned hospital visits. Fifteen variables were independently associated with unplanned hospital visits (c = 0.67). A history of fluid and electrolyte imbalance (odds ratio [OR] = 1.43; 95% confidence interval [CI]: 1.29−1.58), psychiatric disorders (OR = 1.34; 95% CI: 1.22−1.46), and, in the absence of prior arrhythmia, increasing age past 65 years (aged >85 years vs 65−69 years: OR = 1.87; 95% CI: 1.54−2.28) were most strongly associated. The facility risk-standardized unplanned hospital visits calculated using Healthcare Cost and Utilization Project data showed significant variation (median 12.3/1000; 5th−95th percentile, 10.5−14.6/1000). Median risk-standardized unplanned hospital visits were comparable between ambulatory surgery centers and hospital outpatient departments (each was 10.2/1000), and ranged from 16.1/1000 in the Northeast to 17.2/1000 in the Midwest. **CONCLUSIONS:** We calculated a risk-adjusted measure of outpatient colonoscopy quality, which shows important variation in quality among outpatient facilities. This measure can make transparent the extent to which patients require follow-up hospital care, help inform patient choices, and assist in quality-improvement efforts.

Keywords: Health Policy; Outcomes; Endoscopy; Admission.

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Colonoscopy is a common and costly outpatient procedure, with >90% of colonoscopies performed in the outpatient settings of hospital outpatient departments (HOPDs), ambulatory surgery centers (ASCs), and physician offices.[1,2] Although colonoscopy is used for the diagnosis and treatment of a wide range of conditions, most outpatient colonoscopies are for colorectal cancer screening among relatively healthy patients. The US Preventative Services Task Force recommends colorectal cancer screening every 10 years for the general population aged 50−75 years, and more frequently for individuals at higher risk.[3] Although many modalities are available for colorectal cancer screening, colonoscopy is the most widely used[4] and is recommended by some professional organizations as the optimal screening method because of the ability to visualize the bowel and the capacity to remove precancerous lesions (polyps) detected on examination.[5] All positive screening tests, no matter what the initial screening modality is, result in a colonoscopy. Given the widespread use of colonoscopy

Abbreviations used in this paper: **ASC, ambulatory surgery center; CI, confidence interval; CMS, Centers for Medicare and Medicaid Services; FFS, fee-for-service; HCUP, Healthcare Cost and Utilization Project; HOPD, hospital outpatient department; OR, odds ratio; RSHVR, risk-standardized hospital visit rate.**

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in the outpatient setting, often among patients without known illness, measuring and minimizing procedure-related adverse events is a high priority.

Colonoscopies are associated with a range of well-described adverse events that lead to hospital visits, repeat procedures, or injuries requiring surgical intervention. The most severe adverse events reported after colonoscopies are colonic perforation; gastrointestinal bleeding; and anesthesia-related cardiopulmonary events, such as hypoxia, aspiration pneumonia, and cardiac arrhythmias.[6–8] In addition, 20%–34% of patients report a range of less severe adverse events after colonoscopy, such as abdominal pain, abdominal distension, nausea, and vomiting.[9,10] Clinicians performing colonoscopies underestimate these clinical outcomes,[11] in part because they may not be aware when their patients seek follow-up care from other providers in settings such as hospital emergency departments. Hospital visits are generally unexpected after outpatient colonoscopy, yet hospital visit rates after outpatient colonoscopy range from 0.8% to 3.8%,[6,10–12] based on the outcomes measured (eg, admissions alone, admissions and emergency department visits, or hospital visits for specific complications) and timeframe for measurement after colonoscopy (ie, 7, 14, or 30 days post procedure).

Currently, there are no publicly available quality reports of providers or facilities that conduct outpatient colonoscopies. As part of a wider initiative by the Centers for Medicare and Medicaid Services (CMS) to develop outpatient quality measures, we developed an outcomes measure that profiles outpatient facility quality by examining rates of unplanned hospital visits in the 7 days after colonoscopy among Medicare fee-for-service (FFS) beneficiaries to inform patient choice and advance colonoscopy quality-assessment and improvement efforts. In this article, we present the development, validation, and results of this quality measure.

Methods

Measure Overview

To develop the measure, we defined a clinically similar cohort of patients undergoing outpatient colonoscopy, defined the outcome to capture unplanned hospital visits, and identified risk variables that mediated the risk of hospital use and were unrelated to quality. We then developed and validated a patient-level risk-adjustment model. Lastly, we estimated a facility-level risk-standardized hospital visit rate (RSHVR) and examined variation in the RSHVR among facilities. A technical expert panel consisting of a range of stakeholders (ie, clinicians, researchers, patients, and providers) advised on clinical, methodologic, and policy issues encountered during measure development. In addition, we posted preliminary measure specifications on the CMS website for public comment and reached out to stakeholders to actively solicit their input. This process ensured that we identified potential issues and allowed us to incorporate public feedback into measure development.

Colonoscopy Cohort and Outcomes

Data sources. For development and validation of the patient-level risk-adjustment model, we used a 20% sample of Medicare data. We identified outpatient colonoscopies using Medicare FFS beneficiaries' claims from the Carrier Standard Analytical File consisting of physician claims from ASCs, HOPDs, and physician office settings. We identified the outcomes of emergency department visits and observation stays after colonoscopy from the Hospital Outpatient Standard Analytical File and inpatient hospital admissions from the Medicare Provider Analysis and Review file.

The Medicare data contained patients aged ≥65 years undergoing colonoscopy. Because the post-colonoscopy hospital visit rate is relatively low, the 20% sample is insufficient for a reliable estimate of the facility-level outcomes rate. Therefore, we used Agency for Healthcare Research and Quality Healthcare Cost and Utilization Project (HCUP) data from 4 states (New York, California, Florida, and Nebraska) for which unique patient identifiers were available to link the procedure and the outcome to estimate facility-specific RSHVRs. HCUP data from each state contain 3 datasets. We identified outpatient colonoscopies from the State Ambulatory Surgery Database (SASD), which captured all (100%) colonoscopies per facility within the state. We identify the outcomes of emergency department visits and hospital admissions from the State Emergency Department Databases (SEDD) and the State Inpatient Databases (SID), respectively.[13]

Study cohort. The study population for this measure is Medicare FFS patients aged ≥65 years undergoing outpatient colonoscopy at HOPDs, ASCs, and physician office settings.

Inclusion criteria. We included common non–high-risk outpatient diagnostic and therapeutic colonoscopy procedures (current procedural terminology (CPT) codes G0121, G0105, 45378, 45380, 45385, 45384, 45383, and 45381; see Appendix A: Table A1 for specific code definitions; available in the Supplementary Material), with or without biopsy, lesion ablation, and/or polypectomy. We did not include these procedures when codes for high-risk colonoscopy procedures (see Appendix A: Table A2; available in the Supplementary Material) accompanied these codes. In addition, we included only patients with continuous enrollment in Medicare FFS Parts A and B in the 12 months before the procedure in order to have all claims available for identifying comorbidities for risk adjustment.

Exclusion criteria. We excluded high-risk patient groups undergoing colonoscopy for which we could not adequately risk adjust for their baseline (pre-colonoscopy) risk. Specifically, we excluded colonoscopies that occur concurrently with high-risk upper gastrointestinal endoscopies, such as for control of bleeding; and colonoscopies for patients with a history of inflammatory bowel disease or diverticulitis in the year preceding the colonoscopy (specific codes listed in Appendix A: Tables A3, A4, and A5; available in the Supplementary Material). To ensure all patients had full data available for outcomes assessment, we also excluded colonoscopies for patients who lacked continuous enrollment in Medicare FFS Parts A and B in the 1 month after the procedure.

Outcome. We defined the outcome as any all-cause unplanned hospital visit (emergency department visit, observation stay, or unplanned inpatient admission) within 7 days of an outpatient colonoscopy (see Appendix B for specific codes to define emergency department visits and observation stays; available in the Supplementary Material). This is a broad outcome that captures the full range of adverse events related to preparing for, undergoing, and recovering from the colonoscopy. We limited the outcome to 7 days, as most adverse events after