patients over the age of 18 presenting to the emergency department of a safety-net hospital within two weeks of any outpatient endoscopic procedure between July 1, 2013 and December 31, 2014. Controls were matched to cases by age, sex, procedure type, date, and day of week procedure was performed. Univariable and multivariable analysis were performed to identify predictors of emergency visits after endoscopy.

RESULTS: We identified 143 cases from a total of 6,601 outpatient procedures during the study period. 64 (44.8%) of the visits were attributed to the procedure yielding a visit rate of 0.97%. Compared to controls, cases were more likely to have MediCal (Medicaid) insurance (75.7% vs 59.2%, \( p = 0.003 \)), prior ED visits (2.5 vs 0.5, \( p < 0.001 \)), multiple primary care visits (4.9 vs 3.3, \( p < 0.001 \)), trainee involvement (62.9% vs 44.4%, \( p = 0.002 \)), and speak English (67.1% vs 54.9%, \( p = 0.04 \)). On multivariable analysis of cases with visits attributable to the procedure, antiplatelet/anticoagulant use (OR 2.81, CI 1.07-7.34, \( p = 0.04 \)), MediCal insurance (OR 2.55, CI 1.02-6.40, \( p = 0.05 \)), multiple ED visits per year (OR 3.31, CI 2.22-4.94, \( p < 0.001 \)), number of endoscopic interventions (OR 1.22, CI 1.06-1.40, \( p = 0.006 \)), and trainee involvement (OR 2.55, CI 1.09-5.97, \( p = 0.03 \)) were all risk factors for post-procedure visits.

CONCLUSION: In a safety-net system, medically complex patients, greater number of endoscopic interventions, and lower socioeconomic status may influence emergency department utilization after endoscopy. This information may inform future quality improvement efforts.

Key words: Adverse Events; Quality Improvement; Endoscopy; Acute Care Visits; Safety Net; Patient Safety

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colonoscopies, 6.1 million upper endoscopies (EGD), 313,000 flexible sigmoidoscopies, 178,400 upper endoscopic ultrasound (EUS) examinations, and 169,500 endoscopic retrograde cholangiopancreatography (ERCP) procedures were performed across the U.S., with a total cost close to $135.9 billion\textsuperscript{11}. These numbers underscore the overall burden of gastrointestinal disease in the United States and the incredible volume of endoscopic procedures that are being performed.

Given the widespread use of gastrointestinal endoscopic procedures, the safety, immediate adverse events during endoscopy, and the use of acute care services related to the procedure, are of paramount concern. Adverse events relating to EGD and colonoscopy are low (0.13%-0.5%)\textsuperscript{11}, reflecting the overall safety of these procedures; at the same time, endoscopic biliary procedures, such as ERCP, have a much higher rate of adverse events (1.6%-15.7%)\textsuperscript{12}; however, mortality remains low (0.2%-0.5%). Most of these adverse events are immediate and anesthesia-related, yet there is a paucity of data on delayed adverse events which may cause patients to seek emergency care in the days after a procedure.

Assessing for delayed adverse events following outpatient gastrointestinal procedures is challenging due to the large number of procedures performed and lack of follow-up information often available. A number of studies have reported on delayed adverse events following individual endoscopic procedures using various metrics including unplanned hospital presentation\textsuperscript{13-15} or rates of cardiovascular events or GI bleeding following endoscopy\textsuperscript{16}. Yet, no prior studies have included all endoscopic procedures and there are no data regarding outcomes of these procedures in safety-net settings, which reflect a uniquely heterogeneous population and include different patient socioeconomic characteristics that may influence outcomes. Better understanding of this gap in the literature would allow us to better elucidate factors that may relate to patients who return to the ED post procedure and help to develop and steward quality improvement programs.

We assessed all outpatient endoscopic procedures performed at a large safety-net hospital in San Francisco, California over an 18-month period and identified patients who presented to the ED within 14 days of their procedure. Our objectives were to determine the frequency of patients returning to the ED post-endoscopy and to identify patient and procedural characteristics that correlated with an increased likelihood of an ED visit post-endoscopy.

**MATERIALS AND METHODS**

**Ethics, consent and permissions**

This study was approved by the Institutional Review Board (IRB) at the University of California, San Francisco (UCSF IRB number 16-19076). The requirement for individual Research HIPAA Authorization and informed consent was waived for all subjects for the following reasons (1) the research involves no more than minimal risk to the subjects; (2) the waiver will not adversely affect the rights and welfare of the subjects; (3) the research could not practicably be carried out without the waiver; and (4) whenever appropriate, the subjects will be provided with additional pertinent information after participation.

**Study Design and population**

We performed a single-center matched case control study of factors associated with ED visits within 14 days of outpatient endoscopic procedures at the Zuckerberg San Francisco General Hospital (ZSFG). ZSFG is a safety-net institution (i.e. provides a significant level of care to low income, uninsured, and vulnerable patient populations) affiliated with the University of California, San Francisco. Patients are ethnically diverse (20% African American, 20% Asian/Pacific Islander, 25% Caucasian, and 30% Hispanic/Latino), and many are immigrants with more than 20 different languages spoken by patients. Approximately 9% of patients at ZSFG lack insurance, 58% have MediCal (California’s Medicaid program), 22% have Medicare, and 1% report commercial payers or other sources.

**Cases**

All patients over the age of 18 who underwent an outpatient endoscopic procedure at ZSFG between July 1, 2013 and December 31, 2014, and presented to the emergency department within 14 days were included in the study as cases (Figure 1). Endoscopic procedures included in the study were colonoscopy, EGD, flexible sigmoidoscopy (FS), and ERCP. EUS, small bowel enteroscopy, pH BRAVO testing, manometry, and capsule endoscopy were all excluded due to having zero or limited patients who had undergone these procedures and presented to the ED, thus precluding any meaningful comparisons. Patient demographic information, procedure information and data regarding the patient’s visit to the emergency room was abstracted from the electronic medical record. Patients were excluded if the procedure was performed in the inpatient setting or if an immediate complication occurred requiring direct admission to the hospital.

**Controls**

The control group included patients over the age of 18 who underwent an outpatient endoscopic procedure during the study period, but did not present to the emergency room after 14 days. For each case, the respective procedure date in the endoscopy reporting software Provason was searched for a matching control in a 1:1 fashion. Controls were matched to cases by procedure type, date, day of week, age within five years, and sex. After matching was performed, one control was found to have had an inpatient procedure and was subsequently excluded from the analysis.

![Figure 1 Flow diagram demonstrating the selection of cases who presented to the emergency department within two weeks of their procedure.](image)
Data Collection and Abstraction
Two independent reviewers, AT and DS, reviewed the medical records, and findings were confirmed by AMK. Any disagreements were reviewed and adjudicated by LWD. Patient demographics, procedure related factors, and ED related factors, when applicable, were abstracted. Details of the procedure was obtained by reviewing the procedure report. Details of the ED visits were obtained by reviewing the ED note. In order to establish whether or not the ED presentation was related to the procedure, AMK, AT, and DS reviewed the ED note for the patients’ chief complaints, vitals, labs, imaging, diagnosis, and disposition, and came to a final assessment using clinical judgement.

Outcome
The primary outcome examined was the presentation of patients to the ED within 14 days of an endoscopic procedure. The 14-day follow-up period was selected because most endoscopic procedural complications including post-polypectomy bleeding occur within 14 days.

Statistical Analysis
Age, prior ED visits, prior PCP visits, and polyp size were all treated as continuous variables and described with the mean or median and standard deviations (SD). The remaining patient data was described as proportions. Differences between groups of patients were assessed using $\chi^2$ and Student’s $t$-test, as appropriate. To reduce risk of including confounders, univariable comparisons were only made for predictor variables with expected potential clinical relevance. Multivariable logistic analysis reported as odds ratios was performed using variables demonstrating univariable statistical significance or with expected clinical relevance. The statistical methods of this study were reviewed by Justin L Sewell MD, MPH, from Department of Gastroenterology and Hepatology, Zuckerberg San Francisco General Hospital. Stata/SE (version 14; StataCorp LP, College Station, TX, USA) statistical software was used for all analyses.

RESULTS

Patient related factors
Table 1 summarizes the baseline patient demographics of the 143 cases who presented to the ED within 14 days and 142 age-matched controls. The cases had a mean age at time of endoscopic procedure of 53.8 years with 45.5% of procedures performed on women. Our study population was ethnically diverse as shown in the table 1.

|                      | Cases (n = 143) | Controls (n = 142) |
|----------------------|----------------|-------------------|
| Age (years), mean (SD) | 53.8 (12.9)    | 53.9 (12.2)       |
| Female, n (%)         | 65 (45.5)      | 64 (45.1)         |
| Race, n (%)           |                |                   |
| White                | 28 (19.6)      | 17 (12.0)         |
| Black                | 25 (17.5)      | 27 (19.1)         |
| Hispanic             | 47 (32.9)      | 45 (31.6)         |
| Native American       | 9 (6.3)        | 13 (9.2)          |
| Asian                | 30 (21.0)      | 31 (21.8)         |
| Other                | 4 (2.8)        | 9 (6.5)           |
| Specific languages, n (%) |            |                   |
| English              | 96 (66.8)      | 78 (54.9)         |
| Spanish              | 22 (15.7)      | 25 (17.6)         |
| Chinese dialect      | 17 (12.1)      | 27 (19.0)         |
| Other                | 5 (3.6)        | 12 (8.5)          |
| English speaker, n (%) | 96 (67.1)*     | 78 (54.9)         |
| Insurance, n (%)      |                |                   |
| MediCal              | 106 (75.7)*    | 84 (59.2)         |
| Medicare             | 14 (10.0)      | 28 (19.7)         |
| HSF                  | 8 (5.7)        | 22 (15.5)         |
| Other                | 8 (5.7)        | 8 (5.6)           |
| ASA Class, n (%)      |                |                   |
| 1                    | 11 (7.8)       | 14 (9.9)          |
| 2                    | 94 (66.2)      | 107 (75.4)        |
| 3                    | 37 (26.1)      | 21 (14.8)         |
| ED visits year prior, mean (SD) | 2.5 (2.6)* | 4.5 (1.0)         |
| PCP visits year prior, mean (SD) | 4.9 (3.9)* | 3.3 (3.0)         |
| DSM IV diagnosis, n (%) | 33 (23.1)     | 29 (20.4)         |
| DSM IV diagnosis in ED visits attributable to the procedure, n (%) | 11 (7.2) |

*p < 0.05 vs controls. †matched variable. SD: standard deviation; NA: not applicable; ASA: American Society of Anesthesiology Class; ED: emergency department; PCP: Primary care provider; DSM: diagnosis statistical manual.

Procedure related factors
There were several differences observed between both study groups (Table 2). For example, significantly more endoscopic interventions were performed in the cases than in the control group (2.8 vs 2.1, $p = 0.02$). More cases underwent an endoscopic mucosal resection (EMR) as compared to the control group ($p = 0.001$). Lastly, cases were more likely to have had a trainee involved in the endoscopic procedure (62.9% vs. 44.4%, $p = 0.002$).

Emergency room factors
Of the 143 cases, the most common chief complaint after “Other” (54.6%) was abdominal pain (30.1%), followed by GI bleeding including bright red blood per rectum (8.4%) (Table 3). The most common diagnosis documented in the ED discharge for patients was “Other symptoms involving abdomen and pelvis” (18.3%) and hemorrhage of the gastrointestinal tract (4.9%) (See supplementary table 1). The majority of patients were discharged from the ED (60.1%), and it was determined that 64 (44.8%) of admissions from the ED were attributable to the procedure. Among patients presenting to the ED, 51 of those patients presented within 7 days of the procedure and 13 additional patients presented over the following 7 days. The overall ED visit rate was 2.16%, but when examining only patients with ED visits attributable to the procedure then the ED visit rate dramatically decreased to 0.97%.
Table 2: Comparisons of procedure related factors between cases and controls

| Procedure Performed†, n (%) | Cases (N=143) | Controls (N=142) |
|-----------------------------|---------------|------------------|
| Colonoscopy                 | 73 (51.1)     | 73 (51.4)        |
| EGD with Colonoscopy        | 21 (14.7)     | 22 (15.5)        |
| EGD with Sigmoidoscopy      | 1 (0.7)       | 1 (0.7)          |
| Flexible Sigmoidoscopy      | 2 (1.4)       | 2 (1.4)          |
| EGD                         | 28 (19.6)     | 26 (18.3)        |
| ERCP                        | 18 (12.6)     | 18 (12.7)        |
| Indication, n (%)           |               |                  |
| Diagnostic                  | 111 (77.6)    | 108 (76.1)       |
| Screening                   | 3 (2.1)       | 9 (6.3)          |
| Surveillance                | 23 (16.1)     | 23 (16.2)        |
| Diagnostic and surveillance | 5 (3.5)       | 2 (1.4)          |
| Days from procedure to ED visit |           |                  |
| Median (range)              | 5.2 (0.0,15.3) | –              |
| < 7 days, n (%)             | 84 (58.7)     | –                |
| >7 days, n (%)              | 59 (41.3)     | –                |
| Day of the week of procedure† |            |                  |
| Monday                      | 12 (8.4)      | 13 (9.2)         |
| Tuesday                     | 48 (33.6)     | 49 (34.5)        |
| Wednesday                   | 2 (1.4)       | 2 (1.4)          |
| Thursday                    | 22 (15.4)     | 22 (15.5)        |
| Friday                      | 59 (41.3)     | 56 (39.4)        |
| Time of day, n (%)          |               |                  |
| Morning (< 12 pm)           | 103 (72.0)    | 107 (75.9)       |
| Afternoon (12 pm-5 pm)      | 39 (27.3)     | 33 (23.4)        |
| Evening (> 5 pm)            | 1 (0.7)       | 1 (0.7)          |
| Any antiplatelet or anticoagulant use, n (%) | 42 (29.4)* | 24 (16.9)       |
| Antiplatelet or Anticoagulation, n (%) |           |                  |
| None                        | 101 (70.6)    | 118 (83.1)       |
| Aspirin                     | 26 (18.2)     | 28 (19.7)        |
| Clopidogrel                 | 2 (1.4)       | 1 (0.7)          |
| Warfarin                    | 7 (4.9)       | 2 (1.4)          |
| NOAC                        | 2 (1.4)       | 0 (0.0)          |
| Aspirin and Clopidogrel     | 3 (2.1)       | 3 (2.1)          |
| Aspirin and Warfarin        | 2 (1.4)       | 0 (0.0)          |
| Antiplatelet or Anticoagulation held, n (%) |           |                  |
| Yes                         | 29 (17.5)     | 22 (15.5)        |
| No                          | 17 (11.9)*    | 3 (2.1)          |
| NA (none prescribed)        | 101 (70.6)    | 117 (82.4)       |
| Sedation, n (%)             |               |                  |
| Moderate sedation           | 109 (76.7)    | 111 (78.2)       |
| Monitored anesthesia care   | 7 (4.9)       | 7 (4.9)          |
| General anesthesia          | 23 (16.2)     | 20 (14.1)        |
| None                        | 3 (2.1)       | 4 (2.8)          |
| Prep Quality, n (%)         |               |                  |
| Good                        | 81 (56.6)     | 96 (67.6)        |
| Adequate                    | 11 (7.7)      | 8 (4.2)          |
| Poor                        | 5 (3.5)       | 7 (4.9)          |
| Interventions performed, mean (SD) | 2.8 (2.9)* | 2.1 (2.3)       |
| Intervention performed, n (%) | 128 (89.5) | 115 (82.1)      |
| Specific interventions, n (%) |            |                  |
| Cold forceps                | 97 (67.8)     | 89 (62.7)        |
| Cold snare polypectomy      | 9 (6.3)       | 3 (2.1)          |
| Hot snare                   | 21 (14.7)     | 21 (14.8)        |

Risk factors for ED visits post endoscopy

On multivariable analysis (Table 4), the number of ED visits within the previous 12 months (OR 3.96, 95% CI 2.74-5.70) and number of endoscopic interventions (OR 1.17, CI 1.04-1.31) were both risk factors for ED visits post endoscopy. MediCal insurance, ASA classification, antiplatelet/anticoagulant use, and trainee involvement were not predictors of ED visits post endoscopy.

We performed a similar analysis on a subset of the cases whose ED visits were determined to be attributable to the procedure. Again, we observed that the number of ED visits per year (OR 3.31, CI 2.22-4.94, p < 0.001) and number of endoscopic interventions (OR 1.22, CI 1.06-1.40, p = 0.006) were associated with ED visits post endoscopy. Additionally, antiplatelet/anticoagulant use (OR 2.81, CI 1.07-7.34, p = 0.04), MediCal insurance (OR 2.55, CI 1.02-6.40, p = 0.05), and trainee involvement (OR 2.55, CI 1.09-5.97, p = 0.03) were all risk factors for post procedure ED visits that were attributable to the procedure.

DISCUSSION

With the widespread use of endoscopic procedures, understanding the safety of these procedures as well as the use of acute care service post-procedure are of great importance. To further evaluate these issues, we performed a single center matched case control study in order to determine the risk factors for ED visits after outpatient endoscopic procedures at a large integrated safety net hospital in San Francisco. Our overall ED visit rate post procedure was 2.16%, but when considering only ED visits attributable to the procedure the rate was 0.97%, on par with prior studies. Furthermore, we found that patients who had an endoscopy and visited the ED afterwards were more likely to have had more frequent ED and PCP visits in the year prior. At the same time, when attributing the ED visit to the endoscopy itself additional risk factors became evident such as being on an anticoagulant/antiplatelet agent, English speaking, having MediCal insurance, EMR, and having a trainee involved in the procedure. This information adds to the sparse literature on this topic and can help to refine quality metrics relating to this issue as well as assist in developing performance improvement projects aimed at addressing this topic.

Some of our study findings are expected and others unexpected. First, antiplatelet/anticoagulant use as well as frequent ED and PCP visits are surrogates for increased patient complexity and burden of comorbid medical conditions, and thus unsurprisingly
**Table 3** Characterization of emergency department (ED) presenting symptoms and other ED related factors. (Cases only, n=143).

| ED Chief complain, n (%) |          |          |
|--------------------------|----------|----------|
| Abdominal pain           | 43 (30.1)|          |
| BRBPR                    | 12 (8.4) |          |
| Melena                   | 0 (0.0)  |          |
| Nausea and vomiting      | 6 (4.2)  |          |
| Melena, Nausea, and vomiting| 1 (0.7) |          |
| Abdominal pain, nausea, vomiting | 1 (0.7) |          |
| Abdominal pain and melena| 1 (0.7)  |          |
| Other                    | 78 (54.6)|          |

**Table 4** Multivariable analyses of factors associated with post procedure ED visits.

|                                     | All cases compared with controls | Cases attributable to endoscopy compared with controls |
|-------------------------------------|---------------------------------|------------------------------------------------------|
|                                     | OR (95% CI)                      | OR (95% CI)                                          |
| ASA class                           | 0.96 (0.51-1.70)                 | 0.46 (0.21-1.02)                                     |
| Antiplatelet or anticoagulant drug use| 1.76 (0.84-3.69)                 | 2.81 (1.07-7.34)*                                   |
| MediCal insurance                   | 1.93 (0.97-3.83)                 | 2.55 (1.02-6.40)*                                   |
| Number of ED visits per year        | 3.96 (2.74-5.70)*                | 3.31 (2.22-4.94)*                                   |
| Number of endoscopic interventions performed | 1.17 (1.04-1.31)*               | 1.22 (1.06-1.40)*                                   |
| Trainee involved                    | 1.37 (0.72-2.60)                 | 2.55 (1.09-5.97)*                                   |

*P < 0.05 vs controls. ED: Emergency department.

**Supplemental Table 1** Most common post procedure ICD 9 (from endoscopy reports).

| ED Cohort | ICD 9 (n, %) | Description                             | Controls | ICD 9 (n, %) | Description |
|-----------|--------------|-----------------------------------------|----------|--------------|-------------|
| 211.3 (54, 24.1%) | Benign neoplasm of colon | 211.3 (39, 27.46%) | Benign neoplasm of colon |
| 535.5 (17.8%) | Gastrroduodenitis | 535.5 (11, 7.8%) | Gastrroduodenitis |
| 211.4 (6, 4.2%) | Benign neoplasm of rectum | 455 (9, 6.3%) | Hemorrhoids |
| 574.5 (6, 4.2%) | Calculus of the bile duct | 569 (6, 4.2%) | Other disorder of intestine |
| 239 (3, 3.5%) | Neoplasm of unspecified nature | 537.9 (5, 3.5%) | Unspecified disorder of stomach and duodenum |
| 455 (5, 5.3%) | Hemorrhoids | 455 (4, 2.8%) | Hemorrhoidal skin tags |
| 557.9 (5, 3.5%) | Unspecified disorder of stomach and duodenum | 574.5 (4, 2.8%) | Calculus of the bile duct |
| 569 (5, 3.5%) | Other disorder of intestine | 751.69 (4, 2.8%) | Other anomalies of gallbladder, bile ducts, and liver |
| 456.1 (3, 2.1%) | Esophageal varices without bleeding | 211.4 (3, 2.1%) | Benign neoplasm of rectum |
| 558.9 (3, 2.1%) | Unspecified noninfecious gastroenteritis and colitis | 530.89 (2, 1.4%) | Other unspecified disease of esophagus |

**ED visit diagnosis ICD 9 (from ED report)**

| ICD 9 (n, %) | Description                             |
|--------------|-----------------------------------------|
| 789 (26, 18.3%) | Other symptom involving abdomen and pelvis |
| 578.9 (7, 4.9%) | Hemorrhage of gastrointestinal tract unspecified |
| 786.5 (5, 3.5%) | Chest pain |
| 578.1 (4, 2.8%) | Blood in stool |
| 998.11 (4, 2.8%) | Hemorrhage and hematoma of spleen |
| 784 (3, 2.1%) | Symptoms involving head and neck |
| 280 (2, 1.4%) | Iron deficiency anemia unspecified |
| 401.9 (2, 1.4%) | Unspecified essential hypertension |
| 411.1 (2, 1.4%) | Intermediate coronary syndrome |
| 553.1 (2, 1.4%) | Umbilical hernia without obstruction or gangrene |
endoscopy follow-up communication tools. Though some ED visits are unavoidable, most (60.1%) of patients presenting to the ED in our study were discharged home. Thus, this represents an opportunity for prevention of unnecessary ED visits in the form of improved communication with patients detailing return precautions, and improved access for patients to their providers on any new symptoms that arise after their procedures via phone calls or clinic visits.

An interesting study finding was that trainee involvement was associated with post procedure ED visits after endoscopy. A number of studies have not shown trainee involvement in procedural specialties to be associated with acute care visits or increased adverse events[20,18,19], but others have found the opposite[20, 21], thus this remains an unanswered question. Possible explanations for our findings might include that fellow participation could have increased procedure time which may result in increased administration of sedation, use of air insufflation, and potentially suboptimal technique which could increase post endoscopy abdominal pain. This finding may also represent a difference in pre-procedure communication between attendings and trainees possibly not fully detailing or knowing how to communicate what patients should expect post endoscopy. These findings merit further investigation and such information could be helpful in developing educational curricula for gastroenterology fellowship programs.

Another interesting finding is that there were more English speakers who were cases than controls. In the context of gastrointestinal endoscopy, existing data is sparse on differences between English and non-English speakers in seeking acute care after endoscopy. Prior studies have suggested either no difference or increased ED visits in non-English speakers and limited English proficiency patients[22,23]. To the best of our knowledge, English speakers have not previously been shown to have increased risk of ED visits as compared to non-English speakers in a primarily English speaking system. Perhaps this finding reflects a selection bias. Alternatively, English speakers may have an easier time navigating and utilizing the safety-net healthcare system of San Francisco and thus more likely to present to the ED for care.

This is the first study of its kind taking place at a safety-net hospital and also including all outpatient procedures performed by gastroenterologists. The vulnerable, underserved, uninsured patients of San Francisco represent a unique population from that of a tertiary care academic medical center population that has been represented in several previous studies. Being the safety net hospital for the city and county of San Francisco and being part of a dedicated integrated health plan, our patients are less likely to seek emergency care outside the ZSFG emergency room, increasing the reliability of our data. Our study evaluated all outpatient procedures performed in the endoscopy unit to determine if there are common characteristics that may be targets for quality improvement work. Unlike prior studies, all patient charts were reviewed manually to determine relatability of the procedure to the ED visit thereby increasing the accuracy of the data. Furthermore, we employed a much more robust time period for presenting to the ED (i.e. using a 14-day capture period as compared to 7 days as has been used in most studies) in order to capture delayed complications. All of these strengths of our study help to reinforce and validate our results.

There are a number of limitations to this study. First, the study is retrospective and there is the risk of selection bias and confounding for which we may not have been able to account. Second, though unlikely, given the structure of our safety net health system, it remains possible that some patients may have sought emergency care elsewhere and as a result we could have missed these patients in our analysis. Third, controls were matched 1:1 with case which may have limited the overall power of the study. Fourth, although 10 cases underwent EMR, there were no controls who underwent EMR, again raising the possibility of selection bias. Lastly, the study occurred within a safety-net setting and may not be generalizable to other healthcare environments.

In summary, our study determined that the overall ED visit rate 14 days post procedure was 2.16% but when considering only ED visits attributable to the procedure the rate decreased to 0.97%. We highlight that a number of risk factors are associated with increasing ED visits post endoscopy and include prior ED visits, increasing number of endoscopic interventions especially EMR, MediCal insurance, antplatelet/anticoagulant use, and trainee involvement.

Our findings indicate that more medically complex patients and lower socioeconomic status predict ED visits after endoscopy and that this group of patients can be targeted for quality improvement efforts such as focusing on improved communication efforts and improved access to advice post procedure.

ACKNOWLEDGEMENTS

Author contributions: Abdul Kouanda: chart review, interpretation of data, drafting of manuscript; Adam Tabbaa: chart review, interpretation of data, drafting of manuscript; Justin Sewell: statistical analysis, editing of manuscript; Daniel Selvig: chart review; Lukejohn Day: study concept and design, interpretation of data, critical review of manuscript.

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