Gastro Hep Advances 2024;3:510–518

ORIGINAL RESEARCH—CLINICAL

# A 5-Year Statewide Analysis of Unplanned Hospital Visits for EGD, Colonoscopy, Combined EGD/Colonoscopy, and ERCP

Vorada Sakulsaengprapha,[1] Jonathan P. Masterson IV,[2] Samara B. Rifkin,[3] and Simon C. Mathews[4]

[1]Department of Medicine, The Johns Hopkins University School of Medicine, Baltimore, Maryland; [2]Stanford Health Care, Menlo Park, California; [3]Division of Gastroenterology and Hepatology, Department of Medicine, University of Michigan School of Medicine, Ann Arbor, Michigan; and [4]Division of Gastroenterology and Hepatology, Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland

**BACKGROUND AND AIMS:** Conventional complication rates for gastrointestinal endoscopic procedures may underestimate the broader risk represented by postprocedure unplanned hospital visits (UHVs). We aimed to characterize UHVs for procedures in Maryland and the District of Columbia from 2014 to 2018. **METHODS:** Data for all esophagogastroduodenoscopies (EGDs), colonoscopies, combined EGDs/colonoscopies, and endoscopic retrograde cholangiopancreatographies (ERCPs) performed between 2014 and 2018 was provided by the Maryland Health Information Exchange (Chesapeake Regional Information System for our Patients'). Patient demographics, timing of UHV within 14 days postprocedure, distance traveled, facility site ("home" vs "away" institution), and International Classification of Diseases codes for the UHV were analyzed. Only UHVs potentially attributable to the endoscopic procedures were included. **RESULTS:** Among 304,786 endoscopic procedures and 3904 unplanned visits, the 14-day UHV rates were 1.7%, 0.6%, 1.3%, and 5.2% for EGD, colonoscopy, combined EGD/colonoscopy, and ERCP procedures respectively. From 2014 to 2018, the UHV rate on an annual basis remained stable for all procedure types except for ERCPs which increased. Patients who experienced UHVs were statistically different in sex, race, age, and distance traveled. UHVs most often occurred on postprocedure day 1; emergency department visits occurred most commonly. UHVs for all procedures, except ERCPs, were more likely to occur at a "home" institution. Overall, patients were more likely to be admitted postprocedure at an "away" institution. **CONCLUSION:** Postendoscopic procedure UHV rates were generally low. However, UHV rates for EGDs and colonoscopies were significantly higher than conventional complication rates. As 30%–60% of all unplanned visits occurred at an "away" institution, endoscopists should consider a broad approach to detecting postprocedure complications and not rely on a single institution for data capture.

*Keywords:* Unplanned Hospital Visit; Complication Rates; Endoscopy; Maryland

## Introduction

Endoscopic procedures, including esophagogastroduodenoscopy (EGD), colonoscopy, and endoscopic retrograde cholangiopancreatography (ERCP) are commonly performed in the United States with a total of 75 million gastrointestinal endoscopic procedures completed in 2017 alone.[1] As in most procedures, complication risks are routinely discussed during the informed consent process. Endoscopic risks vary by procedure type and are usually specified, such as bleeding, perforation, and infection. The most recent endoscopic adverse event guidelines indicate that aggregated EGD complication rates range from 0.09 to 5.9 in 100022[2]; colonoscopy rates from 0.4 to 0.8 in 1000,[3] and ERCP rates 0.8–100 in 1000.[4] While this data on serious complications is informative, it does not provide context for how often patients seek emergency care after these endoscopic procedures or reflect the larger impact on the healthcare system. This broader characterization of procedure risk is represented by unplanned hospital visits (UHVs) - unanticipated emergency department visits or hospital admissions postprocedure.

Prior research on unplanned visits for common endoscopic procedures has many limitations that hinder its broader use in the discussion of overall risk. A primary limitation is that analysis has often been restricted to a single procedure.[5–9] This makes comparing relative risk of different procedures challenging since other studies with different methodologies and endpoints must be used for comparison. A second limitation is that studies were often conducted at a single center.[8–12] There is greater potential for bias in these cases due to specific clinician, process, or workflow factors unique to that institution or individual in some cases. Volume was also generally lower at single-centers. These 2 considerations limit the generalizability of results from these studies. A third limitation of prior studies was the short time period examined. Prior studies

***Abbreviations used in this paper:*** **ED, emergency department; EGD, esophagogastroduodenoscopy; ERCP, endoscopic retrograde cholangiopancreatography; IP, inpatient; UHV, unplanned hospital visit.**

Most current article



2772-5723
https://doi.org/10.1016/j.gastha.2024.01.017

were often restricted to a 1 or 2 year time range,[10,11] which does not permit adequate assessment for trends.

We sought to address these major limitations and others by conducting a comprehensive analysis of unplanned visits for the most common endoscopic procedures (EGD, colonoscopy, ERCP, and combined EGD/colonoscopy) using data from the state of Maryland health information exchange (HIE). This source included data from all hospitals and endoscopy centers in the state over a 5-year period. Our objectives were to determine the rate of UHV rate by procedure type and its variation over a 5-year period; to assess the temporal distribution of unplanned visits within 14 days of the procedure; to identify which subtypes of unplanned visits were most common; to compare the characteristics of patients with unplanned visits to those without; to identify the most common reasons for unplanned visits; and to determine how often patients returned to their original ("home") or a different ("away") location for an unplanned visit. Of note, data on combined EGD/colonoscopy procedures, temporal distribution of unplanned visits, and "home" vs "away" dispositions have not been previously described. In presenting this analysis, we aim to provide the most comprehensive, up to date, and pragmatic perspective on the overall safety of these common procedures.

# Methods

## Data Source

Deidentified data for all colonoscopies, EGDs, and ERCPs for 2014–2018 was provided from the Chesapeake Regional Information System for our Patients' Maryland HIE upon passing its organizational research and quality review. The list of CPT codes included for each procedure type is provided in Supplemental Materials. Chesapeake Regional Information System for our Patients' contains regulatory data from the Maryland Health Services Cost Review Commission which includes all outpatient and ED visits in regulated space and data from all 47 hospitals in the state.[13] On an annual basis, this includes approximately 700,000 inpatient discharges and 5.7 million outpatient visits.[13] The data included information on all adult patients undergoing colonoscopies and EGD separately as well as those undergoing both during the same visit and ERCPs. The unit of measurement is individual patients. Only unplanned visits that occurred within 14 days of the procedure(s) were included in this study.

## Primary Outcome and Other Variables

Procedures were divided into cases with unplanned visits and controls without. Unplanned visits were further categorized into 4 groups: emergency department to home, observation greater than 24 hours, emergency department to inpatient, and direct to inpatient. Additional data collected included basic patient demographics (eg, sex, age, ethnicity), day of unplanned hospital visit in relation to procedure day up to 14 days, distance traveled to procedure site from home address, primary diagnosis during unplanned visit, and whether the unplanned visit site was the same as the procedural site ("home" vs "away").

## Unplanned Visit Attribution

The ninth and tenth International Statistical Classification of Diseases and Related Health Problems (ICD-9, ICD-10) diagnosis codes relevant to postprocedure signs and symptoms were determined by a panel of 2 gastroenterologists and used to determine whether an unplanned visit was attributable to the preceding GI procedure consistent with prior studies (Supplemental Materials). Both ICD versions were used across the years studied, and therefore included in our analysis. In doing so, prior papers with case reviews as well as those which identified diagnosis codes were referenced. Because there was no accepted standard in using diagnosis codes in the literature, we incorporated codes used in other papers as well as reviewed the diagnosis list in our database. This clinician review was done independently. As a result, unplanned visit rates do not reflect "all-cause" unplanned visits. Because 2 separate ICD coding systems were utilized, diagnoses were harmonized where applicable to capture similar diagnoses with different ICD codes (Supplemental Materials).

## Data Analysis

Data analysis was performed in Excel. To compare characteristics of patients by unplanned visit status and controls, analysis of variance (Kruskal-Wallis) was used for continuous variables and the chi-square test was used for categorical variables. These analyses were performed on Matlab.

# Results

## Unplanned Visit Rates by Procedure

There were a total of 118,716 EGDs, 136,480 colonoscopies, 43,315 combined EGD/colonoscopy, and 10,179 ERCPs included in the analysis over the 5 year period. The resulting unplanned visit rates after 7-days postprocedure were 10.5 in 1000 (1.1%), 3.8 in 1000 (0.4%), 8.2 in 1000 (0.8%), and 39.6 in 1000 (4.0%) for EGD, colonoscopy, combined EGD/colonoscopy, and ERCP respectively. After 14 days postprocedure, the rates were 16.7 in 1000 (1.7%), 6.1 in 1000 (0.6%), 13.1 in 1000 (1.3%), and 51.6 in 1000 (5.2%), respectively. The rate of unplanned visits on an annual basis remained relatively stable for colonoscopies, EGD, and combined EGD/colonoscopy. However, there was a relative rise in unplanned visits after ERCPs, with a peak seen in 2017 (Figure 1). The correlation coefficient of unplanned visits post-ERCPs was 0.69.

## Characteristics Associated With Unplanned Visits

The median age of patient undergoing endoscopic procedures was 58 (interquartile range 58–68), 23.1% were African American and 56.7% were women. People who experienced unplanned visits compared to controls were more likely to be female, African American, and younger in

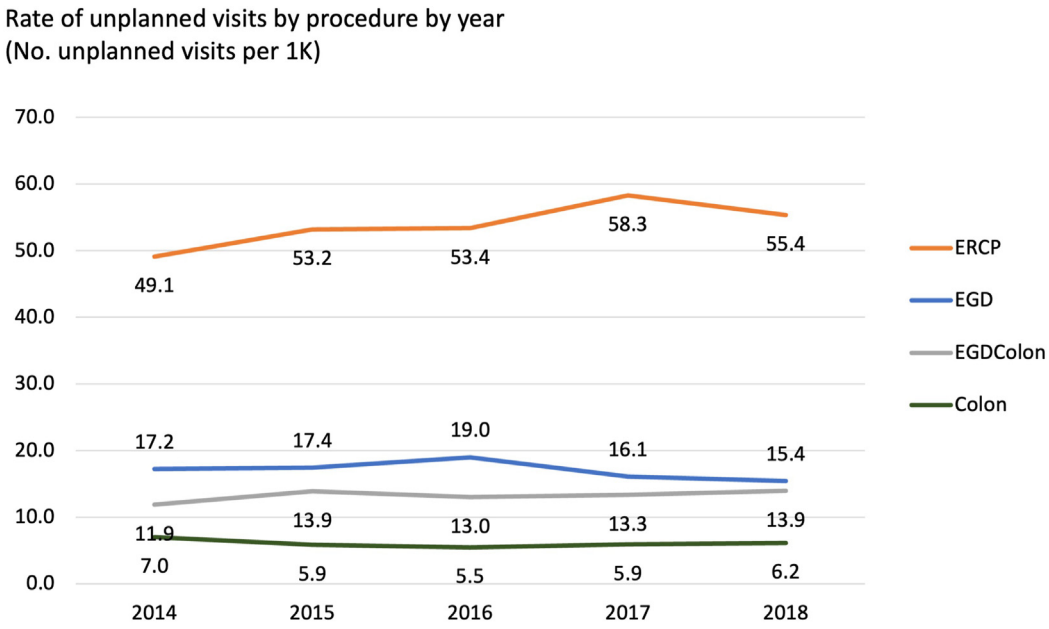


**Figure 1.** Rate of unplanned visit by procedure by year from 2014 to 2018.

age (Table 1). The range of distance travelled was also narrower for those with unplanned visits (Table 1).

## *Distribution of Unplanned Visits Over Time*

The temporal distribution of unplanned visits up to 14 days postprocedure is depicted in Figure 2. The most frequent time period for an unplanned visit was postprocedure day 1 for EGD, colonoscopy, and ERCP. For patients who underwent combined EGD/colonoscopy, postprocedure day 2 had the highest rate of unplanned hospital visits. A more detailed breakdown of visit type by day and procedure is also provided (Figures A1–A4). These supplemental data demonstrated that postprocedure unplanned visits for colonoscopies exhibited a staggered decline with a second peak at 7 days, which was similar to combined EGD/colonoscopy, which had a second

**Table 1.** Patient Demographics for Those Without and With Unplanned Visits

| Demographics | No unplanned visit, n (%) | Unplanned visit, n (%) | *P*-value |
|---|---|---|---|
| Procedure | | | < .001 |
| EGD | 116,729 (38.3) | 1987 (50.9) | |
| Colonoscopy | 135,654 (44.5) | 826 (21.2) | |
| EGD + colonoscopy | 42,749 (14.0) | 566 (14.5) | |
| ERCP | 9654 (3.2) | 525 (13.4) | |
| Patient sex | | | .001 |
| Female | 172,554 (56.6) | 2321 (59.5) | |
| Male | 132,192 (43.4) | 1583 (40.5) | |
| Unknown | 40 (<0.01) | 0 (0.0) | |
| Patient ethnicity | | | < .001 |
| White | 170,685 (56.0) | 2083 (53.4) | |
| African American | 70,192 (23.0) | 1028 (26.3) | |
| Asian or Pacific Islander[a] | 5232 (1.7) | 48 (1.2) | |
| American Indian, Inuit or Aleut | 1698 (0.6) | 14 (0.4) | |
| Biracial | 907 (0.3) | 19 (0.5) | |
| Other/unknown | 11,939 (0.4) | 165 (4.2) | |
| Declined/blank | 44,133 (14.5) | 547 (14.0) | |
| Age | | | |
| Median age (IQR) | 58 (49–68) | 54 (40–67) | < .001 |
| Distance traveled | | | < .001 |
| Median distance to procedure site, mi (IQR) | 10 (5–15) | 10 (5–10) | |

IQR, interquartile range.
[a]Inclusive of Native Hawaiian.

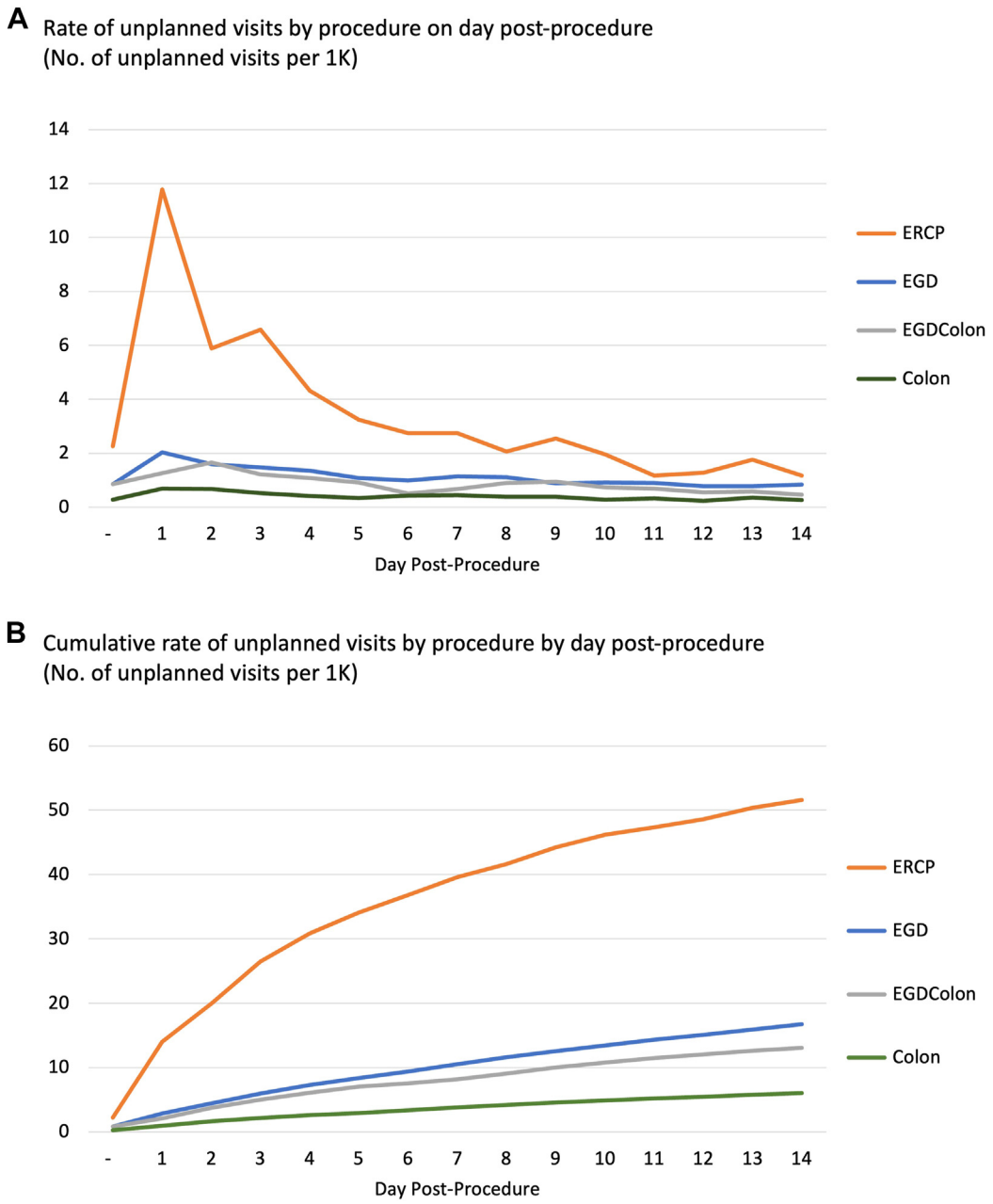


**Figure 2.** Distribution of unplanned visits by all procedure types. (A) Number of unplanned visits by day number. (B) Cumulative unplanned visits by day number.

peak around day 9. The remainder of the procedures (EGD and ERCP) demonstrated a smoother and steady decline after day 1.

### *Distribution of Type of Unplanned Visit*

The most common type of unplanned visit across all types of procedures was emergency department (ED) visit to home, followed by ED to inpatient, observation $>$ 24 hours, and lastly, direct to inpatient (Figure 3).

### *Home vs Away*

All procedure types, except ERCP, resulted in more unplanned visits at home institutions relative to away. In addition, for all procedures the proportion of patients admitted was higher for ERCP and EGD at "away" institutions compared to "home". There was a statistically significant difference in patient ethnicity ($P = .01$) and in distance traveled between patients who went to a home vs away institution ($P < .001$) (Table 2). All other demographic and procedure variables were similar between these groups.

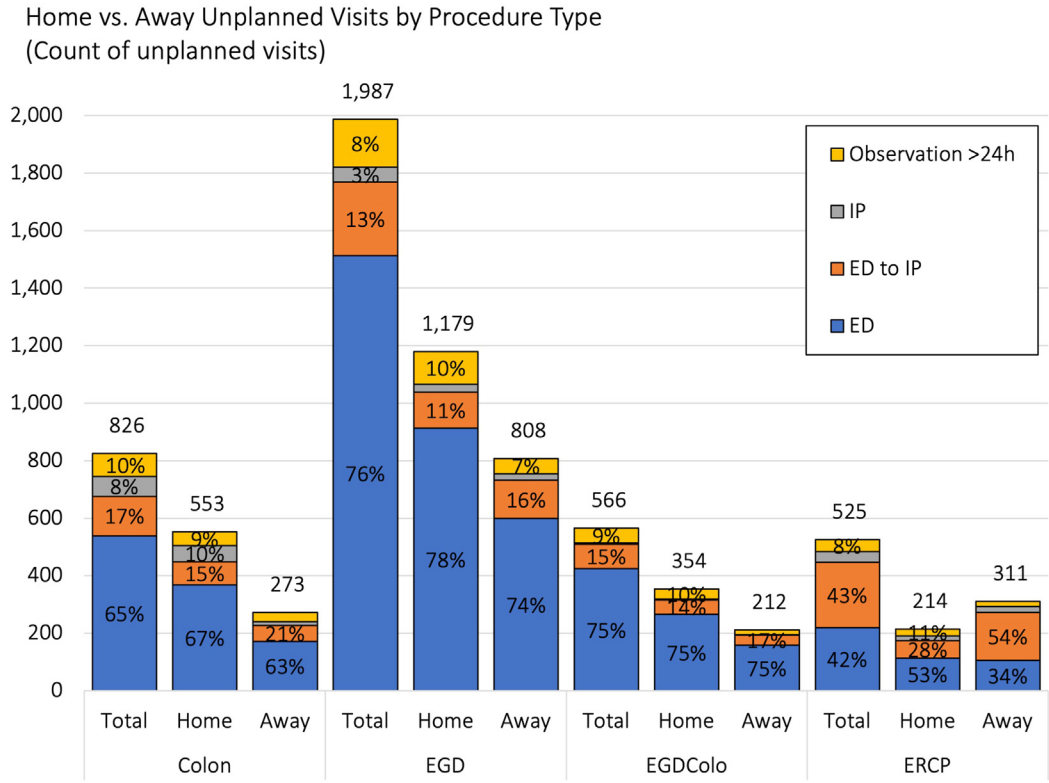


**Figure 3.** Unplanned visits by procedure type and home vs away designation.

## *Reasons for Unplanned Visits*

The most common diagnosis group for unplanned visits was abdominal pain, except for ERCPs which had biliary-related concerns as the most common diagnosis group followed by abdominal pain (Table 3). When stratified by follow-up site (home vs away), the diagnosis for these unplanned visits were similar across both groups (Table A1). Abdominal pain was by far the most common diagnosis for

**Table 2.** Patient Demographics by Home or Away Designation

| Demographics | Home, n (%) | Away, n (%) | *P*-value |
|---|---|---|---|
| Procedure | | | < .001 |
| EGD | 1179 (51.3) | 808 (50.4) | |
| Colonoscopy | 553 (24.0) | 273 (17.0) | |
| EGD + colonoscopy | 354 (15.4) | 212 (13.2) | |
| ERCP | 214 (9.3) | 311 (19.4) | |
| Patient sex | | | .30 |
| Female | 1383 (60.1) | 938 (58.5) | |
| Male | 917 (39.9) | 666 (41.5) | |
| Patient ethnicity | | | .01 |
| White | 1257 (54.7) | 826 (51.5) | |
| African American | 577 (25.1) | 451 (28.1) | |
| Asian or Pacific Islander[a] | 27 (1.2) | 21 (1.3) | |
| American Indian, Inuit or Aleut | 9 (0.4) | 5 (0.3) | |
| Biracial | 7 (0.3) | 12 (0.7) | |
| Other/unknown | 83 (3.6) | 82 (5.1) | |
| Declined/blank | 340 (14.8) | 207 (12.9) | |
| Age | | | .05 |
| Median age (IQR) | 54 (40–67) | 53 (39–65) | |
| Distance traveled | | | < .001 |
| Median distance to procedure site, mi (IQR) | 5 (5–10) | 15 (5–25) | |

IQR, interquartile range.
[a]Inclusive of Native Hawaiian.

**Table 3.** Top 5 Diagnosis Categories for Unplanned Hospital Visit After Each Procedure

| Procedure | Rank | Diagnosis category | Count (% of total) |
|---|---|---|---|
| EGD | 1 | Abdominal pain | 734 (37) |
| | 2 | Chest pain | 333 (17) |
| | 3 | Hemorrhage/bleeding | 237 (12) |
| | 4 | Nausea/vomiting | 215 (11) |
| | 5 | Dysphagia | 85 (4) |
| Colonoscopy | 1 | Abdominal pain | 361 (44) |
| | 2 | Hemorrhage/bleeding | 284 (34) |
| | 3 | Device (ostomy, prosthesis, graft) | 68 (8) |
| | 4 | Anal/rectal | 36 (4) |
| | 5 | Fever | 16 (2) |
| EGD + colonoscopy | 1 | Abdominal pain | 200 (35) |
| | 2 | Chest pain | 98 (17) |
| | 3 | Bleeding/hemorrhage | 98 (17) |
| | 4 | Nausea/vomiting | 38 (7) |
| | 5 | Respiratory | 20 (4) |
| ERCP | 1 | Abdominal pain | 147 (28) |
| | 2 | Biliary | 143 (27) |
| | 3 | Procedural complication | 67 (13) |
| | 4 | Pancreas | 62 (12) |
| | 5 | Nonabdominal pain | 20 (4) |

both groups. However, in patients presenting to their home hospital for colonoscopies, complaints related to devices like ostomies or prostheses were the fourth most common. This was not seen among the top 5 leading diagnosis groups for away sites.

In the ERCP group, abdominal pain was the most common diagnosis group for home visits while biliary-related complaints were most common in the away group. Additionally, a small number of patients presented for respiratory and infectious complaints in the away group. These diagnoses were not seen within the top 5 diagnosis categories in the home group.

## Discussion

### *Unplanned Visit Rates*

Unplanned visit rates for common endoscopic procedures were generally low and stable throughout the 5-year study period with colonoscopies having the lowest rate (0.6%) and ERCPs the highest (5.2%). While unplanned visit rates for EGD, colonoscopy, and combined EGD/colonoscopy remained relatively flat, the annual rate of unplanned post-ERCP visits generally increased between 2014 and 2018. This may reflect the rising complexity of patients in whom this procedure is performed. The most frequent period for patients to experience an unplanned visit was within 1 day postprocedure, though unplanned visits routinely occurred for all procedures up to 2 weeks afterward. In addition, when a colonoscopy was performed, there was a smaller, second peak after 7 days. This resurgence may be consistent with the timing of delayed postpolypectomy bleeding.

Compared to the previous study assessing unplanned visits for EGDs, this analysis demonstrated a higher rate (1.1% at 7 days and 1.7% at 14 days vs 1.07%[10]). This difference is likely due to our study capturing unplanned visits at other institutions, which was not done in the other single center study. Given this difference and the order of magnitude between procedures evaluated (118,716 vs 6383), we have greater confidence in the higher estimate.

Prior studies evaluating colonoscopy varied, including a 30-day all-cause unplanned visit rate of 3.4%[5] in a screening and surveillance population, a 14-day single-center procedure-related rate of 0.84% for all colonoscopy types,[10] and a Polish population screening cohort of 55,390 procedures with a 30-day procedure-related hospitalization rate of 0.24%.[7] These prior data likely both overestimate (in the case of all-cause) and underestimate (in the case of hospitalization only). Our study of 136,480 colonoscopies demonstrated a 7-day rate of 0.4% and a 14-day rate of 0.6%, which were both lower than the single-center rate. Given the over 10-fold difference in number of procedures in our study (136,480 vs 11,632) and the inclusion of outside institutions, we believe that this lower rate of unplanned visits likely represents a more accurate assessment of risk.

The largest prior ERCP study[6] which was conducted over 3 states had an unplanned visit rate of 5.8% at 7 days (and 10.2% at 30 days) compared to 4.0% at 7 days and 5.2% at 14 days in this study. Differences in demographic variables such as age, comorbidities, and criteria used to classify a postprocedure unplanned visit may explain this difference.

No prior published study to our knowledge has demonstrated the unplanned visit rate of combined EGD/colonoscopy procedures. Our rate of 0.8% at 7 days and 1.3% at 14 days fall between the rates of each of the individual procedures. This suggests that there is a lower postprocedure risk associated with combining these procedures than if they were conducted separately. This

empirically supports what is commonly communicated to patients who undergo concurrent procedures. This finding may be explained by the fact that the risk of putting patients under sedation twice rather than once in combined procedures is often communicated as being considered safer, especially with patients who have comorbidities that make sedation riskier. A deeper examination of patient comorbidities may be necessary to fully understand the difference in outcomes. However, our finding of lower complication rates during combined EGD/colonoscopy may overall lend support to a practice that incorporates patient-centered, high-value care in cases where it is safe to do so.

Similar to prior studies, our analysis demonstrated that female sex and racial minority status (biracial, African-American) were associated with higher unplanned visit rates.[14–18] In addition, ED visit to home was validated as the most common visit type. However, by segmenting into "home" vs "away" status, we identified several important findings, including that patients generally returned to their home institution. However, patients were more likely to get admitted when visiting an "away" facility for all procedures, with exception to combined EGD/colonoscopy. This difference was most pronounced for ERCPs where patients were not only more likely to get admitted than sent home from the ED, but also more likely to get sent to a different institution where they would be admitted at nearly twice the rate at a home facility. These findings support the implication that advanced endoscopy coverage gaps are common and may result in more conservative management when patients present to an "away" institution. However, in contrast to prior studies that showed unplanned visits more frequent in older populations or no difference,[5,19,20] our study found them to be more common in younger patients. The lack of comorbidity data in each of these populations limits interpretation of these results.

## Implications

When viewed on a per 1000 procedure basis, our analysis demonstrated that unplanned visits occurred significantly more frequently than traditional endoscopic complications. For EGDs, they occurred nearly 2 times the upper limit at 7 days postprocedure and 3 times the upper limit at 14 days postprocedure of upper endoscopy complication rates; for colonoscopies nearly 5 times the upper limit at 7 days postprocedure and nearly 8 times the upper limit at 14 days postprocedure. However, the rate of unplanned visits per 1000 ERCPs (39.6 at 7 days and 51.6 at 14 days) was within the normal range of ERCP complications rates (0.8–100 in 1000). This suggests that for ERCPs there is a strong association between conventional complications and unplanned visits, which is markedly different than in EGDs and colonoscopy. This discrepancy highlights an opportunity to convey the risk of these 2 more common procedures more accurately to patients and in terms that may be easier to understand. While the morbidity of traditionally quoted endoscopic complications may be more severe than the average unplanned visit, the latter likely remains a meaningful burden for patients. In addition, these results also highlight that single center postprocedure follow-up is insufficient to fully capture the magnitude of postprocedure unplanned visits. As digital technologies in gastroenterology expand, they may provide a unique opportunity to collect this data more systematically.[21]

In addition to impacting patients and their families, unplanned visits present a significant financial burden to the health-care system. As a representative example, a moderate severity ED visit in Maryland costs an average of $623[22] and an average US hospital stay in 2017 was $11,700.[23] Using these values, a conservative estimate of financial cost associated with the unplanned visits in our study was over $12 million. Given that many GI condition-specific hospitalizations generally cost on average significantly more,[24] the true cost is likely much higher. Consequently, the results in this study may inform future efforts to broaden measures of endoscopic quality by providing a pragmatic and real-world context for postprocedure safety and value.

## Limitations

Our study has a number of limitations, including limited data from the state HIE regarding medical/surgical comorbidities and procedural indications associated with each patient, as well as whether the procedure was performed at an ambulatory surgical center vs a hospital. These deficits limited our ability to assess individual risk for unplanned visits. In reviewing unplanned diagnosis codes, due to the limited nature of the data, we erred on the side of being more conservative, which may lead to an overestimation of complication rates. However, to minimize this potential limitation, we only attributed unplanned visits with diagnosis codes that could be secondary to GI procedures. We also restricted the unplanned visit window to 7 and 14 day windows, where most GI procedure-related complications would be conventionally expected. Additionally, without information about specific procedural interventions, specific subgroup analyses could not be done. We note that these additional details would be helpful and remain a future source of potential investigation. However, our goal was to focus our limited resources on the most common procedures. Prior published studies have not all reported or investigated these additional details,[6,7,10,12,18,19] and we believe valuable conclusions can still be made regarding these common procedures without them. Additionally, given the large number of procedures in the study, we believe the results present a reasonable estimate for representative rates of unplanned visits following endoscopy in a general US population. Lastly, though our results were based on the population in a single geographic region which could potentially influence practice patterns and limit generalizability, there is nothing to suggest that care delivery in this region varies considerably from other parts of the US.

### Significance

This study presents the largest analysis of unplanned visits for EGDs and colonoscopies by over 60,000 in each, the second largest for ERCPs, and the only to include combined EGD/colonoscopy as a distinct category. In addition, it is the only study to include all 4 major procedures in the same analysis to permit accurate comparison, and is the only study segment unplanned visits into "home" vs "away" categories. These distinctions provided new insight on the relative risk of these common procedures and their differential impact based on location. Combined with the 5-year time range and the statewide approach to data capture, these results present the most comprehensive and up to date assessment of endoscopic unplanned procedures.

## Conclusion

Postprocedure unplanned visit rates for the 4 most common endoscopic procedures remain generally low and stable. However, for EGDs and colonoscopies, patients may benefit from a broader discussion on postprocedure risk that goes beyond risks associated with less common complications.

## Supplementary Materials

Material associated with this article can be found in the online version at https://doi.org/10.1016/j.gastha.2024.01.017.

## References


1. An astounding 19 million colonoscopies are performed annually in the United States. iData Research. 2018. https://idataresearch.com/an-astounding-19-million-colonoscopies-are-performed-annually-in-the-united-states/. Accessed August 1, 2021.
2. ASGE Standards of Practice Committee, Ben-Menachem T, Decker GA, et al. Adverse events of upper GI endoscopy. Gastrointest Endosc 2012;76(4):707–718.
3. Kothari ST, Huang RJ, Shaukat A, et al. ASGE review of adverse events in colonoscopy. Gastrointest Endosc 2019;90(6):863–876.e33.
4. ASGE Standards of Practice Committee, Chandrasekhara V, Khashab MA, et al. Adverse events associated with ERCP. Gastrointest Endosc 2017;85(1):32–47.
5. Causada-Calo N, Bishay K, Albashir S, et al. Association between age and complications after outpatient colonoscopy. JAMA Netw Open 2020;3(6):e208958.
6. Huang RJ, Barakat MT, Girotra M, et al. Unplanned hospital encounters after endoscopic retrograde cholangiopancreatography in 3 large North American States. Gastroenterology 2019;156(1):119–129.e3.
7. Kobiela J, Spychalski P, Wieszczy P, et al. Mortality and rate of hospitalization in a colonoscopy screening program from a randomized health services study. Clin Gastroenterol Hepatol 2020;18(7):1501–1508.e3.
8. Turbayne AKB, Mehta A, Thomson A. Prolonged endoscopic retrograde cholangiopancreatography results in higher rates of pancreatitis and unplanned hospitalisation [published online ahead of print, 2021 Apr 19]. Surg Endosc 2022;36:2025–2031.
9. Chan E, Neeman T, Thomson A. Follow-up to determine unplanned hospitalization and complications after endoscopic retrograde cholangiopancreatography. ANZ J Surg 2018;88(3):E142–E146.
10. Leffler DA, Kheraj R, Garud S, et al. The incidence and cost of unexpected hospital use after scheduled outpatient endoscopy. Arch Intern Med 2010;170(19):1752–1757.
11. Mahnke D, Chen YK, Antillon MR, et al. A prospective study of complications of endoscopic retrograde cholangiopancreatography and endoscopic ultrasound in an ambulatory endoscopy center. Clin Gastroenterol Hepatol 2006;4(7):924–930.
12. Siegel AB, Yadlapati R, Keswani RN, et al. Risk factors for unplanned hospitalization following ambulatory upper endoscopy [Sa1082]. Gastrointest Endosc 2017;85(5S):AB183–AB184.
13. CRISP. https://www.crisphealth.org/. Accessed July 1, 2021.
14. Sherid M, Sulaiman S. Complications of colonoscopy. In: Samo S, ed. Colonoscopy and colorectal cancer screening - future directions. Books on Demand. Rijeka, Croatia: InTech, 2013:215–242.
15. Sorbi D, Gostout CJ, Henry J, et al. Unsedated small-caliber esophagogastroduodenoscopy (EGD) versus conventional EGD: a comparative study. Gastroenterology 1999;117(6):1301–1307.
16. Katsinelos P, Lazaraki G, Chatzimavroudis G, et al. Risk factors for therapeutic ERCP-related complications: an analysis of 2,715 cases performed by a single endoscopist. Ann Gastroenterol 2014;27(1):65–72.
17. Fiscella K, Franks P, Meldrum S, et al. Racial disparity in surgical complications in New York State. Ann Surg 2005;242(2):151–155.
18. Brooks Carthon JM, Jarrín O, Sloane D, et al. Variations in postoperative complications according to race, ethnicity, and sex in older adults. J Am Geriatr Soc 2013;61(9):1499–1507.
19. Miyanaga R, Hosoe N, Naganuma M, et al. Complications and outcomes of routine endoscopy in the very elderly. Endosc Int Open 2018;6(2):E224–E229.
20. Lin OS. Performing colonoscopy in elderly and very elderly patients: risks, costs and benefits. World J Gastrointest Endosc 2014;6(6):220–226.
21. Mathews SC, Sakulsaengprapha V. Digital health landscape in gastroenterology and hepatology. Clin Gastroenterol Hepatol 2021;19(3):421–424.e2.
22. Learish J. The most expensive states for ER visits, ranked. CBS News. 2020. https://www.cbsnews.com/pictures/emergency-room-visit-cost-most-expensive-states/3/. Accessed August 1, 2021.
23. Liang L, Moore B, Soni A. Statistical brief #261: National inpatient hospital costs: the most expensive conditions by payer, 2017. Healthcare cost and utilization project. 2020. https://www.hcup-us.ahrq.gov/reports/statbriefs/sb261-Most-Expensive-Hospital-Conditions-2017.jsp. Accessed July 1, 2021.

24. Mathews SC, Izmailyan S, Brito FA, et al. Prevalence and financial burden of digestive diseases in a commercially insured population [published online ahead of print, 2021 Jul 1]. Clin Gastroenterol Hepatol 2022;20:1480–1487.e7.

**Received June 24, 2022. Accepted January 29, 2024.**

**Correspondence:**
Address correspondence to: Simon C. Mathews, MD, Division of Gastroenterology and Hepatology, Department of Medicine, Johns Hopkins Medicine, Baltimore, Maryland 21287. e-mail: smathe14@jhmi.edu.

**Authors' Contributions:**
All authors meet the criteria detailed in Author Instructions. Author (Simon C. Mathews) was responsible for concept and design. Authors (Vorada Sakulsaengprapha; Jonathan P. Masterson) were responsible for creation of figures. Authors (Vorada Sakulsaengprapha; Jonathan P. Masterson; Samara B. Rifkin) were responsible for data analysis. All authors (Vorada Sakulsaengprapha; Jonathan P. Masterson; Samara B. Rifkin; Simon C. Mathews) were responsible for interpretation of data; drafting and critical revision of the manuscript.

**Conflicts of Interest:**
The authors disclose no conflicts.

**Funding:**
The authors report no funding.

**Ethical Statement:**
Data from this project was from the Chesapeake Regional Information System for our Patients' (CRISP) Maryland Health Information Exchange (HIE), therefore exempt from institutional review board.

**Data Transparency Statement:**
Data and study materials can be made available to other researchers upon request to the corresponding author.

**Reporting Guidelines:**
Not applicable for this article type.