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Factors influencing patient disposition after ambulatory herniorrhaphy

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Abstract

Purpose: To determine factors associated with patient disposition status other than discharge to their customary residence (DCR) after elective, ambulatory inguinal hernia repair (IHR).
Materials and methods: $N = 7953$ patients who underwent IHR were identified in the National Survey of Ambulatory Surgery (NSAS). Disposition status was examined by age, sex, race, type of anesthetic, anesthesia provider, expected source of payment, laterality of the procedure, facility type and US region. Logistic regression was used to examine independent risk factors for such disposition status.
Results: Independent risk factors for disposition status other than DCR included anesthesia type, anesthesia provider, increasing age of the patient, and bi- versus unilaterality of the procedure. Differences in disposition status were also found by facility type and US region in which the procedure was performed.
Discussion: The increased cost associated with a disposition status other than DCR requires identification of factors that independently contribute to such an outcome. In this study a number of anesthesia related and unrelated factors were identified that may impact on the disposition of patients undergoing ambulatory inguinal hernia repair. In light of limitations inherent to analysis of large databases our results should be interpreted with caution and prospective trials are needed for validation of our findings. The value of our results may lie particularly in the hypothesis generation for such trials.
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Keywords: Ambulatory; Inguinal hernia repair; Disposition status; Risk factors

1. Introduction

Inguinal hernia repair (IHR) is among the most commonly performed surgical procedures. Over 20 million such procedures are performed per year worldwide [1]. Due to advances in surgical technique and anesthetic management, this procedure can be safely and cost-effectively performed on an outpatient basis. However, cost-effectiveness in large part depends on the ability to discharge patients to their customary residence (DCR) on the day of surgery. Disposition status of a patient other than DCR after ambulatory surgery creates financial burdens for the health care provider, the patient and their insurer. The goal of this study was to identify anesthesia- (type of anesthesia and provider) and patient-related (age, sex, laterality of the procedure) factors that contribute to an unanticipated discharge status in the setting of elective IHR using a large, national database. We also examined the influence of facility type (free-standing ambulatory surgical centers (FASC) and hospital-based ambulatory surgical centers (HSC)) and US region where the procedure was performed on disposition status.

2. Materials and methods

2.1. The National Survey of Ambulatory Surgery

Data collected in the National Survey of Ambulatory Surgery (NSAS) were accessed. The plan and operation of

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the NSAS has been previously published in detail [2]. In brief, the NSAS was conducted by the National Center for Health Statistics from 1994 to1996 to compile nationally representative data of ambulatory surgery procedures and practices performed in both freestanding ambulatory surgery and hospital-based ambulatory surgery facilities. The hospital universe included Medicare-participating, non-institutional hospitals exclusive of military, VA and Federal facilities in the 50 States and the District of Columbia. Facilities specializing in dentistry, podiatry, abortion, family planning or birthing were also excluded from NSAS. Hospitals included in the survey were required to have an average length of stay of less than 30 days to be considered short-stay and to have at least six beds.

After extensive pre-testing by the US Bureau of the Census, the survey was based on a sample of data collected from over 700 facilities. Response rates were 88% for hospitals and 70.5% for free-standing facilities (1994 data), respectively. Adjustments were made in the NSAS to minimize the impact of non-response on final estimates. Extensive measures were employed by the Division of Data Processing at the National Centers for Health Statistics to ensure accuracy, consistency, logic and completeness of the data.

To be eligible for inclusion in NSAS, patients had to be scheduled for ambulatory surgery with admission and discharge occurring on the same day. Patients admitted to the hospital, either as an inpatient prior to surgery or through the emergency department, were excluded. In addition, a patient was only included if he did not leave the facility before surgery and if the purpose of the visit was outpatient surgery.

Post-ambulatory procedure admissions were included in the survey. The original location of the patient prior to surgery was recorded during the sampling phase of the survey, but was not available in the database for further analysis.

Data from each visit were abstracted from the medical record. Information collected in the survey included diagnosis and procedure codes (ICD-9-CM), age, sex, race, type of anesthesia, anesthesia provider, facility type and US region in which the procedures were performed.

2.2. Analysis

The public access NSAS data files for 1994–1996 ($N = 364{,}858$) were obtained from the Centers for Disease Control and Prevention (CDC), read into a statistical analysis software program and concatenated. Patients who had ICD-9-CM procedure codes for either uni or bilateral IHR (53.00–53.05 and 53.10–53.17, respectively, Table 1) as their primary procedure codes (out of five possible procedure codes) were identified ($N = 7953$) and included in the study sample. Only approximately 5% of these patients had an additional procedure code listed. The most common secondary procedure code was related to the primary procedure, i.e. laparoscopy/peritoneoscopy, suggesting a further characterization of surgical technique.

Table 1
ICD-9 procedure codes for inguinal hernia repair included in this study

53.0 Unilateral repair of inguinal hernia
53.00 Unilateral repair of inguinal hernia, not otherwise specified inguinal herniorrhaphy
53.01 Repair of direct inguinal hernia
53.02 Repair of indirect inguinal hernia
53.03 Repair of direct inguinal hernia with graft or prosthesis
53.04 Repair of indirect inguinal hernia with graft or prosthesis
53.05 Repair of inguinal hernia with graft or prosthesis, not otherwise specified
53.1 Bilateral repair of inguinal hernia
53.10 Bilateral repair of inguinal hernia, not otherwise specified
53.11 Bilateral repair of direct inguinal hernia
53.12 Bilateral repair of indirect inguinal hernia
53.13 Bilateral repair of inguinal hernia, one direct and one indirect
53.14 Bilateral repair of direct inguinal hernia with graft or prosthesis
53.15 Bilateral repair of indirect inguinal hernia with graft or prosthesis
53.16 Bilateral repair of inguinal hernia, one direct and one indirect, with graft or prosthesis
53.17 Bilateral inguinal hernia repair with graft or prosthesis, not otherwise specified

The ICD-9 procedure codes that were used to identify patients undergoing inguinal hernia repair.

Patients for whom a disposition status was recorded were identified. Disposition status (DCR versus admission to hospital, discharge to recovery care center or discharge to observational status) was examined by age, sex, race, type of anesthetic, anesthesia provider, type of facility, US region and the laterality of the procedure. DCR was defined as discharge to the patient's normal place of residence, i.e., home, nursing home, or prison. Observational status was defined as stay at the operating facility for up to 72 h for "observation", but the patient was not considered an inpatient. The percentages of disposition status other than DCR were determined for subgroups within each category (Table 3). Odds ratios were calculated to determine if patients with specific characteristics were more likely to have a disposition status other than DCR. A logistic regression model was then developed where disposition status was the dependent variable (0 = disposition to customary residence, 1 = not discharged to customary residence) and the characteristics above were independent, categorical variables. Ninety-five percent confidence intervals were calculated.

Anesthesia types were categorized as local, MAC/sedation, general, epidural, spinal, other and not stated. A single anesthetic type is listed when this particular technique was the *only* reported mode of anesthesia. Common combinations of anesthesia types were considered and examined separately.

Races studied include those identified in the NSAS as white, black, "other" and not stated. Races classified as "other" included American Indian, Eskimo, Alaskan Native, Asian and Pacific Islander. No further race categories were included in the NSAS.

3. Results

Table 2 shows the characteristics of the study population ($N = 7953$). The majority of patients was male, white, privately insured, and had a unilateral hernia repair performed under general anesthesia administered by an anesthesiologist.

Table 2
Study group characteristics

Categories	Patient group	Number of patients $N = 7953$	Percent of total
Sex	Male	7012	88.2
	Female	941	11.2
Age (years)	Below 1	527	6.6
	1–14	1616	20.3
	15–44	2064	26.0
	45–64	1868	23.5
	64+	1878	23.6
Race	White	4854	61.0
	Black	535	6.7
	Other	244	3.1
	Not stated	2320	29.2
Laterality of procedure	Unilateral	6752	84.9
	Bilateral	1201	15.1
Anesthesia type	Local	284	2.3
	Local and MAC/sedation	562	7.1
	MAC/sedation	646	8.1
	General	4236	53.3
	General and MAC/sedation	164	2.1
	General and local	232	2.9
	Epidural	539	6.8
	Spinal	516	6.5
	Other	459	5.8
	Not stated	415	5.2
Anesthesia provider	Anesthesiologist	4324	54.4
	CRNA	1283	16.1
	Anesthesiologist/CRNA	1030	13.0
	Other physician	374	4.7
	Other	246	3.1
	Not stated	696	8.8
Insurance type	Private	4277	53.8
	Medicare/-aid/other Government	2396	30.1
	Other pay	832	10.5
	Not Stated	448	5.6
Facility type	Hospital based	6094	76.6
	Freestanding	1859	23.4
US region	NorthEast	2081	27.2
	MidWest	1582	20.6
	South	2317	30.2
	West	1683	22.0

The characteristics of the study population ($N = 7953$). The first column contains categories, the second describes subgroups with each category. The third and fourth column show the proportion as a total number and in percent, respectively.

Most cases were performed in a hospital-based ambulatory care center.

Disposition status was noted for 7663 (96.4%) of patients undergoing IHR. Of those, 581 (7.6%) were not DCR after surgery. Table 3 shows the percent within each variable group that was not DCR. The highest percents of patients who were not DCR were those who received the combination of general and MAC/sedation anesthesia (18.4%), those who received spinal anesthesia (17.6%), and those who received their anesthetic by an "other" provider (15.3%).

Table 3
Percent of patients with disposition status other than DCR within each group

Categories	Patient group	Percent within patient group not DCR
Sex	Male	7.8
	Female	6.2
Age (years)	Below 1	5.7
	1–14	2.0
	15–44	7.2
	45–64	9.1
	64+	11.8
Race	White	9.4
	Black	6.8
	Other	4.2
	Not stated	4.3
Laterality of procedure	Unilateral	7.4
	Bilateral	8.8
Anesthesia type	Local	1.1
	Local and MAC/sedation	4.5
	MAC/sedation	3.5
	General	9.0
	General and MAC/sedation	18.4
	General and local	3.4
	Epidural	1.5
	Spinal	17.6
	Other	7.2
	Not stated	0.8
Anesthesia provider	Anesthesiologist	5.6
	CRNA	13.0
	Anesthesiologist/CRNA	10.0
	Other physician	11.0
	Other	15.3
	Not stated	1.9
Insurance type	Private	5.9
	Medicare/-aid/other Government	10.3
	Other pay	8.0
	Not stated	8.3
Facility type	Hospital based	9.3
	Freestanding	2.3
US region	NorthEast	2.7
	MidWest	7.1
	South	15.1
	West	3.7

The percentage of patients within each patient group that had a disposition status other than discharge to their customary residence (DCR) after inguinal hernia repair.

Table 4
Odds ratios and 95% confidence intervals for disposition status other than DCR based on univariate analysis

Categories (referent)	Patient group	Odds ratio	95% CI
Sex (male)	Male	1	1
	Female	0.78	0.59, 1.04
Age (years) (15–44)	Below 1	0.78	0.52, 1.12
	1–14	0.27	0.18, 0.39*
	15–44	1	1
	45–64	1.23	1.02, 1.63
	64+	1.72	1.38, 2.15*
Race (white)	White	1	1
	Black	0.70	0.49, 1.00
	Other	0.43	0.22, 0.81*
	Not stated	0.44	0.35, 0.55*
Laterality of procedure (unilateral)	Unilateral	1	1
	Bilateral	1.22	0.98, 1.53
Anesthesia type (general)	Local	0.12	0.03, 0.47*
	Local and MAC/ sedation	0.48	0.32, 0.73*
	MAC/sedation	0.37	0.24, 0.57*
	General	1	1
	General and MAC/ sedation	2.23	1.52, 3.45*
	General and local	0.36	0.18, 0.74*
	Epidural	0.16	0.08, 0.31*
	Spinal	2.16	1.67, 2.80*
	Other	0.78	0.54, 1.14
	Not stated	0.08	0.03, 0.26*
Anesthesia provider (Anesthesiologist)	Anesthesiologist	1	1
	CRNA	2.53	2.04, 3.14*
	Anesthesiologist/ CRNA	1.90	1.49, 2.42*
	Other physician	2.10	1.48, 2.99*
	Other	3.06	2.11, 4.46*
	Not stated	0.33	0.18, 0.59*
Insurance type (private)	Private	1	1
	Medicare/-aid/other Government	1.83	1.52, 2.20*
	Other pay	1.39	1.04, 1.84*
	Not stated	1.43	0.99, 2.08
Facility type (freestanding)	Hospital based	4.36	3.17, 6.00*
	Freestanding	1	1
US region (Northeast)	Northeast	1	1
	Midwest	2.76	1.99, 3.82*
	South	6.43	4.82, 8.59*
	West	1.41	0.98, 2.03

The odds ratios and 95% confident intervals (95% CI) for disposition status other than DCR obtained from the univariate analysis (i.e., every variable was only compared to a referent variable within each patient category). The referent group is shown in parenthesis in the category column.
* Significant at $P < 0.05$ at alpha level.

Table 5
Odds ratios and 95% confidence intervals for disposition status other than DCR based on multivariate analysis

Categories (referent)	Patient group	Odds ratio	95% CI
Sex (male)	Male	1	1
	Female	0.891	0.72, 1.33
Age (years) (15–44)	Below 1	0.47	0.30, 0.75*
	1–14	0.19	0.13, 0.29*
	15–44	1	1
	45–64	1.41	1.09, 1.81*
	64+	1.81	1.30, 2.52*
Race (White)	White	1	1
	Black	0.64	0.43, 0.94*
	Other	0.54	0.27, 1.07
	Not stated	0.64	0.50, 0.84*
Laterality of procedure (unilateral)	Unilateral	1	1
	Bilateral	1.40	1.09, 1.81*
Anesthesia type (general)	Local	0.05	0.01, 0.25*
	Local and MAC/ sedation	0.24	0.15, 0.38*
	MAC/sedation	0.31	0.20, 0.50*
	General	1	1
	General and MAC/ sedation	1.83	1.17, 2.86*
	General and local	0.43	0.20, 0.92*
	Epidural	0.33	0.16, 0.69*
	Spinal	1.05	0.78, 1.39
	Other	0.53	0.35, 0.79*
	Not stated	0.14	0.04, 0.46*
Anesthesia provider (Anesthesiologist)	Anesthesiologist	1	1
	CRNA	1.32	1.04, 1.67*
	Anesthesiologist/ CRNA	1.37	1.05, 1.79*
	Other physician	4.60	3.05, 6.94*
	Other	4.70	3.05, 7.25*
	Not stated	0.43	0.23, 0.79*
Insurance type (private)	Private	1	1
	Medicare/-aid/other Government	1.27	0.96, 1.70
	Other pay	1.02	0.75, 1.40
	Not stated	1.83	1.20, 2.79*
Facility type (freestanding)	Hospital based	3.80	2.66, 5.42*
	Freestanding	1	1
US region (northeast)	Northeast	1	1
	Midwest	1.82	1.29, 2.58*
	South	4.39	3.22, 5.97*
	West	1.76	1.18, 2.62*

The odds ratios and 95% confident intervals (95% CI) for disposition status other than DCR obtained from the multivariate analysis (i.e., the calculation of the OR was performed while controlling for all other variables). The referent group is shown in parenthesis in the category column.
* Significant at $P<0.05$ at alpha level.

Table 4 shows results of the univariate analysis. While no differences in the odds for a disposition other that DCR were found by sex or laterality of the procedure, disposition status other than DCR varied significantly within all other variable groups studied.

Table 5 shows the results of the regression analysis. When controlling for all studied variables the choice of local and epidural anesthesia significantly decreased the risk for disposition status other than DCR when compared to general or spinal anesthesia. Administration of anesthesia by a non-anesthesiologist physician significantly increased the odds

of disposition status other than DCR when compared with an anesthesiologist. The odds ratio for disposition status other than DCR among patients receiving care from a Certified Registered Nurse Anesthetists (CRNA) or an anesthesiologist/CRNA team, were also higher than with a solo anesthesiologist, but lower than those of non-anesthesiologist MDs. The odds ratios for non-DCR disposition status among those receiving care from CRNA's and anesthesiologist/CRNA teams were reduced in the multivariate, whereas for non-anesthesiologist MD's the odds were higher in multivariate analysis.

Increasing age remained a risk factor for disposition status other than DCR in the multivariate analysis. Bi- versus unilaterality of the procedure slightly but significantly increased the risk for such disposition status in multivariate but not univariate analysis. Those identified as black had a lower likelihood of discharge to other than DCR compared to whites when controlling for other factors.

4. Discussion

In the setting of ambulatory surgery, discharge of a patient to any location other than their customary residence can be viewed as "unanticipated." The increased cost associated with unanticipated disposition status requires identification of factors that independently contribute to such an outcome. In this study we demonstrate that age, laterality of the procedure, type of anesthesia provider, anesthetic technique, race, type of insurance, region, and facility type may impact the disposition of patients undergoing ambulatory inguinal hernia repair.

4.1. Type of anesthetic

A number of studies have found a correlation between anesthetic factors and disposition status after ambulatory surgical procedures [3–11]. The estimated rate for anesthesia-related causes for unanticipated admission to the hospital after ambulatory surgery is between 12 and 44% [6–8,11]. Nordin et al. examined the impact of the type of anesthesia used on disposition status in the setting of inguinal hernia repair. The authors found that local anesthesia was associated with far fewer admissions to the hospital when compared to regional or general techniques [3]. These results are similar to our findings. However, we were able to further separate those patients receiving regional anesthesia into spinal and epidural groups. Our analysis showed that the risk for disposition status to other than DCR was significantly higher among those receiving spinal when compared to epidural anesthesia.

A number of authors have reported the potential benefits of local anesthesia compared to general or spinal techniques [12–23]. Cited advantages include earlier ambulation [13,18,22], a shorter time to home-readiness [12,15], and a decreased incidence of urinary retention [12–14,18,20], nausea and vomiting [3,12,13,23] and pruritus [12]. Lower cost [12], lower pain-scores [3,12,13] and the ability to test the integrity of the repair during the procedure have also been cited as favorable factors [19,20]. Patient satisfaction also seems to be higher when local anesthesia is used [12,13,19,21].

Common side effects of general anesthesia are post-operative nausea and vomiting (PONV) and higher pain scores [3,12], potentially contributing to higher rates of admission. The administration of inhalational gases and opioids has been linked to PONV and may explain the increased risk of disposition status other than DCR in the groups that received MAC/sedation and general anesthesia. Interestingly, when general anesthesia was combined with local anesthesia, the odds ratio was significantly lower for a disposition status to other than DCR. This may reflect a decreased need for opioids during and after the procedure, thus reducing the risk of nausea and vomiting and pain. When general and MAC/sedation were recorded together, the odds ratio for disposition status other than DCR was significantly above that for general anesthesia alone. This may reflect a conversion from MAC/sedation to general anesthesia for a variety of reasons, which may include intra-operative complications. The authors caution that this interpretation is purely speculative as data to confirm it are not available in the NSAS database. The designation of multiple anesthetic techniques for a single procedure could not be interpreted with certainty and our assumptions have to remain speculative.

Spinal anesthesia is burdened with urinary retention [3,12] and this may be the reason for the increased likelihood for prolonged post-operative care. Nordin et al. report that 29% of patients had to undergo catheterization after spinal anesthesia for IHR [3]. We found that disposition status other than DCR after spinal was the same as for general anesthesia after IHR.

Epidural anesthesia has the advantage of a lower incidence of post-dural puncture headache, and transient radicular irritation when compared to spinal anesthesia and thus may contribute to the lower rate of unfavorable post-surgical dispositions.

4.2. Anesthesia provider

Attempts to study the impact of type of anesthesia provider on outcome have been made in the past and are subject to a wide range of criticism. Studies comparing outcomes between CRNAs and anesthesiologists are rare and focus mainly on mortality, morbidity and cost as outcome variables. Publications supporting the superiority of either side can be found [24,25]. Analysis of the NSAS data suggest that when controlling for age, race, sex, laterality of the procedure, type of anesthesia, insurance type, US region and facility type, patients with a CRNA listed as the anesthesia provider are more likely to have a disposition status other than DCR after elective, ambulatory herniorrhaphy when compared to anesthesiologists alone. Interestingly, the odds for disposition status other than DCR were even higher among

patients receiving care from non-anesthesiologist MDs than for CRNAs, increasing the risk 4.6-fold compared to anesthesiologists.

4.3. Demographics

Patient-related characteristics such as age and sex have been reported to influence disposition status after ambulatory surgery. Junger et al. reported a prolonged stay for females after ambulatory surgery [9], while others have found male gender to be a risk factor [11]. Although differences were found in our univariate analysis, no significant gender-differences were found by multivariate analysis. Advanced age is consistently associated with an increased risk of unplanned admission to the hospital after ambulatory surgery [5,9–11,26]. In concordance with these findings, our data suggest that patients over 64 years of age have a significantly higher chance for a disposition status other than DCR when compared to those 15–44 year old.

4.4. Insurance and race

Race and insurance type are known to influence medical treatment. Studies across medical specialties suggest that socio-economically disadvantaged and minority patients are at risk of receiving care that is not deemed the standard of care [27,28]. A study examining the impact of these factors on disposition status in an emergency department setting showed that patients with Medicare or other government insurance were more likely to be admitted to the hospital than privately insured patients. The same study found that members of minority groups were less likely to be admitted [29]. Although in a different setting, these findings mirror our results. Higher admission rates among Medicare/Medicaid recipients may be explainable by the difficulties these patients face regarding follow-up care and medical access [29,30], leading physicians to keep these patients in the hospital. In this context, Fortier et al. report that 19.5% of unanticipated hospital admissions after ambulatory surgery are related to "social reasons" [11].

4.5. Laterality

Surgical reasons for unpredicted disposition status have been reported to be between 38 and 62% [7,8,11]. Performance of bilateral versus unilateral IHR has been studied in the past with no significant impact on rates of overnight admission. However, a trend was seen (9.6% versus 4.3%, respectively), and the study including a sample size of $N = 243$ may have been underpowered to detect significance for this outcome [31]. In our study, when controlling for all other studied factors, patients undergoing bilateral inguinal hernia repair were significantly more likely to have a disposition status other than DCR than those undergoing a unilateral procedure, although the finding was on the borderline of significance.

4.6. Facility and US region

When comparing free-standing and hospital-based ambulatory centers, both univariate and multivariate analysis showed an increased risk of DCR associated with hospital-based centers. This may reflect a number of factors that cannot be captured by the NSAS including lower thresholds for admission, patient selection and triaging to appropriate facilities based on co-morbidities.

Multivariate analysis showed a significantly higher risk of not DCR for patients undergoing procedures in the South, Midwest, and West compared to the Northeast. This suggests that conventions of medical practice in the US may vary by region, emphasizing the need to more closely examine the systems that dictate post-operative care in different regions.

4.7. Limitations

Although we used a large, national sample, our findings must be interpreted in the context of the limitations inherent to secondary data analysis. Administrative databases collect data for many reasons; however, it is rarely for evaluation of clinical practice. As such, information needed to definitively answer questions related to clinical practice is often not available in databases. Our analysis of the NSAS is retrospective in nature and prohibits examination and incorporation of impact factors other than those provided by the survey. One of the biggest concerns surrounding outcome studies based on large databases has been the lack of sufficient risk adjustment to control for differences in patients' overall health status. The NSAS does not provide information on factors such as the ASA physical status. Age and diagnosis codes provide only minimal information about the individual's state of health, especially in the context of ambulatory surgery, in which procedures and documentation tend to be problem-focused. In this context, 99% of patients in our analysis had a single diagnosis code reflecting the diagnosis of inguinal hernia recorded while only 3.4% had a second diagnosis. However, the authors who include ASA class or similar health status classifications in studies evaluating risk factors for prolonged hospital stay or admission after ambulatory surgery have found no [9] or limited impact [5,8] of this variable on the studied outcome. Gold et al. noted in their study of 9616 patients that 96% of patients admitted to the hospital after undergoing ambulatory surgery were ASA class 1 or 2 [10]. Patient preference may also play a role in the type of anesthesia selected, but is not recorded in the NSAS. In addition, despite information about major geographical regions, medical practices may vary on a more local level and thus these differences in practice were not captured by the NSAS. Although administrative databases do not provide definitive answers to clinical questions, they are able to provide a "snap-shot" of practice in time, thus allowing researchers to generate hypotheses for further research.

4.8. Conclusion

In conclusion, we identified a variety of independent risk factors for disposition status other than DCR in the setting of ambulatory inguinal hernia repair. Due to medical innovation and the passage of time, these data may reflect an historical "snap-shot" of practice. However, they may also represent the need to reexamine practice. In light of limitations inherent to analysis of large databases our results should be interpreted with caution. These results appear to confirm other findings in the literature and may be used to generate hypotheses for the prospective trials that are needed for validation of our findings.

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