UC Irvine

UC Irvine Previously Published Works

Title

Unplanned readmission after appendectomy.

Permalink

<https://escholarship.org/uc/item/10m6k56v>

Journal

American journal of surgery, 212(3)

ISSN

0002-9610

Authors

Moghadamyeghaneh, Zhobin
Hwang, Grace
Hanna, Mark H
et al.

Publication Date

2016-09-01

DOI

10.1016/j.amjsurg.2015.08.018

Peer reviewed

Unplanned readmission after appendectomy

Zhobin Moghadamyeghaneh, M.D., Grace Hwang, M.D., Mark H. Hanna, M.D., Joseph C. Carmichael, M.D., Steven Mills, M.D., Alessio Pigazzi, M.D., Ph.D., Michael J. Stamos, M.D.*

*Department of Surgery, University of California,
Irvine, School of Medicine, 333 City Boulevard
West Suite 1600, Irvine, CA, 92868, USA*

Abstract

BACKGROUND: Unplanned readmission of patients who undergo appendectomy is a relatively frequent occurrence. Our aim was to report the most common reasons and the predictors of unplanned readmission after appendectomy.

METHODS: The National Surgical Quality Improvement Program database was used to examine the clinical data of patients undergoing emergent and/or urgent appendectomy during 2012 to 2013. Multivariate regression analysis was performed to identify the predictors of unplanned readmission.

RESULTS: We evaluated a total of 46,960 patients who underwent appendectomy. Of these, 18.5% had perforated appendicitis. Overall, 1,755 (3.7%) of patients had an unplanned readmission. The most common reasons for readmission were intra-abdominal infection (27.3%), nonspecific abdominal pain (7.9%), and paralytic ileus (4.6%). Factors such as perforated appendicitis (adjusted odds ratio [AOR], 1.38; $P < .01$), preoperative sepsis (AOR, 1.30; $P < .01$), and dirty surgical wound (AOR, 1.91; $P < .01$) were associated with unplanned readmission.

CONCLUSIONS: Overall, 3.7% of patients who underwent emergent appendectomy had an unplanned readmission. Intra-abdominal infections and nonspecific abdominal pain are the most common reasons for readmission. Unplanned readmissions are predominantly related to postoperative complications and severity of disease.

Hospital readmission with an incidence rate of 4% to 13% after appendectomy is relatively common in children.¹⁻³ Readmission significantly increases hospital costs and is closely associated with morbidity after appendectomy.^{1,2} More important, hospital readmission is a marker for quality of care which is attributed to substandard care during the index hospitalization, poor resolution of the main problem, and inadequate postdischarge care.⁴ Recently published studies show that 12% to 75% of readmissions may be preventable by pre-discharge assessment, patient education, and postdischarge care.⁴ Investigation of factors associated with hospital readmission will improve hospital care and clinical outcomes.

A number of recent studies have reported relatively high rates of hospital readmission after appendectomy in children (8% to 13%).^{1,2} Numerous factors including the disease stage and management approach (such as appendectomy, drainage, and antibiotics therapy only) have been reported to be associated with readmission after appendectomy in children. However, there are limited published data investigating readmission after appendectomy in adults. This study aims to

investigate and report predictors of unplanned readmission after appendectomy in adults.

Methods

A retrospective study was conducted using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database during 2012 to 2013. American College of Surgeons NSQIP is a nationwide outcome-based database which provides preoperative to 30day postoperative information of surgical patients based on clinical data in the United States.⁵ We analyzed the available data on patients with acute appendicitis who underwent urgent and/or emergent appendectomy. To be eligible for the analysis, patients were required to have the diagnosis of acute appendicitis based on the International Classification of Diseases, 9th Revision, clinical modifications (ICD-9-CM) codes of: 540.0-540.9. The ICD-9 code of 540.0 was used to find patients with acute appendicitis with perforation with or without peritonitis. The ICD-9 code of 540.1 was used to find patients with acute appendicitis with perforation and peritoneal abscess, and the ICD-9 code of 540.9 was used to find patients with acute appendicitis without perforation, rupture, or peritonitis with or without gangrenous. Patients who had ICD-9 codes of 540.0 or 540.1 were considered to have a perforated appendicitis with or without peritonitis or abscess. We only included patients who underwent appendectomy based on the current procedural terminology codes of 44,950, 44,960, 44,970, and 44,979. We excluded all patients who underwent appendectomy concomitant with other major procedure and patients who had elective operation. Unplanned readmission was defined based on the original NSQIP variable which was readmission (to the same or another hospital), for any reason, within 30 days after the principal operative procedure. The readmission has to be classified as an 'inpatient' stay by the readmitting hospital, or reported by the patient and/or family as such.

Numerous patient and operative factors were analyzed including: demographic data (age, sex, and race); comorbid conditions, such as chronic steroid use, congestive heart failure, renal failure with need for dialysis, diabetes mellitus, severe chronic obstructive pulmonary disease, ascites, and hypertension requiring medication. Other factors analyzed included: American Society of Anesthesiologists class score, body mass index, operation length, hospitalization length, preoperative white blood cell count, surgical approach (open vs laparoscopic), presence of complications (peritonitis or peritoneal abscess), and wound classification (clean, clean-contaminated, contaminated, and dirty). The primary end points investigated were prevalence, reasons for, and predictors of unplanned readmission.

Statistical analysis

The statistical analysis was conducted using the SPSS software statistical package Version 22 (SPSS Inc., Chicago, IL). Multivariate statistical analysis using logistic regression was conducted to estimate the association between perioperative factors and unplanned readmission. Multivariate logistic linear regression analysis was used for linear outcomes. Risk adjustment was done for all variables of the study including demographic data, all comorbid conditions, hospitalization length, body mass index, disease stage, wound classification, surgical approach (open vs laparoscopic), preoperative white blood cell count, and operation length. The adjusted odds ratio with a 95% confidence interval was calculated, and *P* values less than .05 indicate statistical significance.

Variables	Patients without unplanned readmission (45,205)	Patients with unplanned readmission (1,755)	P value
Age, years			
Mean $\pm$ SD	40 $\pm$ 16	45 $\pm$ 18	<.01
Median	36	44	—
Sex			
Female	21,819 (48.3%)	829 (47.2%)	.39
Race			
White	32,547 (83.6%)	1,244 (82.8%)	.39
Black or African American	3,168 (8.1%)	164 (10.9%)	<.01
Asian	2,608 (6.7%)	77 (5.1%)	.01
Other	612 (1.6%)	18 (1.2%)	.25
Body mass index			
Mean $\pm$ SD	28.1 $\pm$ 6.7	28.6 $\pm$ 7.1	<.01
Median	27	27	—
White blood cell count			
Mean $\pm$ SD (cell/mm ³)	13.1 $\pm$ 4.3	13.4 $\pm$ 4.7	<.01
Median	13	13.2	—
Comorbidity			
Hypertension	7,238 (16%)	463 (26.4%)	<.01
Diabetes mellitus	2,105 (4.7%)	151 (8.6%)	<.01
Chronic obstructive pulmonary disease	456 (1%)	49 (2.8%)	<.01
Chronic steroid use	477 (1.1%)	47 (2.7%)	<.01
Congestive heart failure	53 (.1%)	8 (.5%)	<.01
Bleeding disorders	857 (1.9%)	100 (5.7%)	<.01
Ascites	45 (.1%)	7 (.4%)	<.01
Dialysis	86 (.2%)	15 (.9%)	<.01
Perforation			
Perforated appendicitis*	8,022 (17.7%)	666 (37.9%)	<.01
Nonperforated appendicitis†	37,183 (82.3%)	1,089 (62.1%)	<.01
Disease stage			
Acute appendicitis without mention of perforation, peritonitis, or rupture‡	37,183 (82.3%)	1,089 (62.1%)	<.01
Acute appendicitis with peritoneal abscess	2,484 (5.5%)	211 (12%)	<.01
Acute appendicitis with perforation, peritonitis, or rupture	5,538 (12.3%)	455 (25.9%)	<.01
ASA class‡			
I	15,493 (34.3%)	422 (24%)	<.01
II	23,953 (53%)	896 (51.1%)	<.01
III	5,268 (11.7%)	391 (22.3%)	<.01
IV	449 (1%)	46 (2.6%)	<.01
Operation length			
Mean $\pm$ SD (minutes)	50 $\pm$ 38	60 $\pm$ 35	<.01
Median	43	52	—
Hospitalization length			
Mean $\pm$ SD (days)	2 $\pm$ 7	3 $\pm$ 3	<.01
Median	1	2	—
Surgical approach			
Laparoscopic	41,003 (90.7%)	1,471 (83.8%)	<.01
Open	4,202 (9.3%)	284 (16.2%)	<.01
Other factors			
Preoperative sepsis/septic shock	4,778 (10.6%)	436 (24.8%)	<.01

SD = standard deviation.
 *With or without abscess or peritonitis.
 †Includes gangrenous appendicitis.
 ‡The American Society of Anesthesiologists score.

Results

A total of 46,960 patients underwent appendectomy for acute appendicitis were identified during 2012 to 2013. The median age was 36 years, and most the patients were Caucasian (83.6%) and male (51.8%). The most common comorbidities included hypertension (16.4%) and diabetes mellitus (4.8%). Demographics of the patient population based on unplanned readmission are described in Table 1. Among all the patients who met inclusion criteria, 81.5% had

acute appendicitis without peritonitis, 5.7% had acute appendicitis with peritoneal abscess, and 12.8% had acute appendicitis with generalized peritonitis.

Laparoscopic approach was used for 90.4% of patients, and 9.6% of laparoscopic procedures were converted to open surgery. Overall, 1,755 (3.7%) of patients had unplanned readmission within 30 days of operation. Of these, 82% of unplanned readmissions were directly related to the appendectomy procedure.

Overall, 1,755 (3.7%) of patients had unplanned readmission within 30 days of operation. Of which 81.8% of unplanned readmissions were directly related to the appendectomy procedure. Patients with unplanned readmissions doubled their risk of mortality compared with patients without (adjusted odds ratio, 2.62; $P = .01$). The most common reasons for unplanned readmission after appendectomy are reported in Table 2, with intra-abdominal infections (27.3%), unspecified abdominal pain (7.9%), and paralytic ileus (4.6%) being among the most common causes.

Table 3 describes the associations between perioperative variables and unplanned readmission. Factors such as open surgery, perforated appendicitis, hospitalization more than 3 days, preoperative sepsis and/or septic shock, bleeding disorders, chronic steroid use, and operation length were associated with unplanned readmission.

Reason of readmission	Number	Rate (%)
Organ space surgical site infection	479	27.3
Unspecified abdominal pain	140	7.9
Paralytic ileus	80	4.6
Obstruction	75	4.2
Superficial incisional surgical site infection	63	3.6
Postoperative infection (unspecified)	60	3.4
Deep incisional surgical site infection	46	2.6
Hematoma	30	1.7
Pneumonia	28	1.6
Sepsis	27	1.5
Peritoneal abscess	22	1.2
Pulmonary embolism	20	1.1
Fever	19	1
Hernia with obstruction	16	.9
Intestinal infection due to <i>Clostridium difficile</i>	15	.9
Deep vein thrombosis	14	.8
Dehydration	9	.5
Progressive renal insufficiency	9	.5
Wound disruption	8	.5
Malignancy in appendix	8	.5
Urinary tract infection	6	.3

Fig. 1 reports timing of unplanned readmission after appendectomy. Overall, 71.3% of readmissions were occurred within 2 weeks of the operation. Also, 15.3% of patients with unplanned readmission required reoperation.

Comments

Unplanned readmission is uncommon for adult patients undergoing appendectomy. However, it is associated with a significant increase in mortality. We observed that most unplanned readmissions after appendectomy are directly related to the procedure rather than any changes in patients' comorbid diseases

(81.8%). We found the rate of unplanned readmission after appendectomy in adults was about 3.7%, which is lower than the 4% to 13% readmission rate in children.^{1,2} Considering that the disease stage, mortality, and postoperative morbidity are generally similar between adults and children, the lower rate of readmission after adult appendectomy may be related to the inability of NSQIP to track all patients readmitted after appendectomy because of hospitalization in hospitals other than NSQIP registered hospitals.⁶ Nevertheless, the higher rate of readmission after appendectomy in children may be related to insufficient education to the patient and parents. The readmission rate after appendectomy in children may be reduced by parent education, explaining possible postoperative expectations, and potential complications. This education process should start preoperatively and include clear discharge instructions as well as follow-up details.

Our study results show that intra-abdominal infection is the leading cause of unplanned readmission after appendectomy. Similar results have been previously reported in children.^{3,7} Intra-abdominal infection is a common problem after appendicitis, which consumes approximately 11 million hospital days each year in the US.^{8,9} Early detection and appropriate management of intra-abdominal abscess, and proper use of antibiotics (such as those set forth by the Surgical Infection Society and the Infectious Diseases Society of America) may decrease the rate of readmission for intra-abdominal infections.⁸ We have found that unspecific abdominal pain is the second most common reason for readmission after appendectomy. Investigation of postoperative complications such as intra-abdominal infections should be done for patients with abdominal pain after operation before discharge. In addition, preoperative abdominal pain may continue postoperatively in patients with falsely positive appendicitis. Such patients require additional work up for the cause of abdominal pain after appendectomy. Also, proper education regarding the postoperative expectations may decrease readmission rates in patients with unspecified abdominal pain. Our results show that paralytic ileus and/or obstruction is the 3rd most common cause of unplanned readmission. The incidence of postoperative paralytic ileus and/or obstruction has been reported to be .16% to 10.7% after appendectomy.¹⁰⁻¹² Serious postoperative complications such as intra-abdominal infections and colonic perforation must be ruled out in patients with paralytic ileus. Although the degree of intraoperative inflammation appears to be related to this phenomenon,¹³ the highest rate of paralytic ileus and/or obstruction has been reported in patients with the normal appendix.¹¹ This may be explained by searching in abdominal cavity for other pathologies that must be ruled in presence of a normal appendix, which is associated with activation of proinflammatory cytokines and subsequent adhesion formation.^{11,14}

We found that most patients with acute appendicitis underwent laparoscopic appendectomy. These patients had significantly lower rate of unplanned readmission compared with patients who underwent open appendectomy.

Laparoscopic appendectomy has been reported as the preferred method in managing acute appendicitis compared with open surgery, with significantly lower rate of infectious complications.¹⁵ However, the choice to start with an open procedure likely is a reflection of disease severity and/ or surgeon preference guided by disease severity rather than inaccessibility of laparoscopic equipment in most centers, and surgical approach is not always a choice that can be modified to prevent readmission after appendectomy.

Table 3 Risk-adjusted analysis of predictors of unplanned readmission after appendectomy

Variables	Adjusted odds ratio	95% confidence interval	P value
Age, years			
Age	1.005	1.001–1.009	.01
Sex			
Female	1	.90–1.11	.92
Comorbidity			
Bleeding disorders	1.67	1.30–2.14	<.01
Hypertension	1.05	.90–1.22	.49
Diabetes mellitus	1.05	.86–1.30	.58
Chronic obstructive pulmonary disease	1.30	.92–1.82	.12
Chronic steroid use	1.59	1.13–2.24	<.01
Congestive heart failure	1.45	.65–3.25	.36
Ascites	1.34	.57–3.15	.49
Dialysis	1.81	.99–1.31	.05
ASA class*			
I	Reference	Reference	Reference
II	1.13	.99–1.30	.06
III	1.20	1.06–1.36	<.01
IV	1.24	1.01–1.54	.04
Surgical approach			
Laparoscopic	Reference	Reference	Reference
Open	1.17	1.01–1.36	.04
Wound class			
Clean/contaminated	Reference	Reference	Reference
Contaminated	.98	.85–1.14	.85
Dirty	1.91	1.60–2.28	<.01
Disease stage			
Acute appendicitis without mention of perforation, peritonitis, or rupture†	Reference	Reference	Reference
Acute appendicitis with peritoneal abscess	1.11	.90–1.37	.31
Acute appendicitis with perforation, peritonitis, or rupture	1.30	1.11–1.52	<.01
Perforation			
Nonperforated appendicitis‡	Reference	Reference	Reference
Perforated appendicitis‡	1.38	1.20–1.60	<.01
Other factors			
Preoperative sepsis/septic shock	1.30	1.12–1.51	<.01
Presence of postoperative complications during hospitalization§	1.09	.90–1.32	.34
Body mass index	.99	.98–1	.37
Operation length	1.002	1.001–1.003	<.01
White blood cell count	.99	.99–1.01	.48
Hospitalization longer than 3 days	1.31	1.13–1.52	<.01

*The American Society of Anesthesiologists score.

†Includes gangrenous appendicitis.

‡With or without abscess or peritonitis.

§Includes superficial surgical site infection, deep surgical site infection, organ space surgical site infection, pneumonia, deep vein thrombosis, pulmonary embolism, ventilator dependency, unplanned intubation, sepsis, septic shock, acute renal failure, progressive renal insufficiency, myocardial infarction, wound disruption, cardiac arrest, urinary tract infection, and hemorrhagic complications.

Figure 1 Timing of unplanned readmission after appendectomy.

Patients with complicated appendicitis may require a higher level of postoperative care. This study found a number of factors which are statistically associated with unplanned readmission after appendectomy. We have found that readmissions were more frequently attributable to the disease stage. We have found that patients with acute appendicitis with perforation have a significantly higher risk of unplanned readmission. In addition, there is a significantly higher rate of unplanned readmission in patients with preoperative sepsis and/or septic shock. Similar findings were reported previously.² Also, patients with dirty surgical wounds had a significantly higher rate of unplanned readmission. Associations between sepsis, white blood cell count (WBC), dirty surgical wound, and perforated appendicitis with unplanned readmission reinforce the association between disease stage and unplanned readmission. However, we could not find any significant associations between the presence of postoperative complications during hospitalization and unplanned readmission. This could be related to the short median hospitalization length for patients with appendicitis (1 day) and a big percentage of postoperative complications (40.7%) happened after discharge. For other factors which are statistically associated with unplanned readmission it is unclear if the correlations are clinically significant. However, comorbidities of bleeding disorders and chronic steroid use may be clinically relevant associations with unplanned readmission. Vitamin A may dampen the inflammatory response of corticosteroids before appendectomy.¹⁶ Also, in patients with the history of

bleeding disorders, correcting the bleeding disorders preoperatively, and using a multidisciplinary approach (such as hematologists and specialized nurses) in the surgical management for such patients may decrease risk of unplanned readmission. Patients with complicated appendicitis, bleeding disorders, and chronic steroid use are potential targets for hospitals working to reduce postsurgical readmissions.

Hospitalization length may predict the risk of postoperative readmission after appendectomy. We have found that the median hospitalization length is 1 day for patients with acute appendicitis. However, patients who were hospitalized for more than 3 days had a 31% increased risk of unplanned readmission. Discharge within 48 hours of appendectomy is safe in selected patients and does not put patients at greater risk for readmission. One reason may be that healthier patients with an uncomplicated appendicitis are more likely to be discharged within 48 hours of operation and have less risk factors for readmission. Similar results have been reported after general, vascular, and thoracic operations.¹⁷ Longer initial hospitalization in patients requiring readmission can be related to the undiagnosed complications during the first hospitalization as we found a large portion of postoperative complications after appendectomy happen after hospital discharge. Although patients with hospitalization longer than 3 days had higher rates of in-hospital complications, there was no significant association between the presence of in-hospital complications and unplanned readmission.

Our analyses identify several factors that influence hospital readmission which can provide clinical insights into the identification of high-risk patients. Adequate perioperative care and early detection and adequate management of complications may decrease the risk of unplanned readmission. Also, evidence suggests that patients education may decrease the readmission rate.¹⁸ Our study shows that only a small percentage (15.3%) of patients with unplanned readmission requires reoperation. Considering that a large portion of patients were discharge from the hospital the day after operation, and the rate of readmission is obviously higher in the 1st week after operation (Fig. 1), improving postdischarge care as well as patients education may decrease readmissions rates. Finally, it is essential to note that many unplanned readmissions may be unavoidable and related to the stage of disease or poor general conditions of patients, and surgeons should not be deterred from readmitting patients because of concerns about quality measure performance and resulting consequences.

Study limitations

This study is a large retrospective review based on administrative data, and as with such studies, is limited in its ability to produce cause–effect relationships. Data in this study were extracted from the discharge data and coding errors may potentially have occurred.¹⁹ The study's data have been collected from more than 500 hospitals across the United States and the wide variation in hospital setting, hospital quality, surgical strategy, and surgeons' expertise may confound the study. Using large databases small differences between groups of patients may reach statistical significance. However, they may not have true clinical significance. ICD-9 separates patients with perforated appendicitis from patients without perforation. However, in the perforated appendicitis group it is impossible to separate patients with peritonitis from patients without peritonitis using ICD-9 codes. Also, in the nonperforated appendicitis group it is impossible to separate patients with gangrenous appendicitis from patient with catarrhal appendicitis. Although ICD-9 clarified perforated appendicitis with gangrenous appendicitis, it is difficult to

separate perforated appendicitis from gangrenous appendicitis, and some patients with gangrenous appendicitis may have perforation which was not reported. This study finds 5.7% of patients with acute appendicitis who were operate emergent and/or urgently had peritoneal abscess. However, some patients with acute appendicitis and peritoneal abscess do not get an appendectomy urgently and the reported number probably underestimates the actual rate of peritoneal abscess in patients with acute appendicitis. The NSQIP database did not collect some important information such as management of readmitted patients and hospital charges. Also, NSQIP does not include information of patients younger than 18 years old. Despite these limitations, this study is one of the first to report predictors of unplanned readmission after appendectomy in adults.

Conclusions

Unplanned readmission occurs at a rate of 3.7% after appendectomy in adults. Although only 15.3% of readmitted patients required reoperation, the mortality risk of readmitted patients is increased considerably. A large proportion of readmissions occur within the 1st week after surgery and 82% of readmissions were directly related to the appendectomy. Intra-abdominal infections and nonspecific abdominal pain are the most common reasons for readmission. Unplanned readmissions are predominantly related to postoperative complications and severity of disease. Among comorbid factors, patients with bleeding disorders and chronic steroid use are potential targets for hospital efforts to reduce postsurgical readmissions.

References

1. Rice-Townsend S, Gawande A, Lipsitz S, et al. Relationship between unplanned readmission and total treatment-related hospital days following management of complicated appendicitis at 31 children's hospitals. *J Pediatr Surg* 2013;48:1389–94.
2. Rice-Townsend S, Hall M, Barnes JN, et al. Hospital readmission after management of appendicitis at freestanding children's hospitals: contemporary trends and financial implications. *J Pediatr Surg* 2012; 47:1170–6.
3. Kelly KN, Fleming FJ, Aquina CT, et al. Disease severity, not operative approach, drives organ space infection after pediatric appendectomy. *Ann Surg* 2014;260:466–71; discussion 472–3.
4. Benbassat J, Taragin M. Hospital readmissions as a measure of quality of health care: advantages and limitations. *Arch Intern Med* 2000;160: 1074–81.
5. National Surgical Quality Improvement Program [Home Page on the Internet]. Chicago, IL: American College of Surgeons; 2005 [cited 2012 Jan 17] Available from: www.acsnsqip.org; 2005.
6. Lee SL, Ho HS. Acute appendicitis: is there a difference between children and adults? *Am Surg* 2006;72:409–13.
7. Merkow RP, Ju MH, Chung JW, et al. Underlying reasons associated with hospital readmission following surgery in the United States. *JAMA* 2015;313:483–95.
8. Solomkin JS, Mazuski JE, Bradley JS, et al. Diagnosis and management of complicated intra-abdominal infection in adults and children: guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. *Clin Infect Dis* 2010;50: 133–64.

9. DeFrances CJ, Cullen KA, Kozak LJ. National Hospital Discharge Survey: 2005 annual summary with detailed diagnosis and procedure data. *Vital Health Stat* 13; 2007;1–209.
10. Duron JJ, Hay JM, Msika S, et al. Prevalence and mechanisms of small intestinal obstruction following laparoscopic abdominal surgery: a retrospective multicenter study. French Association for Surgical Research. *Arch Surg* 2000;135:208–12.
11. Leung TT, Dixon E, Gill M, et al. Bowel obstruction following appendectomy: what is the true incidence? *Ann Surg* 2009;250:51–3.
12. Andersson RE. Small bowel obstruction after appendectomy. *Br J Surg* 2001;88:1387–91.
13. Saba AA, Godziachvili V, Mavani AK, et al. Serum levels of interleukin 1 and tumor necrosis factor alpha correlate with peritoneal adhesion grades in humans after major abdominal surgery. *Am Surg* 1998;64:734–6; discussion 737.
14. Wang Y, Reen DJ, Puri P. Is a histologically normal appendix following emergency appendectomy always normal? *Lancet* 1996;347:1076–9.
15. Ming PC, Yan TY, Tat LH. Risk factors of postoperative infections in adults with complicated appendicitis. *Surg Laparosc Endosc Percutan Tech* Jun 2009;19:244–8.
16. Anstead GM. Steroids, retinoids, and wound healing. *AdvWound Care* Oct 1998;11:277–85.
17. Lucas DJ, Haider A, Haut E, et al. Assessing readmission after general, vascular, and thoracic surgery using ACS-NSQIP. *Ann Surg* 2013;258: 430–9.
18. Shepperd S, McClaran J, Phillips CO, et al. Discharge planning from hospital to home. *Cochrane Database Syst Rev*; 2010:CD000313.
19. Lorence DP, Ibrahim IA. Benchmarking variation in coding accuracy across the United States. *J Health Care Finance* 2003;29:29–42.

The authors declare no conflicts of interest.

Presented as a poster presentation at the Society for Surgery of the Alimentary Tract/Digestive Disease Week, May 17, 2015.

* Corresponding author. Tel.: 11-714-456-6262; fax: 11-714-4566377.

E-mail address: mstamos@uci.edu

Manuscript received April 25, 2015; revised manuscript July 26, 2015