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Preoperative frailty is associated with discharge to skilled or assisted living facilities after urologic procedures of varying complexity

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Abstract (250/250 words)

Objective: To evaluate the association between frailty and post-operative discharge destination after different types of commonly performed urologic procedures in older patients.

Materials and Methods: Using data from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) from 2011-2013, we

identified commonly performed inpatient urologic procedures among patients age 65 and older. We then assessed the effect of frailty, measured by the NSQIP Frailty Index (NSQIP-FI), on discharge to a skilled or assisted living facility using logistic regression and assessed the heterogeneity of this effect across procedures using two-level random effects modeling.

Results: Overall, 1,144 out of 20,794 (5.5%) urologic cases, representing 19 different procedures, resulted in discharge to a skilled or assisted living facility. Cystectomy and large TURBT had the highest percentage (16.3%). Twenty-five percent of patients undergoing urology procedures were frail (NSQIP-frailty index [FI] 0.18+), including 9.8% of patients discharged to a facility. Even after adjustment for year, age, race, type of anesthesia, smoking status, recent weight loss, and whether or not the procedure was elective, frailty was strongly associated with discharge to a facility [adjusted OR 3.1 (96% CI 2.5, 3.8) for NSQIP-FI 0.18+ compared to NSQIP FI 0]. This finding was consistent across most procedures of varying complexity with an overall effect of OR 1.6 (95% CI 1.5, 2.0).

Conclusions: Increasing frailty is associated with discharge to a skilled or assisted living facility across most inpatient urologic procedures evaluated, regardless of complexity. This information is important for preoperative counseling with patients undergoing urologic surgery.

Introduction

More than two-thirds of all urologic procedures are performed in individuals ages 65 years and older.[1] Some of these individuals experience acute functional

decline after surgery and are unable to return home immediately post-operatively.[2] While 10-40% of older individuals undergoing various non-urologic surgeries are discharged to skilled or assisted living facilities,[3-8] similar data on urologic surgery are limited to complex procedures such as cystectomy, and information on more commonly performed urologic procedures is lacking.

Frailty, expressed as a physiologic decrease in capacity resulting from stressors, has been identified as a risk factor for non-home discharge among patients undergoing non-urologic surgery.[3,9,10] The effect of frailty on patients undergoing urologic surgery, however, has been limited to 30-day morbidity and mortality,[11-14]and its effects on discharge destination have not been well characterized. This is problematic because discharge to a facility can be life changing for an individual, is strongly associated with increased 12 month mortality,[3] and is very costly to society.[15]

Using data from the American College of Surgeons National Quality Improvement Program (ACS NSQIP), we examined baseline frailty and its association with discharge to skilled or assisted living facilities among patients undergoing various types of inpatient urologic surgery of varying complexity in the United States from 2011 to 2013.

Materials and Methods

Patients and Databases

We used data from the ACS NSQIP Participant Data Use File from 2011 to 2013 to conduct a retrospective cross-sectional study. This study was determined to be exempt by our institution's Institutional Review Board. The NSQIP database

uses clinical reviewers employed by each hospital and specifically trained by the ACS to examine patient records and extract post-operative clinical data and outcomes up to 30 days, including discharge destination.[16] Clinical reviewers are selected by each site and are specifically trained and monitored in a uniform manner across all sites to ensure quality resulting in reliable and robust data. Inter-rater disagreement across all variables in the NSQIP dataset is low, at 1.5% and kappa values suggest substantial or almost perfect agreement for most variables.[17]

We identified urologic cases by the surgical subspecialty variable for all procedures except for sling operations for stress incontinence, which also included procedures performed by gynecologists. We then narrowed our focus to the 20 most commonly performed urologic procedures in the inpatient setting during our study period in the NSQIP database. Two of the codes identified were for cystectomy and were therefore combined for analyses, leaving 19 separate procedures in total. Of note, the code for laparoscopic prostatectomy includes robotic prostatectomy.

Outcomes

Our primary outcome of interest was discharge destination. Patients discharged to skilled care facilities (e.g., transitional care units, subacute hospitals, ventilator beds, and skilled nursing homes), assisted living and other care facilities that are not skilled nursing homes and were not the patient's home preoperatively, and rehab facilities were categorized as "discharged to a skilled or assisted living facility". We excluded patients who died, came from a facility preoperatively, or

whose discharge status was unknown. All other patients were categorized as being discharged to home.

Covariates

We used the NSQIP Frailty Index (NSQIP-FI) in order to calculate frailty in our cohort. The NSQIP-FI was adapted from the Canadian Heath and Aging-Frailty Index (CSHA-FI) for use specifically with NSQIP data and includes items such as functional status and impaired sensorium that can easily be solicited from patient history. This index has been demonstrated to have greater precision in measuring frailty than the Charlson Comorbidity Index, and has been shown to distinctly measure frailty, as opposed to comorbidity, in all surgical subspecialties including urology. The NSQIP-FI items include the following: history of diabetes, impaired functional status, history of chronic obstructive pulmonary disease (COPD) or pneumonia, history of congestive heart failure, history of myocardial infarction within 6 months of surgery, history of percutaneous coronary intervention, cardiac surgery, or angina, being on hypertensive medications, peripheral vascular disease or rest pain, impaired sensorium, transient ischemic attack or cerebral vascular accident defined as focal neurologic deficits of sudden onset and brief duration, and cerebrovascular accident with deficit defined by history of cerebrovascular accident with persistent residual dysfunction. NSQIP-FI scores are summed and divided by the total number of items (11). Patients with 2 or more frailty items on the NSQIP-FI with a score of 0.18 (2/11) or greater were defined as frail for the purposes of this paper, consistent with the literature.[18,19]

Additional baseline covariates for demographic and case-based characteristics were abstracted from the NSQIP database. These include the following: calendar year of the procedure, age (by decade), race, type of anesthesia, smoking status, recent weight loss (defined as >10% loss of body weight in the last 6 months), and whether or not the surgery was performed electively. Of note, we purposefully chose variables that would be available to surgeons in the preoperative period so that findings from this study could be applied to the preoperative counseling discussion.

Statistical Analysis

Demographic and case-based characteristics were reported as frequencies and percentages. Items were compared based on discharge destination (home versus skilled or assisted living facility) using chi square tests for significance. In order to evaluate the demographic and case-based characteristics associated with discharge to a skilled or assisted living facility, unadjusted and adjusted logistic regression modeling was performed adjusting for calendar year, age, race, type of anesthesia, smoking status, recent weight loss, whether or not the procedure was elective, and NSQIP-FI.

Because we looked at a heterogeneous mix of urologic procedures, we wanted to determine whether certain procedures were driving our results or if our results were generalizable across procedures. In order to do this we used a two-level random effects model in which the association between frailty and discharge to a skilled or assisted living facility was assessed both within each procedure and then across procedures. Due to low numbers of discharges to skilled or assisted living

facilities for sling procedures for stress urinary incontinence, laparoscopic partial nephrectomy and prostatectomy with lymph node dissection, these procedures were excluded from this part of the analysis. The log odds ratios (and 95% CIs) were combined using random effects models to provide a summary of the association between frailty and discharge to a skilled or assisted living facility across procedures. Models compared NSQIP-FI >/=0.18 in reference to NSQIP FI=0.

Results

Among the 19 most commonly performed urologic procedures in the NSQIP database from 2011 to 2013 there were 21,938 individuals discharged home and 1,144 (5.5%) individuals discharged to a skilled or assisted nursing facility. Baseline demographic and surgical characteristics are described in Table 1. Overall, 25% of patients undergoing these 19 commonly performed inpatient urologic surgeries were frail and 9.8% of frail patients were discharged to a skilled or assisted living facility. This proportion was higher than other subgroups examined – 5.2% of individuals ages 71-80, 6.4% of African Americans, 5.4% of patients undergoing general anesthesia, and 6.9% of smokers were discharged to skilled or assisted living facilities. Notably, 18.1 % of older individuals with recent weight loss and 17.1% who underwent non-elective surgery were discharged to such facilities.

Frequencies of discharge to a skilled or assisted living facility for specific urologic procedures are listed in Table 2. Of note, the inpatient urologic procedure with the highest frequency of discharge to a facility was cystectomy and large transurethral resection of bladder tumor (TURBT) (16.3%) followed by nephrectomy with lymph node dissection (12.6%). The procedures with the lowest

frequency of discharge to a skilled or assisted living facility were sling surgery for stress urinary incontinence, laparoscopic/robotic prostatectomy, and prostatectomy with lymph node dissection (all <1.0%).

Unadjusted and adjusted logistic regression models identifying factors associated with discharge to a skilled or assisted living facility are shown in Table 3. Increasing frailty was associated with higher odds of discharge to a skilled or assisted living facility [adjusted OR 1.5 (95% CI 1.2, 1.9) for NSQIP-FI 0.09 and adjusted OR 3.1 (95% CI 2.5, 3.8) for NSQIP-FI 0.18+], when compared to NSQIP-FI 0.

Additional variables associated with discharge to a skilled or assisted living facility include increasing age [adjusted OR 2.9 (95% CI 2.4, 3.5) for ages 71-80 and adjusted OR 8.7 (95% CI 7.2, 10.7) for ages 80+ compared to ages 65-70], smoking status [adjusted OR 1.7 (95% CI 1.4, 2.1)], and recent weight loss [adjusted OR 2.5 (95% CI 1.8, 3.5)]. Races other than white or African American [adjusted OR 0.6 (95% CI 0.4, 0.9)], anesthesia techniques other than general or monitored assisted care (MAC) [adjusted OR 0.3 (95%CI 0.2, 0.5)], and elective surgery [adjusted OR 0.4 (95% CI 0.3, 0.5)] were all associated with a decreased likelihood of being discharged to a skilled or assisted living facility.

We found that frailty was associated with discharge to a skilled or assisted living facility for most inpatient urologic procedures examined with the exception of laser TURP [log odds effect -0.08 (95% CI -0.7, 0.6)]. Nephrectomy with lymph node dissection, TURP regrowth, medium size TURBT, laparoscopic nephrectomy, partial nephrectomy, small TURBT, open prostatectomy all had a similar trend but did not

reach statistical significance. The remainder of the procedures evaluated demonstrated a significant association between increased frailty and discharge to a skilled or assisted living facility including the following: cystectomy, large TURBT, laparoscopic nephrectomy with lymph node dissection, laparoscopic/robotic prostatectomy, radical nephrectomy, TURP, nephrectomy with partial ureterectomy and prostatectomy with extended lymph node dissection. The overall log OR of the summary statistic across all procedures was significant at 0.5 (95% CI 0.4, 0.7). Of note, this is a log odds ratio, not an odds ratio, so any number exceeding 0 represents a positive result. A log odds ratio of 0.5 is equivalent to and odds ratio of 1.6.

Conclusions

We found that frailty is strongly associated with discharge to skilled or assisted living facilities among patients undergoing most types of inpatient urologic surgery of varying complexity. Additionally, discharge to a skilled or assisted living facility was associated with older age, smoking and recent weight loss, while races other than white and African American, anesthesia techniques other than general, and the surgery being elective were associated with a decreased likelihood of discharge to these facilities. For specific procedures, overall discharge rates to skilled or assisted living facilities ranged from <1% for sling surgery for stress urinary incontinence, laparoscopic/robotic prostatectomy, and prostatectomy with lymph node dissection to 16.3% after cystectomy and large TURBT.

Our finding that increasing frailty was significantly associated with increasing log odds of discharge to a skilled or assisted living facility was consistent

across many urologic inpatient procedures ranging from and TURP to laparoscopic prostatectomy to various nephrectomy procedures to cystectomy. For the few procedures in which frailty did not reach statistical significance for this association, they did follow the same trend of a positive association between frailty and discharge to skilled or assisted living facilities. Thus, the importance of considering frailty in the pre-operative setting exists for both "big" and "small" procedures and should be considered in pre-operative discussions among older patients.

Studies examining discharge status for patients undergoing urologic surgery are limited and focus primarily on oncologic procedures. One study using the Nationwide Inpatient Sample found that 13.2% of patients undergoing cystectomy were discharged to subacute care facilities in the year 2000,[20] which is similar to our estimate of 16.3% now 10 years later. In our study, cystectomy was associated with a higher use of non-home discharges than any other urologic procedure except large TURBT. However, this number is lower than other types of non-urologic procedures among older adults, such as colectomy (40%), pancreatectomy (46%), open abdominal aortic aneurysm repair (45%)[21]and hip fracture surgery (35%).[4] While the reason behind the lower discharge rates to skilled and assisted living facilities among urologic procedures compared to these non-urologic procedures is beyond the scope of this study, some hypotheses may include that urologic patients are healthier, that urologic procedures are well tolerated by older individuals, or that urologists may be underutilizing post operative care in such facilities. Overall, however, the number of patients discharged to such facilities after urologic surgery is relatively low.

Studies from outside the field of urology have also identified several factors, such as frailty, associated with non-home discharges. One study evaluated patients undergoing major elective procedures including general, cardiac, thoracic, urologic and vascular surgery, who were admitted to the intensive care unit post-operatively. Up to 30% of these patients required discharge to an institution other than home and factors for this outcome included several variables related to frailty: older age, Charlson >/=3, Hematocrit <35%, any functional dependence, Up-and-Go test >/=15 seconds, albumin <3.4 mg/dL, Mini-Cog>/=3, and having fallen in the last 6 months. Further analysis using multivariate logistic regression found that a prolonged Up-and-Go test and any functional dependence were the strongly associated with discharge to an institutional facility.[22] Additional studies in women undergoing surgery for epithelial ovarian cancer found that 12.8% of women had non-home discharges post-operatively, similar to our rates for many urologic procedures in our study. Advanced age, worse ECOG performance status, greater ASA score and higher CA-125 were all identified as risk factors for non-home discharges.[10] Advanced age, poor functional status, and inpatient complications were also strongly associated with non-home discharges among patients undergoing colectomy, pancreatectomy, and open abdominal aortic aneurysm repair.[21]

This study should be interpreted with certain limitations in mind. First, we are limited by the nature of the NSQIP database in the level of detail that is available for analysis and for the definition of frailty. However, we used the NSQIP-FI, which is a validated instrument designed to measure frailty using these data.[18] Further, the nature of the data do not allow us to understand the reasons why individuals were

discharged to skilled or assisted living facilities (including social and environmental factors such as caregiver support and accessibility of the home environment) and we cannot evaluate whether our findings represent under or overutilization of such resources. Another limitation of this study is that it uses data collected from hospitals that volitionally report their outcomes to the ACS. These institutions may differ from those who are not a part of this database and may not be generalizable beyond this group of hospitals. Additionally, there are several other factors that may influence discharge to a skilled or assisted living facility that relate to the hospitalization, such as length of stay and post-operative complications, that were not evaluated in this study. Socioeconomic status is another factor that we could not evaluate because it is not collected as part of the NSQIP data. We chose to only evaluate factors that were available pre-operatively since the purpose of this study was to assist in the pre-operative counseling process.

Frailty is common among patients who undergo urologic surgery -- 25% of individuals undergoing common urologic procedures qualified as frail, based on our study criteria. Increasing frailty was associated with discharge to a skilled or assisted living facility among patients undergoing most types of urologic surgery of varying complexity. Overall, however, the number of patients discharged to such facilities after urologic surgery is low, indicating that these patients tend to do well. These data can be used in preoperative counseling of patients undergoing urologic surgery, as knowledge of possible discharge to a non-home facility may influence the decision-making process and should be a part of pre-operative counseling for older patients.

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Legend:

Figure 1. Impact (log odds) of increasing NSQIP FI on discharge to a skilled or assisted living facility by urologic procedure. Models compared NSQIP-FI >/=0.18 in reference to NSQIP-FI=0. Data represent a multivariable logistic regression model adjusted for year, age, race, type of anesthesia, smoking status, recent weight loss, and whether or not the procedure was emergent.

Table 1. Characteristics of patients discharged home vs to a skilled or assisted living facility

	Home (n=20,794)		Skilled/assisted living facility (n=1,144)		
	freq	%	Freq	%	P value
Year					
2011	5523	95.0	291	5.0	0.10
2012	7262	95.1	376	4.9	
2013	8009	94.4	477	5.6	
Age					
65-70	9405	98.1	184	1.9	<0.01
71-80	8234	94.8	453	5.2	
80+	3155	86.2	507	13.8	
Race					
White	14133	94.0	902	6.0	0.07
African American	1017	93.6	69	6.4	
Other	563	96.2	22	3.8	
Anesthesia					
General	18064	94.6	1038	5.4	<0.01
MAC	143	88.3	19	11.7	
Other	2576	96.7	87	3.3	
Smoking status					
Smoker	2068	93.1	153	6.9	<0.01
Non-smoker	18726	95.0	991	5.0	
Recent weight loss					
No	20523	95.0	1084	5.0	<0.01
Yes	271	81.9	60	18.1	
Elective surgery					
Yes	19107	96.0	806	4.0	<0.01
No	1612	82.9	332	17.1	
NSQIP Frailty					

Status					
0	6075	97.6	152	2.4	<0.01
.09	9712	95.6	445	4.4	
.18+	5007	90.2	547	9.8	

Table 2. Proportion of patients discharged to a skilled or assisted living by urologic procedure.

Procedure	Number	%
Cystectomy with LND	267/1638	16.3
TURBT – large	78/478	16.3
Nephrectomy with LND	79/625	12.6
TURBT – medium	49/413	11.9
Nephrectomy with partial ureterectomy	53/483	11.0
Lap nephrectomy	64/626	10.2
TURBT – small	32/372	8.6
Partial nephrectomy	59/853	6.9
Radical nephrectomy	83/1284	6.5
Laser TURP	43/693	6.2
Lap nephrectomy with partial ureterectomy	47/814	5.8
Prostatectomy – open	*	4.8
TURP	166/4194	4.0
TURP regrowth	22/599	3.7
Lap partial nephrectomy	29/1325	2.2
Prostatectomy with extended LND	*	1.6
Sling procedure for stress urinary incontinence	*	0.8
Lap prostatectomy	38/5358	0.7
Prostatectomy with LND	*	0.2

*These procedures had individual cell sizes <20, which are non-reportable by NSQIP standards.
LND=Lymph node dissection
VC=vena cava
Lap=laparoscopic

Table 3. Factors associated with discharge to a skilled or assisted living facility after urologic surgery.

	Events/N (%)	Unadjusted OR	95% CI	Adjusted OR	95% CI
Year					
2011	291/5814 (5.0%)	1.0		1.0	
2012	376/7638 (4.9%)	1.0	(0.8, 1.2)	1.1	(0.9, 1.3)
2013	477/8486 (5.6%)	1.1	(1.0, 1.3)	1.2	(1.0, 1.5)
Age					
65-70	184/9589 (1.9%)	1.0		1.0	
71-80	453/8687 (5.2%)	2.8	(2.4, 3.3)	2.9	(2.4, 3.5)
80+	507/3662 (13.8%)	8.2	(6.9, 9.8)	8.7	(7.2, 10.7)
Race					
White	902/15035 (6.0%)	1.0		1.0	
African American	69/1086 (6.4%)	1.1	(0.8, 1.4)	1.1	(0.8, 1.4)
Other	22/585 (3.8%)	0.6	(0.4, 0.9)	0.6	(0.4, 0.9)
Anesthesia					
General	1038/19102 (5.4%)	1.0		1.0	
MAC	19/162 (2.3%)	2.3	(1.4, 3.8)	1.0	(0.6, 1.9)
Other	87/2663 (3.3%)	0.6	(0.5, 0.7)	0.3	(0.2, 0.5)
Smoking status					
Non-smoker	991/19717 (5.0%)	1.0		1.0	
Smoker	153/2221 (6.9%)	1.4	(1.2, 1.7)	1.7	(1.4, 2.1)
Recent weight loss					
No	1084/21607 (5.0%)	1.0		1.0	
Yes	60/331 (18.1%)	4.2	(3.1, 5.6)	2.5	(1.8, 3.5)
Elective surgery					
No	332/1944 (17.1%)	1.0		1.0	
Yes	806/19913 (4.0%)	0.2	(0.2, 0.2)	0.4	(0.3, 0.5)
NSQIP Frailty Index					
0	152/6227 (2.4%)	1.0		1.0	

0.09	445/10157 (4.4%)	1.8	(1.5, 2.2)	1.5	(1.2, 1.9)
0.18+	547/5554 (9.8%)	4.4	(3.6, 5.2)	3.1	(2.5, 3.8)

There's No Place Like Home

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Surgeons, and urologists in particular, frequently now provide procedural and operative care to the very old (those over 75) and even to the oldest-old (those over 85). How often this happens today might have been unimaginable 40 years ago. The savvy urologist always wants to know, is this older patient robust or vulnerable?

Also, for many older adult patients, discharge to a post-acute care setting rather than to home could potentially be regarded as a less than optimal outcome. Certainly in the framework of informed decision making, patients- and urologists- would like to know.

Assessing frailty, which flows from this concept of vulnerability, may help on both counts. Frailty has been defined as a biologic syndrome of decreased reserve and resistance to stressors, resulting from cumulative declines across multiple physiologic systems, and causing vulnerability to adverse outcomes. Most current frailty work stems from two different, but related, conceptualizations. Fried, et al, validated the *frailty phenotype*. Patients can be assessed and categorized as *not-frail*, *intermediately frail*, or *frail* based upon having *0*, *1-2*, or *3 or more* (respectively) specifically defined attributes: slowness; weight loss; weakness; fatigue; and low activity [1]. Suskind, et al, uses a different framework, one embedded in the National Surgical Quality Improvement Project (NSQIP) that flows from the conceptualization of Rockwood, et al[2, 3]. Rockwood posits frailty as discrete failures of redundant physiologic systems. As a greater and greater proportion of deficits accumulate for an individual, negative outcomes become more and more likely[4]. Deficit accumulation is measured as a proportion (*frailty index*, between 0.0 and 1.0) of responses to a pool of items covering a range of

self-reported conditions, diseases, and functional status items. Here, in this analysis, having 2 of 11 items, or an FI of 0.18, defined frailty. Of the 21938 individuals in the sample, (9589 were 65-70, 8687 were 71-80, and 3662 over 80), 25% were categorized as frail.

Some predictors of discharge to post-acute settings likely are known: more involved procedures (16.3% for cystectomy and large TURBT; lap partial nephrectomy 2.2%); or older patients (65-70: 1.9%; 80+: 13.6%) have a greater chance of ending up in a post-acute care settings rather than home. Suskind, et al, here demonstrated that those who were frail, even following multivariable adjustment for year, age, race, type of anesthesia, smoking status, recent weight loss, and emergent procedure, still had over 3 times the odds of being discharged to a facility. Overall, 9.8% of those assessed to be frail were discharged to post-acute care settings.

It is important to distinguish that the discharge destinations of patients not returning home are varied i.e. short-term rehabilitation centers, skilled nursing facilities (SNF) or long-term acute care (LTAC) hospitals and differ in terms of long term prognosis for returning home, dying or being committed to a longer term nursing facility[5]. Discharge to a non-home setting is associated with increased mortality and readmissions [5-9]. This may be a function of the underlying patient frailty versus decline in physical and cognitive function after discharge to non-home setting. Legner, et al., showed a four-fold higher mortality[5] for patients discharging to skilled care versus those returning home

after major abdominal surgery which would be akin to a majority of the urologic procedures in this study.

Urologists face important choices working with their patients. Older patients contemplating indicated procedures need to know the chance to derive meaningful benefits with low risks. Frailty offers, above simple chronological age, a helpful, predictive tool. This current study, by Suskind, et al, provides new information about the independent association between frailty and likelihood of post-procedural discharge to a post-acute care facility.

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Response to Editorial Comment "There's no place like home"

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Response to Editorial Comment "There's no place like home"

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We strongly agree that frailty should be an integral component of the perioperative decision-making process. There are many validated methods to measure frailty, which requires choosing a measure that can be thoughtfully integrated into routine urologic practice. A reason to do this is that frailty is strongly correlated in the literature with poor surgical outcomes, such as increased risk of both major and minor complications.[1,2] Also, we've now shown that frailty, measured by the NSQIP frailty index, increases the risk of discharge to skilled or assisted living facilities among patients undergoing urologic surgery.

While it seems logical to consider measurement of frailty for older individuals undergoing major urologic surgery such as cystectomy, our study also found frailty has a meaningful impact on non-home discharges among patients undergoing commonly performed less-major surgery such as transurethral resection of the prostate (TURP) and laparoscopic prostatectomy. Our findings highlight the fact that among frail older individuals *any* surgery, big or small, can potentially have undesirable outcomes and the increased risk for non-home discharge should be considered during perioperative decision-making.

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