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Impact of a documentation intervention on health-assessment metrics on an inpatient gynecologic oncology service

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HIGHLIGHTS

- A documentation initiative on an inpatient gynecologic oncology service increased severity of illness scores.
- Following our initiative, risk of mortality scores increased significantly for surgical admissions.
- Risk of mortality scores was unchanged for medical admissions following our intervention.
- Median expected mortality increased, which further reflects improved documentation following the intervention.
- More accurate reflections of patients' medical complexity resulted in non-significant lowering of mortality ratios.

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ABSTRACT

Objective. Accurate documentation is critical for patient care and hospital reimbursement. We sought to improve the accuracy of severity of illness (SOI) and risk of mortality (ROM) scores through implementation of documentation initiatives.

Methods. We performed a pre- versus post-implementation analysis to assess the impact of a documentation intervention bundle on calculated admission/discharge SOI/ROM scores on an inpatient gynecologic oncology service. Introduced in January 2017, the bundle included educational in-service, introduction of problem-based progress notes, a documentation tip ID badge and video, and weekly chart audits. Admission/discharge SOI/ROM scores (range 1–4) were obtained from hospital performance services. Demographics and 30-day mortality were collected from electronic medical records for all inpatients in historic (calendar year 2015) and intervention (2017) cohorts. Primary outcomes (discharge SOI/ROM) were modelled using ordinal and multinomial logistic regressions, controlling for confounders. 30-day observed/expected mortality ratios were reported for each cohort.

Results. 629 patients were included: 378 (60%) in 2015, 251 (40%) in 2017. Increased odds of having higher SOI score were observed in the intervention cohort for medical (OR = 2.22; 95% CI 1.38, 3.58) and surgical admissions (OR = 2.63; 95% CI 1.47, 4.40). Surgical (OR = 5.54; 95% CI 1.29, 23.96), but not medical (OR = 1.45; 95% CI 0.46, 4.57), admissions in the intervention cohort had higher odds of having the worst ROM score. Observed/expected mortality was 0.24 in the intervention compared to 0.37 in historic cohort ($p = 0.58$, NS).

Conclusion. An intervention bundle to improve physician documentation accuracy resulted in higher discharge SOI scores for medical and surgical admissions.

1. Introduction

Accurate physician documentation and coding are vital to providing patients with the highest quality care. Properly documented and coded data is critical to facilitate communication between health care providers who care for complex patients [1]. In the inpatient environment, there are several unique challenges to accurate documentation and coding. First, in teaching hospitals, trainees, and in particular residents, often perform a sizeable portion of inpatient documentation, but receive little, if any, instruction on proper documentation and coding terminology [2]. Concurrently, inpatients generally have multiple medical complexities that are not only simultaneously active, but are in a constant

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state of transition as problems are identified, treated, reassessed, and in some cases, resolved. With the ICD-10 system, coding has become an even more integral component of tracking patient health information to provide optimal management [3]. In addition to its essential role in patient care, accurate documentation is an important determinant of hospital reimbursement.

Patient classification systems were developed to identify patient characteristics that are predictive of hospital resource consumption and patient outcomes [4]. The All Patient Refined Diagnosis Related Groups (APR-DRG) system, used by Medicare and state-based Medicaid programs to determine hospital reimbursement [5] in conjunction with complex financial calculations, classifies patients based on admission diagnosis, expected mortality, severity of illness (SOI), and risk of mortality (ROM). SOI refers to the extent of organ loss of function/physiologic decomposition, while ROM refers to the likelihood of death during the admission [4]. SOI and ROM scores are assigned by institutions' departments of performance services using a standardized, complex, multi-phase algorithm that is determined by patients' specific medical diagnoses and the procedures completed during an inpatient hospital stay [6]. While a more complicated medical picture should be expected to be associated with higher SOI and ROM scores, inaccurate documentation may result in scores that are not reflective of true medical complexity. This is important because more ill and medically complex patients require higher utilization of hospital resources, incur higher costs, and have statistically higher chances of adverse outcomes and death.

SOI and ROM are inherently dependent on physician documentation [7]. As described above, in instances where trainees perform a sizeable portion of inpatient documentation despite minimal or no training and instruction regarding proper coding and documentation, there is potential for a high level of inaccuracy in the capture of patients' true SOI and ROM. The objective of the current study was to introduce several documentation interventions in order to improve the accuracy of both SOI and ROM scores on the inpatient gynecologic oncology service at our institution. We also sought to investigate the effect of these interventions on the coder-assigned expected mortality, as well as the observed/expected mortality ratio, which is a key metric in hospital quality reporting [8].

2. Materials and methods

This study was approved under exempt status by the Duke Institutional Review Board (Protocol 0007869). Our gynecologic oncology inpatient census is highly medically complex and was the subject of frequent queries by the hospital's coding and documentation specialists to physicians during the year prior to study initiation. This led to collaborative conversations regarding the opportunity to improve documentation of patient complexity by the inpatient physician team and resulted in development of a documentation bundle.

2.1. Study design

We designed a prospective study to compare discharge SOI and ROM scores as well as calculated expected mortality before and after introduction of our documentation intervention. The intervention cohort consisted of all patients admitted to and discharged from the gynecologic oncology service in 2017. The historic cohort consisted of all patients admitted to the gynecologic oncology service in 2015, as this was the most recent full year of admissions occurring prior to institutional/departmental discussions about the need to improve coding and documentation. Lists of all admitted patients for both cohorts were provided by performance services. Patient demographics and admission diagnoses were additionally collected for both cohorts.

2.2. SOI and ROM

SOI and ROM scores, each scaled from 1 (least severe) to 4 (most severe), were provided to the QI team by our institution's office of Performance Services. Both admission and discharge scores were assigned after the patient's discharge. Our QI team had no contact with performance services while scores were calculated. All scores for 2015 admissions were received at initiation of the study in late 2016. Scores for the intervention cohort were received at approximately monthly intervals, with each set corresponding to the prior month's admissions/discharges from the gynecologic oncology service (for example, scores for June 2017 were available at the end of July 2017).

SOI and ROM scores are calculated by a complex, multi-phase algorithm [9] by hospital performance services using standardized software as follows. First, a base APR-DRG is assigned to the patient, based on the patient's principal admission diagnosis and/or surgical procedure. Second, in phase one of score determination, any secondary diagnosis associated with the primary diagnosis is excluded such that a single diagnosis is only included once; for example, if "malignant neoplasm of the endometrium" was the patient's primary diagnosis, "endometrial hyperplasia" would be excluded as a secondary diagnosis, as the primary diagnosis negates this secondary diagnosis. The level (minor, 1, though extreme, 4) of each remaining secondary diagnosis during the admission is then determined, and modified based on patient characteristics, such as age. In phase 2, patients are assigned a base subclass determined from all of their secondary diagnoses which is subsequently used in the third and final phase to determine their final subclass (i.e., their SOI or ROM score, between 1 and 4). These scores are then reportable both internally and externally to organizations reporting hospital quality measures [9]. SOI reflects the specific extent of physiologic decompensation expected of a patient with a specific medical diagnosis; stated more plainly, the immediate effect of the diagnosis on the patient's physical state. ROM refers to how that same diagnosis impacts a patient's likelihood of death during admission. Scores may differ because a diagnosis may in the short term worsen a patient's physiological state while having little effect on the risk of death. Examples of common SOI and ROM are cited in Table 1.

2.3. Observed/Expected mortality

The mortality ratio is calculated as observed/expected mortality. Observed mortality (death during admission) was provided to the documentation team by hospital performance services. Additionally, study personnel individually searched the electronic medical record for patient deaths occurring within 30 days of discharge. Expected mortality is the probability of death during a hospital admission, represented as a number between 0 and 1, that is calculated by hospital performance services and coding personnel using a standardized mathematical model that incorporates admission diagnoses, procedures, and hospital problems [9]. The 30-day observed/expected mortality ratio, reported

Table 1
Common severity of illness and risk of mortality scores for secondary diagnoses.

Diagnosis	Severity of illness score	Risk of mortality score
Acute blood loss anemia	2	1
Acute renal failure	4	3
Atrial fibrillation	4	2
Carcinomatosis	2	4
Depression	2	1
DVT	2	1
Hypernatremia	2	3
Malnutrition - moderate	3	2
Malnutrition - severe	4	3

Severity of illness and risk of mortality scores/subclasses for common diagnoses on the inpatient gynecology service. Scores range from 1 to 4 and correlate with minor, moderate, major, and extreme severity of illness/risk of mortality. Addition of multiple secondary diagnoses can change the patient's severity of illness or risk of mortality subclass.

to external bodies and used by various hospital ranking systems, is calculated as an aggregate for each cohort of patients, and is defined as the sum of observed mortality within the cohort divided by the sum of the calculated expected mortality within the cohort.

2.4. QI initiative

Our quality improvement initiative comprised a bundle of documentation interventions, introduced simultaneously in January 2017. Problem-based, as opposed to systems-based, charting has been shown to improve the accuracy of patients' problem lists [10], and problem lists are utilized by hospital coding teams in the assignment of health-assessment metrics. Our first intervention was a change in the format of the assessment and plan in electronic health record (EHR)-based daily progress notes from systems-based to problem based. In this new format, the patient's hospital problem list was automatically populated into the assessment/plan in each progress note. Team members were responsible for updating the problem list daily.

Second, a formal educational in-service session was held by study personnel for residents and fellows to review the change in progress note format and to review important features of coding and appropriate documentation for often improperly documented hospital diagnoses and problems. For example, team members would frequently improperly document anemia, neglecting to distinguish acute and chronic anemia and neglecting to include important details. Often, team members would document “the patient's hematocrit decreased from 30 to 28,” or “low hemoglobin and hematocrit” rather than the specific information necessary for coding, such as “acute blood loss anemia” or “chronic iron deficiency anemia” or “acute blood loss requiring blood transfusion.” Other common, improperly documented problems included descriptions of electrolyte abnormalities (for example, “low sodium” rather than “hyponatremia” and “elevated creatinine” rather than “acute kidney injury”), and failure to classify the degree of a patient's malnutrition (for example, “severe protein-calorie malnutrition”). During the in-service session, an overview of hospital assessment metrics was provided, which defined and explained SOI and ROM scores and their derivation from documentation and coding during an inpatient hospital stay. Third, a high-yield documentation tip ID badge was designed for residents and fellows focusing on common documentation errors and how to correctly document certain medical problems and diagnoses (Fig. 1). The tip badge was developed following discussions with hospital coders regarding common documentation queries. Fourth, several months after initiation of the prior items in the bundle, we produced a high-yield video with the assistance of our hospital coding specialist reviewing SOI and ROM metrics, the goals of our project, as well as the high-yield diagnoses and problems on the documentation tip badge. The video (accessible at https://vimeo.com/218496983) was produced in May 2017, to be viewed by the resident team prior to start of each new rotation block (approximately every six weeks). Finally, progress notes, patient charts, and problem lists were audited weekly by our coding specialists to identify and correct documentation errors. Emails were sent by study team members to the on-service resident team weekly throughout 2017 following each weekly audit to highlight and correct these errors as well as to reinforce proper documentation practices.

2.5. Data collection

Following implementation of the documentation bundle, demographic information, admission type (medical, surgical, or chemotherapy), admission diagnosis, admission and discharge SOI and ROM (each scaled from 1 to 4) were collected from all gynecologic oncology inpatients in the historic cohort (all inpatient encounters with discharge date in 2015) and intervention cohort (all inpatient encounters with discharge date in 2017).

Demographic information included race, ethnicity, insurance status, cancer diagnosis, indication for admission, and length of hospital admission. Mortality data was also included for each patient, with specific attention to death occurring within 30-days of hospital discharge. Patients with multiple admissions were assumed to be independent and each admission was included separately in the analysis.

Primary outcomes were discharge SOI, discharge ROM, expected mortality, and 30-day mortality ratio (observed mortality/expected mortality). Patient demographics were compared between the historic and intervention cohorts using Student's *t*-test (age), Wilcoxon rank sum test (length of admission), and χ^2 test or Fisher's exact test (race, ethnicity, insurance, and indication for admission). An ordinal logistic regression was used to model the intervention, admission type, and their interactions on discharge SOI while controlling for age, race, ethnicity, insurance status, and length of stay. Contrasts were used to estimate and test the effect of the intervention on discharge SOI for each admission type. A multinomial logistic regression was used to model the intervention, admission type, and their interactions on discharge ROM due to violation of the proportional odds assumption, as this is a more general model. Contrasts were also used to estimate and test the effect of the intervention on discharge ROM for each admission type. Chemotherapy admissions were reported separately from medical admissions due to multiple expected admissions per patient and were excluded from analysis of discharge ROM due to a low frequency of patients. Cochran Q's test for homogeneity was used to compared the mortality ratios between two cohorts while Wilcoxon rank sum test was used to test for differences in expected mortality. All analyses were performed in SAS 9.4 (SAS Institute Inc., Cary, NC).

3. Results

A total of 629 patient encounters were identified; 378 (60%) in the historic cohort and 251 (40%) in the intervention cohort. 414 unique patients were identified; 111 patients (26.8%) had more than one admission, with the range of admissions per patient 1–14. The average age of included patients was similar in both cohorts. The majority of patients (528/628, 84%) had a cancer diagnosis. There was a higher percentage of medical admissions in the intervention cohort (144/251 57%) than in the historic cohort (164/371, 44%). The median length of stay was 4 days for the entire study cohort (IQR: 3,7), with a shorter median length of stay in the historic cohort (IQR: 2,6) compared to the intervention cohort (median 4, IQR: 3, 7) ($p = 0.01$). Patient demographics are summarized in Table 2.

Fig. 2a summarizes discharge SOI scores in the historic and intervention cohorts. Patients in the intervention cohort with a medical (OR = 2.22, 95% CI = 1.38, 3.58) or surgical (OR = 2.63, 95% CI = 1.57, 4.40) admission had higher odds of having higher discharge SOI scores than patients in the historic cohort, while controlling for confounders. There was no difference observed for patients with a chemotherapy admission (Table 3).

Fig. 2b summarizes discharge ROM scores in the historic and intervention cohorts. The odds of having a discharge ROM score of 4 compared to a score of 1 was higher in the intervention cohort for surgical admissions (OR = 5.54, 95% CI = 1.29, 23.96) but not medical admissions (OR = 1.45, 95% CI = 0.46, 4.57), while controlling for confounders. We additionally compared the odds of having a high discharge ROM of either 3 or 4 to a low score of 1 or 2. Odds of a higher score approached significance for surgical admissions (OR = 2.01, 95% CI = 1.00, 4.04), but not for medical admissions (OR = 1.39, 95% CI = 0.84, 2.31) after controlling for confounders (Table 4).

The median expected mortality increased from 0.003 (IQR 0.01, 0.17) in the historic 2015 cohort to 0.01 (IQR 0.002, 0.02) in the intervention 2017 cohort ($p = 0.0003$) (Table 5). Observed 30-day mortality rates were 4/378 (1.1%) in the historic cohort and 2/251 (0.8%) in the intervention cohort. The observed/expected mortality ratio dropped from 0.37 in the historic cohort to 0.24 in the intervention cohort ($p = 0.58$).

DUKE GYN/ONC DOCUMENTATION TIPS

Write the diagnosis - Not the symptom!

Remember: Update problem list BEFORE writing progress note!

When documenting…	Consider the diagnosis of:
Anemia or other bleeding disorders (i.e. post-op hemorrhage)	**Acute blood loss anemia**, chronic blood loss anemia, coagulopathy with underlying cause (medication, disease, etc.)
Drop in all three counts (anemia, leukopenia, thrombocytopenia)	Pancytopenia (NOT pancytopenic!) with underlying cause (chemotherapy, medication, disease, malignancy, etc.)
Infectious descriptions	Cellulitis, wound infection, **post-operative fever** with suspected underlying cause (ie. atelectasis)
SOB, hypoxia, respiratory distress	Acute, chronic or acute on chronic respiratory failure (specify with hypoxia, hypercapnia, or both), atelectasis
Fluid overload, bibasilar crackles, edema on CXR	**Acute or chronic pulmonary edema**
Bacteremia, Meets SIRS criteria	Sepsis, Severe Sepsis, Septic Shock, SIRS (link any organ failure (if present) to Sepsis or SIRS
AMS, Confusion, in restraints, combative	Acute delirium, Encephalopathy (toxic and/or metabolic)
HCAP, Atypical pneumonia, concern for/evidence of aspiration	Community acquired pneumonia, Hospital acquired pneumonia, Aspiration pneumonia (**suspected organism you are treating based on antibiotics**, ie. MRSA, pseudomonas, Gram Negatives – **you don't need cultures!**)

When documenting…	Consider the diagnosis of:
+UA, positive urine culture, urosepsis	UTI, acute cystitis, acute pyelonephritis, sepsis due to UTI **(include suspected/cultured organism)**
UTI in patient with indwelling catheter	Catheter associated UTI (specify: POA [present on admission], HAC [hospital acquired condition])
↑Na,↓ Na; +/- lab value; Low or High electrolyte level	**Hyponatremia, hypernatremia, hypokalemia, hyperkalemia, etc.**
Acute renal insufficiency, elevated creatinine, contrast-induced nephropathy	Acute renal failure, AKI, ATN(think: hemorrhage!), AIN (think: NSAIDS!)
CKD, Chronic renal insufficiency	Specify CKD Stage if known (1-5 or ESRD) and if on dialysis
CHF, Systolic or diastolic dysfunction	Specify acute, chronic or acute-on-chronic, AND systolic, diastolic or combined CHF
Ascites	**Clarify if malignant ascites**
Blood in urine, blood tinged urine	Hematuria
Cachetic, muscle wasting, thin, poor appetite, early satiety	Cachexia, underweight, protein-calorie malnutrition (specify as mild, moderate or severe!– see below)

Mild (2 or more of the following): BMI <18.5, <95% usual body weight, <90% I.B.W, albumin <3, prealbumin <15
Moderate (2 or more of the following): : BMI <17, <85% usual body weight, <80% I.B.W., albumin <2.5, prealbumin <10
Severe (2 or more of the following): : BMI <16, <75% usual body weight or unintended weight loss >5% in 1 month, <70% I.B.W., albumin <2, prealbumin <5
Note: obesity and malnutrition are not mutually exclusive! I.B.W. = ideal body weight

Fig. 1. Documentation tip badge, front and back displayed.

Mortality ratios dropped from 0.44 to 0.26 in medical cohort ($p = 0.54$) and remained 0 in both surgical cohorts.

4. Discussion

As hospital systems move toward value-based care models, physicians caring for oncology patients are increasingly accountable for improving both quality and cost in their patient populations [11]. Accordingly, future interventions to provide high quality patient care while simultaneously ensuring documentation supportive of the level of patients' medical complexity will become increasingly important. Methods to improve physician documentation and coding have been the subject of several recent studies in internal medicine, neurosurgery, and general surgery in light of the direct connection between accurate coding and hospital reimbursement. Introduction of documentation educational sessions, mandatory progress note review, and documentation reference cards have all resulted in improved code capture rates, higher SOI and ROM, and decreased hospital stay [12,13].

Our study demonstrates that introduction of our coding documentation bundle targeted at trainee education was associated with higher discharge SOI scores for both medical and surgical admissions in our intervention cohort. This finding is important as it more appropriately

Table 2
Patient demographics.

Characteristic	Historic cohort 2015 ($N = 378$)	Intervention cohort ($N = 251$)	*P*-value
Age, mean (standard deviation)	59.8 (13.9)	59.9 (14.0)	0.91
Primary diagnosis			
Cancer	316 (83.8%)	212 (84.5%)	0.83
Benign disease	62 (16.4%)	39 (15.5)	
Missing	1	0	
Admission indication			0.001
Medical	164 (44.2%)	144 (57.4%)	
Surgical	159 (42.9%)	91 (36.3%)	
Chemotherapy	48 (12.9%)	16 (6.4%)	
Missing	7	0	

Demographic data for included patients.

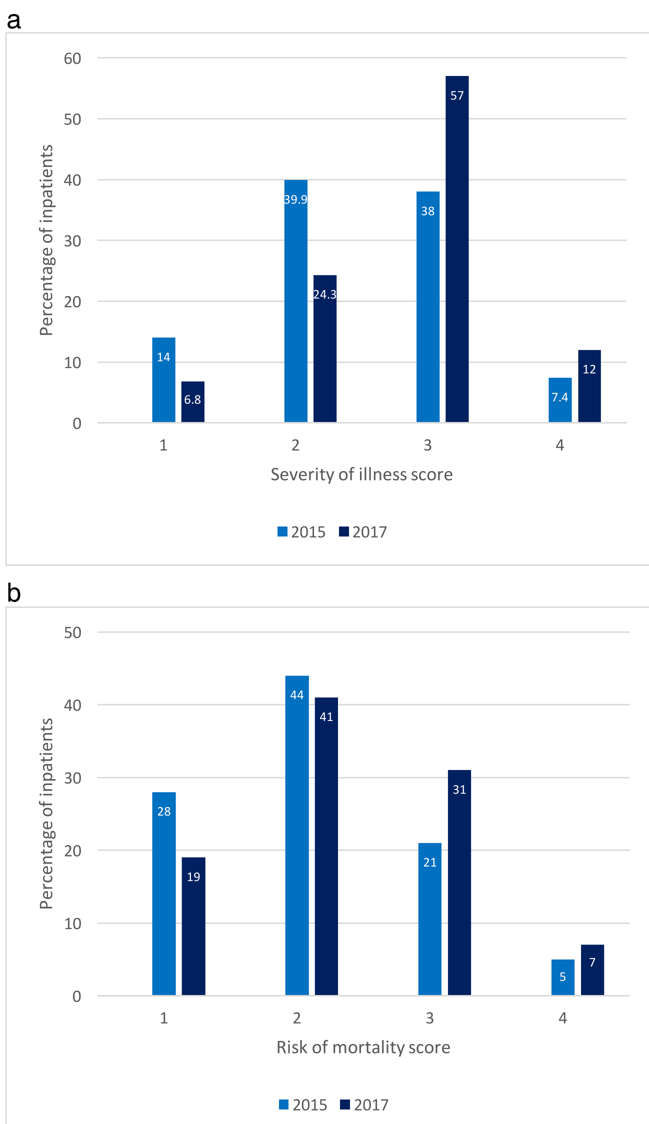

Fig. 2. a. Discharge severity of illness in historic and intervention cohorts. X-axis depicts severity of illness scores (1–4) for historic cohort (light blue) and intervention cohort (navy blue). Y-axis depicts percentage of patients with each score. b. Discharge risk of mortality in historic and intervention cohorts. X-axis depicts risk of mortality scores (1–4) for historic cohort (light blue) and intervention cohort (navy blue). Y-axis depicts percentage of patients with each score.

Table 3
Odds of increased severity of illness score in intervention cohort compared to historic cohort.

	Medical admission	Surgical admission	Chemotherapy admission
Historic cohort (2015)	Reference	Reference	Reference
Intervention cohort (2017)	2.22 (1.38, 3.58)	2.63 (1.57, 4.40)	2.76 (0.92, 8.24)

Odds ratios and 95% confidence interval are presented. Models were controlled for age, race, ethnicity, insurance, and length of hospital stay.

classifies the complex and medically acute patients cared for on a gynecologic oncology service. SOI scores are an important component of standardized measures of hospital quality and hospital rankings. An increase in ROM to the highest possible score of 4 was observed for surgical but not for medical admissions. While SOI and ROM are both based on admission diagnoses, procedures, and problems, an escalation in scoring for either depends on the specific impact of a diagnosis or procedure on a patient's current physiologic state and her mortality risk. For example, a tracheotomy imminently results in a physiologic disability, but at the same time decreases mortality risk. As such, the SOI and ROM scores change, but in different directions. We postulate that our documentation bundle impacted SOI scores more than ROM scores because not all problems/diagnoses that impact a patient's physiologic decompensation necessarily translate to an increased risk of mortality. As such, the documentation bundle described here should not be interpreted as at attempt to falsely "up-code" patients. In fact, more accurate documentation for certain patients could actually result in a lower SOI or ROM score as described. The goal is, above all, documentation that supports patients' medical complexity, with the realization that there is significant variability of medical complexity between patients.

We report both a significantly higher expected mortality and a non-significantly lower observed/expected mortality ratio in the intervention cohort compared to the historic cohort. Any change in the observed/expected mortality ratio can be important, as this ratio is based on SOI and ROM scores and would not change without an improvement in physician documentation and coding. As such, given the relatively similar observed mortality of 1.1% versus 1% in the two cohorts, we again conclude that introduction of our documentation bundle resulted in a more accurate representation of our patients' degree of medical complexity.

Our study has several strengths. This is the first prospective, quality-improvement driven documentation initiative geared toward improving accuracy of SOI and ROM scores in the specialty of gynecologic oncology. We introduced several easy to use and accessible interventions that facilitate continuation of our initiative. Our interventions were reviewed with our coding department to ensure accuracy. We controlled for demographics to correct for any possible differences in the patient population between the two cohorts which could lead to differences in health assessment metric scoring.

Our study has several limitations. First, we did not have a method to definitively assess the extent to which each intervention was utilized on

Table 4
Association between intervention (2017) cohort and discharge risk of mortality score by type of admission.

Discharge ROM[a]	Medical Admission	Surgical Admission
1	Reference	Reference
2	1.21 (0.54, 2.70)	1.46 (0.77, 2.80)
3	1.66 (0.70, 3.92)	2.28 (0.97, 5.33)
4	1.45 (0.46, 4.57)	5.54 (1.29, 23.96)
Low (1 or 2)	Reference	Reference
High (3 or 4)	1.39 (0.84, 2.31)	2.01 (1.00, 4.04)

Odds ratios and 95% confidence interval are presented. Models were controlled for age, race, ethnicity, insurance, and length of hospital stay.
[a] ROM: Risk of mortality.

Table 5
Patient mortality.

	Historic cohort 2015 (N = 378)	Intervention cohort 2017 (N = 251)	*P*-value
Expected mortality, median (IQR)	0.003 (0.001, 0.17)	0.01 (0.002, 0.03)	0.0003
Observed mortality	4	2	
Sum of expected mortality[a]	10.74	8.49	
Observed/expected mortality ratio	0.37	0.24	0.58

[a] Sum refers to the sum of the individual expected mortality for all patients in that cohort; this sum is used for calculation of observed/expected mortality ratio and cannot be interpreted independently.

a daily basis. There was likely variability in the utilization of interventions, namely, the documentation tip-badge and the documentation tip-video. Next, our intervention depended on both chart audits by the hospital coding team (who did not receive additional training) and weekly email reminders that were performed by a gynecologic oncology fellow. A more sustainable method is needed so that progress will not become stagnant in identification and correction of common documentation errors. We are currently working with our departmental QI committee and hospital performance services to achieve sustainability without constant trainee attention. Finally, cohorts were not identical in composition, namely, there was a higher number and percentage of surgical admissions in the historic cohort. This is likely due to the increased emphasis on and expansion of indications for minimally invasive surgery over the past several years. Patients who were admitted for observation following surgery or who were discharged home on the same day were not included in our study.

Moving forward, as hospital care continues to increasingly transition to quality-based reimbursement models, accurate documentation is critical to reflect the true health care needs of patients such that reimbursement parallels the care provided [12]. Although we did not explore the impact of our intervention on hospital reimbursement, this would be an important and interesting research question for future investigation. Our study lays a foundation within an academic department to demonstrate the level of medical complexity of our gynecologic oncology patients and additionally to ensure that our institution is compensated appropriately for the degree and level of care provided. Continued progress, assessment and re-assessment of our introduced documentation bundle and the appropriate introduction of new interventions will be necessary to as we strive to remain competitive with our peer-institutions.

Author contributions

J. Arquiette, H. Moss, and L. Havrilesky contributed to study idea, study design and study implementation. T. Truong and C. Pieper developed the plan for and carried out the statistical analysis. J. Arquiette and L. Havrilesky wrote the manuscript. All authors discussed the results, commented on the manuscript versions, and provided critical feedback throughout all aspects of the research.

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