

ORIGINAL RESEARCH

Improving the mortality index among gynecologic oncology patients

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Abstract

Background: The mortality index is a quality metric that measures the ratio of observed mortality to expected mortality among inpatients. Expected mortality is a probability calculation based on documentation of patient risks and comorbidities. A mortality index of <1.0 represents fewer patients dying while admitted to the hospital than expected. We aimed to decrease the mortality index in our department by 10% in 6 months. **Methods:** We formed a multidisciplinary team from Gynecologic Oncology, Health Information Management, Office of Performance Improvement, Revenue Operations, Coding and Institutional Compliance. We educated providers on documentation of patient comorbidities, standardized documentation templates, focused coder analysis and in-depth review and discussion as a department of all inpatient deaths. Pre-intervention 8/2017–7/2018 and post-intervention 11/2018–2/2020 outcomes were compared using the Mann Whitney U test. **Results:** The median mortality index decreased by 44% from 0.84 to 0.47 ($p = 0.03$). The median expected mortality increased by 37% from 2.94 to 4.02 ($p = 0.002$). The median number of inpatient deaths, or observed mortalities, was unchanged though there was a non-significant decreasing trend. **Conclusions:** Inpatient mortality index is an important quality metric that can be improved through education, standardized documentation, focused review and discussion of all inpatient mortalities.

Keywords

Mortality index; Mortality review; Inpatient mortality

1. Introduction

Development of standardized quality metrics and regular reporting of these metrics has been thought to drive quality improvement in healthcare [1–3]. However, there is no accepted standard for how to analyze and present morbidity and mortality data and there is inconsistent evidence of what impact presenting and reviewing such data has on the quality of care delivered [4–8].

Despite the inconsistent evidence to support this, public reporting of quality measures, including mortality associated metrics, has increased over recent years [9–12]. In addition, mortality data factor into publicly reported rankings of healthcare institutions [9–12]. Publicly reported rankings affect the financial stability of healthcare organizations and can have ramifications for patient care [13–16]. The mortality index (MI) is an example of a standardized quality metric related to mortality. The MI is the ratio of observed to expected mortalities. A ratio of less than one represents that fewer mortalities occurred than were expected. The MI factors heavily into the previously described public reporting of quality of care metrics that are publically reported. Due to this metric having a high impact on how quality of care is measured, we developed a quality improvement initiative focused on improving the MI.

In order to improve the MI, we planned to improve both the observed rate of inpatient death as well as to accurately capture the expected risk of inpatient death for our patients.

We initiated a quality improvement initiative in August 2018 to assess if clinician education, use of standardized documentation templates, focused coder analysis and regular monthly reviewing and reporting of every inpatient mortality could decrease the MI among the inpatient Gynecologic Oncology service. Our aim was to decrease the median MI value by 10% compared to pre-intervention (8/2017–7/2018) for the Department of Gynecologic Oncology and Reproductive Medicine over a six-month period (11/2018–4/2019). As part of this goal, we hoped to see both an improvement in the expected mortality calculation and a decrease in the observed inpatient mortality. The data reported here includes a full 16 month follow up period in order to better describe and analyze the impact of this quality improvement initiative.

2. Materials and Methods

The MI is a standardized quality metric that compares the observed mortality to the expected mortality for a given patient. This calculation can then be expanded to calculate the MI for an entire inpatient service. The observed mortality is

the number of inpatient deaths that occur during a set time period. A value of 'one' indicates that a patient died while admitted to the hospital. A value of 'zero' indicates that the patient did not die. The expected mortality, however, is an estimate of the expected risk of inpatient mortality for a patient that is generated from patient characteristics and risk factors that are present on admission to a hospital and that are risk-adjusted given his or her medical comorbidities and standardized across hospitals [17]. Expected mortality values range from 0.01 to 0.99 representing a one to 99% risk of inpatient death. The expected mortality calculation can then be summed for an inpatient service for a period of time which creates a total value of greater than one. The MI is then calculated by dividing the observed by the expected number of inpatient deaths. For an individual patient, this ratio will be zero for all patients who do not die while admitted to the hospital and greater than one for all patients who die while admitted to the hospital. For an inpatient service, a MI is calculated for a specific time period, often a month at a time. A MI of less than one for an inpatient service represents that fewer patients died while inpatient than expected during that time period. The source of the risk-adjustment methodology used for all patients included here is based on the Vizient® calculation for expected mortality. Vizient® is a member-owned healthcare performance improvement organization that uses a database of clinical and administrative data in order to create risk-adjusted models for expected mortality. The risk-adjusted model used for this quality improvement initiative was risk-adjusted within academic medical centers.

Ethics approval and consent to participate: This quality improvement initiative was reviewed by our institutional Quality Improvement Assessment Board (the Quality Improvement Assessment Board approves quality improvement initiatives in lieu of IRB review) and approved it to proceed (protocol #313). The Quality Improvement Assessment Board also allowed a waiver of informed consent. Following Quality Improvement Assessment Board approval, we formed a multidisciplinary quality improvement team in August 2018 including members from Gynecologic Oncology, Health Information Management, Office of Performance Improvement, Revenue Operations, Coding and Institutional Compliance. The clinical setting where this quality improvement initiative was implemented is an urban Academic Medical Center which is also a Comprehensive Cancer Center in Houston, Texas (United States of America) within the Department of Gynecologic Oncology and Reproductive Medicine. The target population were all patients admitted to our service within the Department of Gynecologic Oncology and Reproductive Medicine. Our inpatient Gynecologic Oncology service cares for women requiring hospital admission due to a surgical procedure, management of sequela of chemotherapy or other antineoplastic therapies or for evaluation and treatment of an acute medical issues related to their oncologic disease process. We care for women with gynecologic malignancies through the course of treatment for their disease including from diagnosis to transition to end of life care. Our quality improvement initiative focused on four interventions in order to decrease the MI: clinician education, standardization of clinical documentation, focused coder analysis of clinical documentation

among patients at highest risk of inpatient mortalities and 100% mortality review of all inpatient deaths by our quality improvement team. Plan-Do-Study-Act (PDSA) cycles were repeated with adjustments made to the review and education processes on a quarterly basis. There were no conflicts of interest among the team members and a formal ethics review of this quality improvement initiative was not indicated. There were no other departmental or institutional initiatives impacting the MI during either the pre or post-intervention time period.

2.1 Clinician Education

Gynecologic Oncology clinical providers were educated on appropriate documentation of patient comorbidities and severity of illness in compliance with official coding guidelines. Clinicians were educated on the mechanism by which clinician documentation translates into a diagnosis-related group (DRG) which then is used to determine a patient's expected mortality risk model. Furthermore, the importance of designating a comorbidity or medical illness as being present on admission was explained. Within Vizient®, only those comorbidities or medical illnesses that are present on admission are incorporated into the risk model which determines the expected mortality calculation. Faculty, trainees and advanced practice practitioners were all educated with individualized presentations.

2.2 Standardization of Clinical Documentation

A standardized approach to clinical documentation was implemented by creation of clinical note templates with problem-based assessments and plans for admission, daily progress notes and discharge summaries. A problem-based assessment and plan is a form of documentation where a diagnosis (also known as the problem) is listed and the plan of care to address that diagnosis is then written associated with that diagnosis. This intervention was modeled after other successful quality improvement initiatives that improved calculation of medical complexity [18]. The note templates were created and shared among all clinicians caring for patients on the Gynecologic Oncology service. An audit was performed monthly with direct feedback to the clinical teams.

2.3 Focused Coder Analysis of Clinical Documentation among Patients at Highest Risk of Inpatient Mortality

Per institutional protocol, all clinical documentation was reviewed during an inpatient admission in order to appropriately code for patient comorbidities and diagnoses. However, additional audits of the documentation were performed by the multidisciplinary team with direct feedback to the clinical care teams for patients identified as being at risk for an inpatient mortality. Based on clinical judgement, the clinical care teams would contact a member of the multidisciplinary team on admission or when a change in status occurred in order to identify a patient as high risk. As the expected mortality calculation is not typically completed until after the patient is discharged or passes, we identified those patients at high risk of an inpatient

mortality by clinical judgement of inpatient care team. The multidisciplinary team would assign additional coding reviewers to assess the documentation. Coding queries were sent to the responsible providers in order to clarify which conditions would be appropriate for inclusion or whether conditions were present on admission. The final approval, however, of every condition included in the final coding assessment was at the discretion of the treating provider.

2.4 100% mortality review

All inpatient mortalities on the Gynecologic Oncology service were reviewed at the monthly departmental Morbidity and Mortality conference in a standardized format similar to what has been described in another quality improvement initiative targeting inpatient mortalities [10]. Prior to this initiative, there was no standardized approach to discuss and review inpatient mortalities. Each inpatient mortality was discussed for opportunities for avoidance of inpatient death and ways to have improved the patient care experience. The calculated expected mortality for each inpatient death was reviewed and an explanation for the how that value was derived was given in order to reinforce the prior education provided to clinicians. As part of these monthly reviews, we covered trends in patient care and provider's perspectives during the care of those patients who experienced an inpatient mortality. We had in-depth discussions about advance care planning and referring to hospice care among other aspects of end of life care.

2.5 Case Study

The following is an example of how the four interventions of this quality improvement initiative were implemented together: A 30 year-old woman with advanced, treatment-refractory metastatic cervical cancer, multi-organ failure and hemodynamic instability related to septic shock was directly admitted from the Emergency Room to the Gynecologic Oncology inpatient service and ultimately passed during that hospital admission. The clinical providers, who had previously received education related to appropriate documentation of patient comorbidities, used standardized note templates in the electronic medical record to document patient care. Based on the clinical providers' initial documentation, there was only sufficient information for the coding team to determine that this patient had a fluid and electrolyte disorder, malnutrition, thrombocytopenia, altered mental status without coma, shock and to have suffered a cardiac arrest. Her DRG was assigned as 'severe sepsis' and the expected mortality was estimated to be 0.249 meaning that she had a 24.9% risk of an inpatient mortality. Our multidisciplinary quality improvement team was notified that this patient was at risk of an inpatient mortality and we performed a review of her medical record and clinical documentation. Our team sent additional coding queries to the inpatient clinical providers in order to clarify her medical comorbidities. As a result of the clinical providers' responses to the coding queries, the following additional patient comorbidities were appropriately documented and included in the calculation of expected mortality: need for mechanical ventilation on day of admission, metastatic cancer, coagulation defect, gastrointestinal hemorrhage. Due

to inclusion of this additional documentation, the expected mortality for this patient increased to 0.80 meaning that she had an 80.0% risk of an inpatient mortality. The assigned DRG was unchanged and remained 'severe sepsis.' This patient's death was reviewed and discussed at a subsequent departmental Morbidity and Mortality conference and a multidisciplinary discussion was had related to her outcome and opportunities for avoidance of an inpatient mortality. A thoughtful conversation was had regarding the unique challenges of caring for a critically ill young oncology patient.

In order to evaluate the effect of this quality improvement initiative, the pre-intervention period of August 2017 to July 2018 was compared to the post-intervention period of November 2018 to February 2020. The median monthly values for the MI, number of observed mortalities and expected mortality calculation were compared between the pre-intervention and post-intervention groups using a two-tailed Mann Whitney U test. Due to the data not being normally distributed, median values were chosen to compare the pre-intervention and post-intervention groups. The rates of inpatient mortality were calculated using Fisher's Exact test. A p -value of 0.05 was considered to be significant. A sample size analysis was not performed. An initial analysis of the impact of this intervention was planned after six months. Given early evidence of success, the longer analysis described here was performed to allow for better evaluation of whether or not the success was sustained. It was recognized that this analysis could be underpowered to reach statistical significance given the projected change in outcomes. Our concern was that the length of time required to obtain an adequate sample size could be beyond what would be beneficial from the standpoint of stakeholder engagement. A formal cost analysis was not performed. Efforts toward this initiative were incorporated into existing clinical and administrative roles. The Standards for Reporting Implementation Studies (StaRI) guidelines were followed for reporting of this initiative [19].

3. Results

From the pre-intervention time period of August 2017 to July 2018 there were 1211 hospital admissions with 23 inpatient deaths (1.9%) with a median monthly admission volume of 104 admissions. Of the 23 inpatient deaths, three (13.0%) were within 30 days of surgery. From the post-intervention time period of November 2018 to February 2020 there were 1660 hospital admissions with 33 inpatient deaths (2.0%) with a median monthly admission volume of 105. Of the 33 inpatient deaths, 3 (9.0%) were within 30 days of surgery.

The median number of inpatient deaths was unchanged during the post-intervention period compared to the pre-intervention period (pre-intervention 2.0 versus post-intervention 2.0; $p = 0.60$). Though the median did not change between the rates of observed mortality, there appears to be consistently lower numbers of inpatient deaths in the post-intervention group. This is particularly clear in the data from April 2019 and after (Fig. 1).

The pre-intervention monthly median expected mortality was 2.94 while the post-intervention with a median monthly value increased by 37% to 4.02 ($p = 0.002$) (Fig. 2).

Observed Mortality

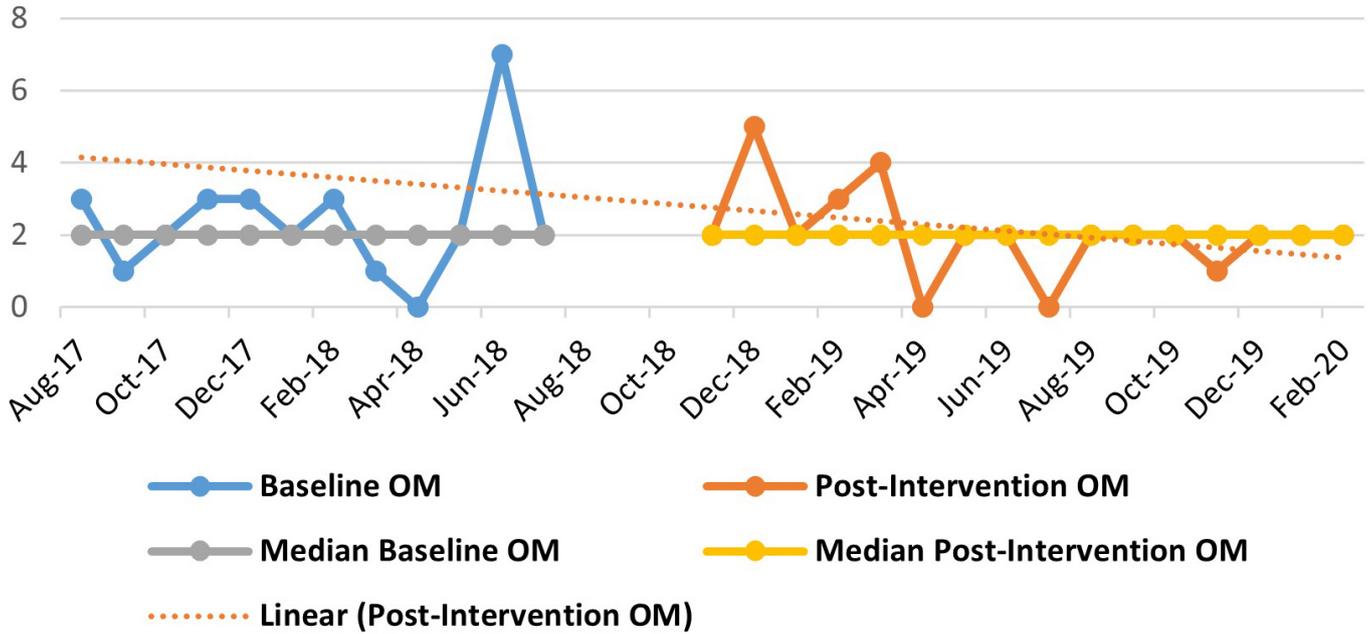


FIGURE 1. Observed Mortality (OM) Run Chart.

Expected Mortality

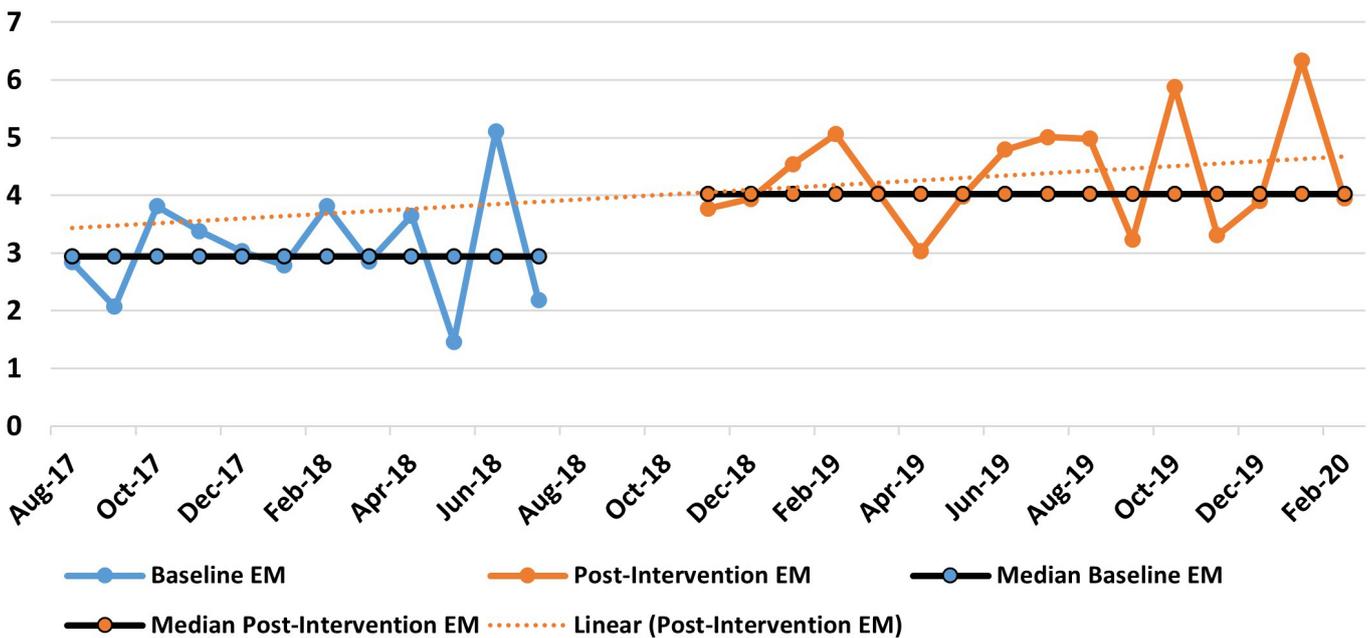


FIGURE 2. Expected Mortality (EM) Run Chart.

The pre-intervention median monthly MI was 0.84 while the post-intervention median monthly MI decreased by 44% to 0.47 ($p = 0.03$) (Fig. 3).

4. Discussion

Our initiative describes a successful quality improvement initiative reporting the effect of clinician education, standardization of clinical documentation, focused coder analysis and

100% mortality review on the MI among Gynecologic Oncology patients. We exceeded our aim to decrease the median MI by 10% and were able to decrease our median MI by 44%. The monthly admission volume was very similar between pre-intervention and post-intervention groups, there were no other competing quality improvement initiatives that would impact these metrics and there were no changes to the methodology used by Vizient® to calculate the expected mortality value during this time period. Therefore, the observed effects on the

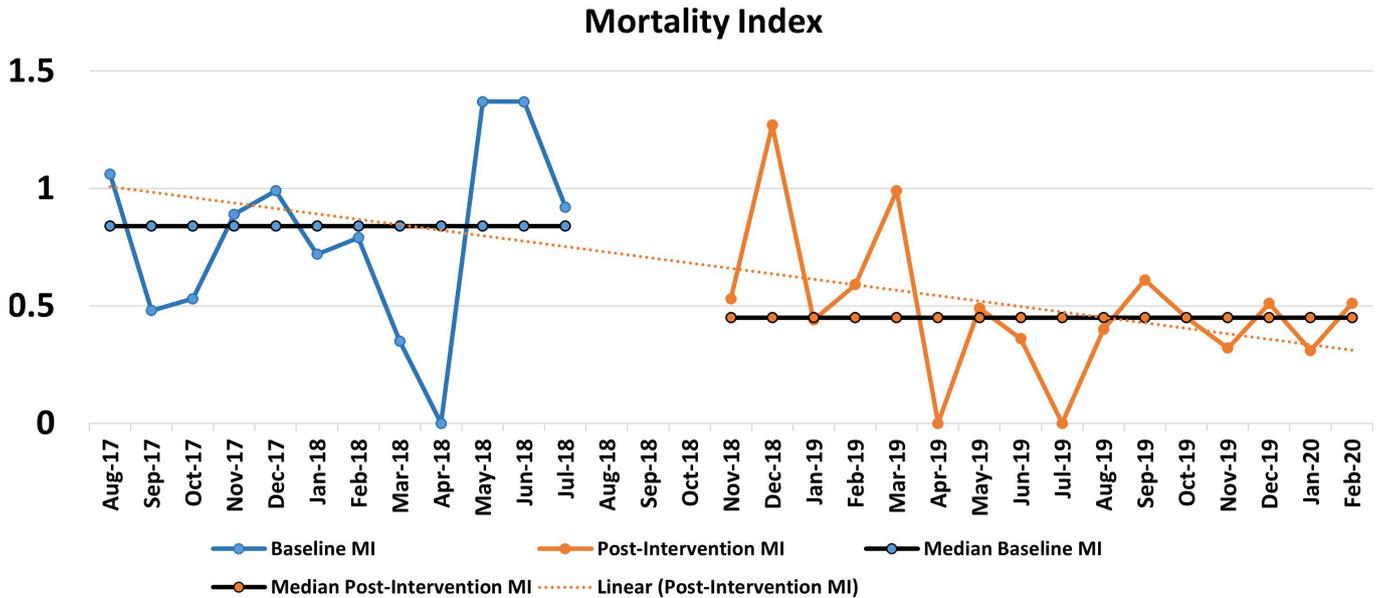


FIGURE 3. Mortality Index (MI) Run Chart.

monthly MI, observed mortality rate and expected mortality calculation can be assumed to be directly related to this quality improvement initiative. We cannot, however, determine to what extent the different parts of the quality improvement initiative impacted the overall success of the initiative.

Unlike in other quality improvement initiatives targeting mortality, the median observed mortality, or number of patients who died while admitted to the Gynecologic Oncology service, did not immediately improve following implementation of this intervention [10]. However, looking at the most recent months of data, there appear to be consistently fewer inpatient deaths and less variation in the rate of observed inpatient deaths. It is possible, therefore, that changes to our rate of observed mortality will lag behind the changes to the expected mortality and the MI. Such a lag may be due to the causes of an inpatient mortality being multi-factorial and therefore requiring a longer period of time of regularly discussing and reviewing these events to have an impact. Our in-depth monthly discussions reviewing the inpatient mortalities have led to improved awareness of the need to address advance care planning early and often during a patient's treatment of cancer. Another important improvement has been to discuss the barriers to earlier outpatient transition to hospice. Early outpatient referral to hospice, rather than referral to hospice after an inpatient admission or a patient passing during an admission to address symptoms near the end of life, is associated with improved quality of end of life care [20]. Furthermore, as a tertiary referral hospital, many of our patients who experience an inpatient death present to our facility with an advanced stage of illness require direct admission to the inpatient setting and ultimately pass away during that admission. Our quality improvement initiative described here was not designed to address such a scenario.

The areas where the greatest improvements were seen were in the increase in the expected mortality calculation by 37% and the decrease in the MI by 44%. The post-intervention expected mortality increased by 37% and was the driving

force behind the overall improvement in the MI during the post-intervention period. This is consistent with the other quality improvement initiatives where a systemic approach to clinician education led to an increase in the expected mortality calculation [18]. Our initiative has been able to show sustained improvement with a narrower range of monthly expected mortality calculations during the post-intervention period reflecting consistently higher values. Clinician documentation has been shown to be unreliable and often underreports patient comorbidities [18, 21, 22]. As a result, improving clinician documentation of patient comorbidities, which leads to a more accurate assessment of the expected mortality, is a vital component of any quality improvement initiative intended to improve the MI. This is also a critical step in accurately understanding any patient population in order to assess for other areas of improvement in clinical care. Though other quality improvement initiatives have described successfully raising the expected mortality calculation, an aspect of our quality improvement initiative that is unique is the way in which we formed a multidisciplinary team that played an active role in providing regular review and updates to the clinicians regarding effectiveness of documentation that has not only improved our expected mortality calculations but has also begun valuable conversations related to advance care planning and optimal timing of referral to hospice [18].

A limitation of our initiative was that the Vizient® calculations which we used for this initiative were risk-adjusted among academic medical centers and did not include smaller care centers. Also, during the time of this analysis, Vizient® did not differentiate mortality risk among different gynecologic disease sites though gynecologic malignancies have very different prognoses. Furthermore, there is debate surrounding the accuracy and validity of risk-adjust models though these models remain the accepted standard among publicly reported data [23]. Another limitation of this initiative is that it was not a randomized control trial. Demographic and other clinical data at the patient level are not available to be able to verify that

patient characteristics did not change significantly between the pre-intervention and post-intervention time periods. In addition, due to the nature of the available data, we could not perform additional statistical methodology to account for patients with multiple admissions. The lack of patient level data also precluded the ability to perform subgroup analyses that could identify if certain types of patients benefited more than others. However, the large volumes of patient admissions during the pre-intervention and post-intervention periods should mitigate minor variations in patient characteristics and we believe that the conclusions remain valid.

5. Conclusions

Inpatient mortality is an important quality metric but accurate calculation of inpatient expected mortality is critical for this value to be meaningful. Even though studies have questioned the correlation between inpatient mortality data and the quality of healthcare delivered, the increasing public transparency of such quality metrics and their incorporation into hospital rankings highlight a need to have accurate data related to these outcomes [24–26]. Accurate calculation of the inpatient expected mortality and the MI requires proper documentation of comorbidities and illness severity. Our results show that this can be improved through clinician education, standardization of clinical documentation, focused coder analysis of clinical documentation among patients at highest risk of inpatient mortalities and 100% mortality review of all inpatient deaths by our quality improvement team. Better understanding of our inpatient data is critical to providing the optimal care for our patients. Our initiative outlines one way that other healthcare organizations can systemically improve their approach to understanding and improving documentation related to inpatient care as well as how to initiative culture change related to prioritizing advance care planning and appropriate early referral to hospice. As the field of Gynecologic Oncology is a specialty that spans both the surgical and medical sides of oncology care, our results are widely applicable to other oncology specialties.

AUTHOR CONTRIBUTIONS

JT, JM, EB, CB, AH, AS and AP designed and developed this initiative, implemented this initiative and contributed to writing this manuscript. LM, KL and KS participated in education, review of the outcomes and preparation of the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

We received Quality Improvement Assessment Board approval within our institution on 12/11/2018. Our Quality Improvement Assessment Board protocol approval number is 313. We received a waiver of informed consent.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

- [1] Hibbard JH, Stockard J, Tusler M. Does publicizing hospital performance stimulate quality improvement efforts? *Health Affairs*. 2003; 22: 84–94.
- [2] Marshall MN, Shekelle PG, Leatherman S, Brook RH. The Public Release of Performance Data: what do we expect to gain? A review of the evidence. *The Journal of the American Medical Association*. 2000; 283: 1866.
- [3] Longo DR. Consumer reports in health care: do they make a difference in patient care? *The Journal of the American Medical Association*. 1997; 278: 1579.
- [4] Orlander JD, Fincke BG. Morbidity and mortality conference. *Journal of General Internal Medicine*. 2003; 18: 656–658.
- [5] Dholakia CA, Reavis KM. Morbidity and Mortality Conference. *The SAGES Manual of Quality, Outcomes and Patient Safety* (pp. 161–164). Boston, MA: Springer. 2012.
- [6] Harbison SP, Regehr G. Faculty and resident opinions regarding the role of morbidity and mortality conference. *The American Journal of Surgery*. 1999; 177: 136–139.
- [7] Hutter MM, Rowell KS, Devaney LA, Sokal SM, Warshaw AL, Abbott WM, *et al*. Identification of Surgical Complications and Deaths: an Assessment of the Traditional Surgical Morbidity and Mortality Conference Compared with the American College of Surgeons-National Surgical Quality Improvement Program. *Journal of the American College of Surgeons*. 2006; 203: 618–624.
- [8] Horwood CR, Latimer T, Powers CJ, Moffatt-Bruce SD, Rushing GD, Eiferman DS. Improving the mortality index by capturing patient acuity through interprofessional real-time documentation improvement in a single hospital system. *Surgery*. 2018; 164: 687–693.
- [9] Ferris TG, Torchiana DF. Public Release of Clinical Outcomes Data — Online CABG Report Cards. *New England Journal of Medicine*. 2010; 363: 1593–1595.
- [10] Barbieri JS, Fuchs BD, Fishman N, Cutilli CC, Umscheid CA, Kean C, *et al*. The Mortality Review Committee: a Novel and Scalable Approach to Reducing Inpatient Mortality. *The Joint Commission Journal on Quality and Patient Safety*. 2013; 39: 387–AP9.
- [11] Dharmarajan K, Hsieh AF, Lin Z, Bueno H, Ross JS, Horwitz LI, *et al*. Diagnoses and Timing of 30-Day Readmissions after Hospitalization for Heart Failure, Acute Myocardial Infarction, or Pneumonia. *The Journal of the American Medical Association*. 2013; 309: 355.
- [12] Martin G, Majumder A, Adams Z, Binger T, Harder B. *Methodology U.S. News & World Report 2019-2020 Best Hospitals Procedures & Conditions Ratings*. 2019.
- [13] Pope DG. Reacting to rankings: Evidence from “America’s Best Hospitals” *Journal of Health Economics*. 2009; 28: 1154–1165.
- [14] Jin GZ, Sorensen AT. Information and consumer choice: the value of publicized health plan ratings. *Journal of Health Economics*. 2006; 25: 248–275.
- [15] Scanlon DP, Chernew M, McLaughlin C, Solon G. The impact of health plan report cards on managed care enrollment. *Journal of Health Economics*. 2002; 21: 19–41.
- [16] Wedig GJ, Tai-Seale M. The effect of report cards on consumer choice

- in the health insurance market. *Journal of Health Economics*. 2002; 21: 1031–1048.
- [17] DesHarnais SI, Chesney JD, Wroblewski RT, Fleming ST, McMahon LF. The Risk-Adjusted Mortality Index: a new measure of hospital performance. *Medical Care*. 1988; 26: 1129–1148.
- [18] Arquette JM, Moss HA, Truong T, Pieper CF, Havrilesky LJ. Impact of a documentation intervention on health-assessment metrics on an inpatient gynecologic oncology service. *Gynecologic Oncology*. 2019; 153: 385–390.
- [19] Pinnock H, Barwick M, Carpenter CR, Eldridge S, Grandes G, Griffiths CJ, *et al*. Standards for Reporting Implementation Studies (StaRI): explanation and elaboration document. *BMJ Open*. 2017; 7: e013318.
- [20] Hui D, Kim SH, Roquemore J, Dev R, Chisholm G, Bruera E. Impact of timing and setting of palliative care referral on quality of end-of-life care in cancer patients. *Cancer*. 2014; 120: 1743–1749.
- [21] Lloyd SS. Physician and coding errors in patient records. *The Journal of the American Medical Association*. 1985; 254: 1330–1336.
- [22] Shahian DM, Wolf RE, Iezzoni LI, Kirlie L, Normand ST. Variability in the Measurement of Hospital-wide Mortality Rates. *New England Journal of Medicine*. 2010; 363: 2530–2539.
- [23] Kipnis P, Liu V, Escobar GJ. Accuracy of hospital standardized mortality rates: Effects of model calibration. *Medical Care*. 2014; 52: 378–384.
- [24] Pitches DW, Mohammed MA, Lilford RJ. What is the empirical evidence that hospitals with higher-risk adjusted mortality rates provide poorer quality care? A systematic review of the literature. *BMC Health Services Research*. 2007; 7: 91.
- [25] Dubois RW, Rogers WH, Moxley JH, Draper D, Brook RH. Hospital Inpatient Mortality. *New England Journal of Medicine*. 1987; 317: 1674–1680.
- [26] Thomas JW, Hofer TP. Accuracy of Risk-Adjusted Mortality Rate as a Measure of Hospital Quality of Care. *Medical Care*. 1999; 37: 83–92.

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