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ORIGINAL RESEARCH

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Disparities in the surgical treatment of loco-regional endometrial cancer

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Abstract

This study aims to assess disparities in the surgical treatment of women with loco-regional endometrial carcinoma (EC) utilizing a large national cancer database. The Surveillance, Epidemiology and End Results Program (SEER)-Medicare linked resource was used to analyze data from women with loco-regional EC treated in the United States from 2009–2017 who underwent a hysterectomy and were enrolled in Medicare. This is a retrospective cohort study. Total of 26,398 women met inclusion criteria. Most patients (17,921; 67.9%) underwent minimally invasive surgery (MIS). The percentage of patients undergoing MIS for EC significantly increased with time from 53% in 2009–2011 to 79% in 2015–2017 ($p < 0.0001$). Most non-Hispanic Black patients underwent laparotomy (1066 of 2091; 51%); most non-Hispanic White and Hispanic patients underwent MIS (non-Hispanic White: 15,127 of 21,555; 70%, Hispanic: 992 of 1632; 61%, $p < 0.0001$). A lower proportion of women with dual Medicare/Medicaid underwent MIS (59% *vs.* 70%, $p < 0.0001$). Centers with "Teaching Hospital" designation had significantly higher rates of MIS ($p < 0.0001$); "Sole Community" designation centers had significantly lower rates of MIS ($p < 0.0001$). Readmissions for surgical complications within 30 days of surgery were more frequent in the laparotomy cohort ($p < 0.0001$). On multivariate analysis, an increased hazard for death was observed among women who underwent laparotomy (Hazard Ratio (HR) 1.423; 95% Confidence Interval (CI) 1.345–1.507; $p < 0.0001$). These differences remained when analyzing women with localized and those with regional disease separately. We demonstrate both patient and organization-level differences between those who received laparotomy versus MIS for surgical management of EC.

Keywords

Endometrial cancer; Disparities; Surgery

1. Introduction

Endometrial cancer (EC) is the most common gynecologic malignancy in the United States (US) with both an increasing incidence and death rate, now affecting 1 in 37 women by age 80 [1, 2]. For non-Hispanic Black women, EC mortality has surpassed ovarian cancer mortality since 2005 [2]. Most EC cases are loco-regional at time of diagnosis [3]. Surgical management remains the cornerstone of treatment for most women with EC, with risk-adaptive adjuvant therapy [4]. After the Gynecologic Oncology Group-LAP2 trial demonstrated safety of comprehensive surgical staging with laparoscopy and equivalent survival outcomes with fewer complications and shorter hospital stay, the National Comprehensive Center Network (NCCN Guidelines Version 1.2023 Endometrial Carcinoma, ENDO-C) recommends minimally invasive surgery (MIS) for EC when technically feasible [5].

Racial disparities in EC are pronounced and encompass many aspects of cancer care—from diagnosis to treatment and outcomes. Rates of endometrial cancer and mortality are rising among women of all backgrounds but most notably in non-Hispanic Black women who have an overall 55% higher 5-year mortality risk than non-Hispanic White women. Despite numerous studies, causes for this gap are poorly understood [1, 6, 7]. Previous work has shown that non-Hispanic Black women are diagnosed with a greater proportion of aggressive non-endometrioid histologic subtypes of EC which contributes to overall lower 5-year survival [1, 6–8]. Within high-risk subtypes, however, inequality still exists in mortality between non-Hispanic Black and non-Hispanic White women (HR 1.5–2.8) [1, 6]. Moreover, non-Hispanic Black women are more likely to be diagnosed with late-stage than early-stage EC [1, 9, 10]. Access to appropriate care also plays a role in outcomes for non-Hispanic Black patients, contributing to poorer outcomes [7].

Regarding surgical management for EC, previous studies have demonstrated non-Hispanic Black women are less likely to undergo MIS for EC, and have more medical comorbidities,

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increased surgical complexity and higher postoperative complications [10–12]. However, previous work has not emphasized surgical approach in presumed early-stage disease where MIS is more likely to be used. The objective of our study is to assess disparities and trend over time in the surgical approach used in the treatment of women with presumed early-stage EC, and 30-day re-admissions due to surgical complications utilizing a large national cancer database.

2. Methods

This is a retrospective cohort study. The Surveillance, Epidemiology and End Results Program (SEER)-Medicare linked resource (https://healthcaredelivery.cancer.gov/seermedicare/) was used to analyze data from women with loco-regional EC as their first cancer diagnosed in the US from 2009–2017 who underwent a hysterectomy and were included in this data resource. The SEER database is a population-based tumor registry developed by the National Cancer Institute (NCI) and captures data on time of diagnosis, histology, location, stage, treatment, survival and demographics. SEER defines the cancer as localized when it is entirely confined to the organ of origin. It defines the cancer as regional when it extends beyond the organ of origin to adjacent organs or tissues and/or regional lymph nodes. The Medicare database captures data on patients with Medicare Part A (inpatient) and Part B (outpatient), including enrollment, billed claims, services and diagnoses. These two files are linked and provide data on initial services and all follow-up care for Medicare beneficiaries diagnosed with cancer while residing in SEER regions. As this is a study of de-identified data from SEER-Medicare database it was deemed exempt from review after submission to the Temple University Institutional Review Board.

Baseline patient demographics, organization level data as coded by the SEER database, surgical treatment approaches (code: 68.51 for MIS; code: 68.49 for Laparotomy), lymph node sampling ("yes", "no"), type and receipt of radiation therapy and 30-day readmissions due to surgical complications using specified diagnoses related group (DRG) codes (856–858, 862–863, 919–921) were abstracted from the SEER-Medicare linked database. All patients diagnosed with EC were included regardless of histology or tumor grade and information is available in the **Supplemental material**. Organization level data included designation as a teaching hospital or sole community hospital as per SEER dictionary and was coded as "yes" or "no". Adjuvant radiation data was collected for multivariate analysis and specific details about radiation are available in the **Supplemental material**. Descriptive statistics were used to characterize patient demographics and organization level data. Differences by surgical approach and trends in surgical approach were assessed using a chi-square test. Overall survival was defined as the interval from the date of diagnosis to the time of death or censoring and evaluated using the Kaplan-Meier estimate and log rank test. Analysis of maximum likelihood estimates was performed using multivariate regression analysis and hazard ratios for death were determined. All analysis was performed using SAS version 9.4 (SAS Institute, Cary, NC, USA) for statistical computing software. Statistical significance was defined as a p-value $<$ 0.05.

3. Results

3.1 Patient demographics and organization level data

A total of 26,398 women met inclusion criteria as outlined above. Most of them (20,299; 77%) had localized disease (*i.e.*, stage I). Most patients (17,921; 67.9%) underwent MIS (Table 1). The percentage of patients undergoing MIS for treatment of EC significantly increased ($p < 0.0001$) with time from 53% in 2009–2011 to 79% in 2015–2017 (Table 1, Fig. 1). Consequently, the percentage of patients undergoing laparotomy for treatment of EC significantly decreased ($p < 0.0001$) with time from 47% in 2009–2011 to 20% in 2015–2017 (Table 1, Fig. 1). Most patients were non-Hispanic White 21,555 (82%); followed by 2091 (8%) non-Hispanic Black; 1632 (6%) Hispanic; 882 (3%); and Asian/Pacific Islander (Table 1).

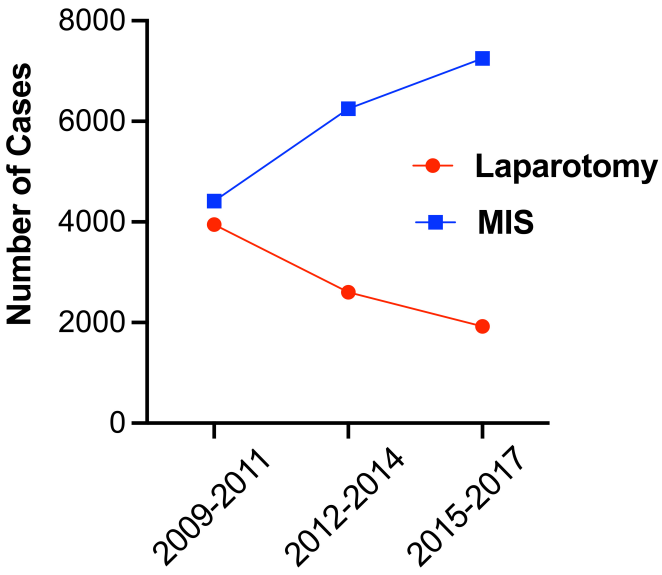

FIGURE 1. Trends in surgical approach over time. MIS: minimally invasive surgery.

3.2 Patient and organization level data

Most non-Hispanic Black patients underwent laparotomy (1066 of 2091; 51%) whereas most non-Hispanic White, Asian/Pacific Islander, and Hispanic patients underwent MIS (non-Hispanic White: 15,127 of 21,555; 70%, Asian/Pacific Islander: 599 of 882; 68%, Hispanic: 992 of 1632; 61%, $p < 0.0001$; (Table 1; Fig. 2A). A lower proportion of women with dual Medicare/Medicaid underwent MIS (59%) compared to those with Medicare (without Medicaid) (70%, $p < 0.0001$) (Table 1; Fig. 2B). Centers with "Teaching Hospital" designation had significantly higher rates of MIS ($p < 0.0001$); whereas hospitals with "Sole Community" status had significantly lower rates of MIS ($p < 0.0001$) (Table 1; Fig. 2C).

TABLE 1. Baseline patient and organization characteristics.

Characteristic		All Patients	Laparotomy		MIS[a] (Laparoscopy or Robotic)		*p*-value (Laparotomy *vs.* MIS)	Localized Cohort	Regional Cohort
		N	N	%	N	%		N	N
All		26,398	8477	32.11	17,921	67.89		20,299	6099
Race/Ethnicity									
	Asian/Pacific Islander	882	283	3.34	599	3.34		671	211
	Black	2091	1066	12.58	1025	5.72		1452	639
	Hispanic	1632	640	7.55	992	5.54	<0.0001	1220	412
	Other Race	238	60	0.71	178	0.99		193	45
	White	21,555	6428	75.83	15,127	84.41		16,763	4792
Age Group									
	1st quartile (65–67)	5111	1841	21.72	3270	18.25		4044	1067
	2nd quartile (68–71)	6991	2087	24.62	4904	27.36	<0.0001	5476	1515
	3rd quartile (72–77)	7419	2268	26.75	5151	28.74		5734	1685
	4th quartile (78–100)	6877	2281	26.91	4596	25.65		5046	1832
Year of Diagnosis									
	2009–2011	8361	3948	46.57	4413	24.62		6337	2024
	2012–2014	8857	2603	30.71	6254	34.90	<0.0001	6698	2159
	2015–2017	9180	1926	22.72	7254	40.48		7264	1916
Insurance									
	Dual Medicare/Medicaid	5034	2097	24.74	2937	16.39	<0.0001	3779	1255
	No Medicaid	21,364	6380	75.26	14,984	83.61		16,520	4844
Teaching Hospital Status									
	Yes	18,102	5910	69.72	12,192	68.03		13,891	4211
	No	172	93	1.10	79	0.44	<0.0001	136	36
	Unknown	8124	2474	29.18	5650	31.53		6272	1852
Sole Community Hospital									
	1	296	126	1.49	170	0.95	0.0001	239	57
	9	26,102	8351	98.51	17,751	99.05		20,060	6042
30-day Readmission Rate (Surgical Complication)	Admitted/Re-Admitted within 30 days of surgery	1034	541	6.38	493	2.75	<0.0001	690	344

[a] *MIS encompasses both laparoscopy and robotic-assisted laparoscopy.*

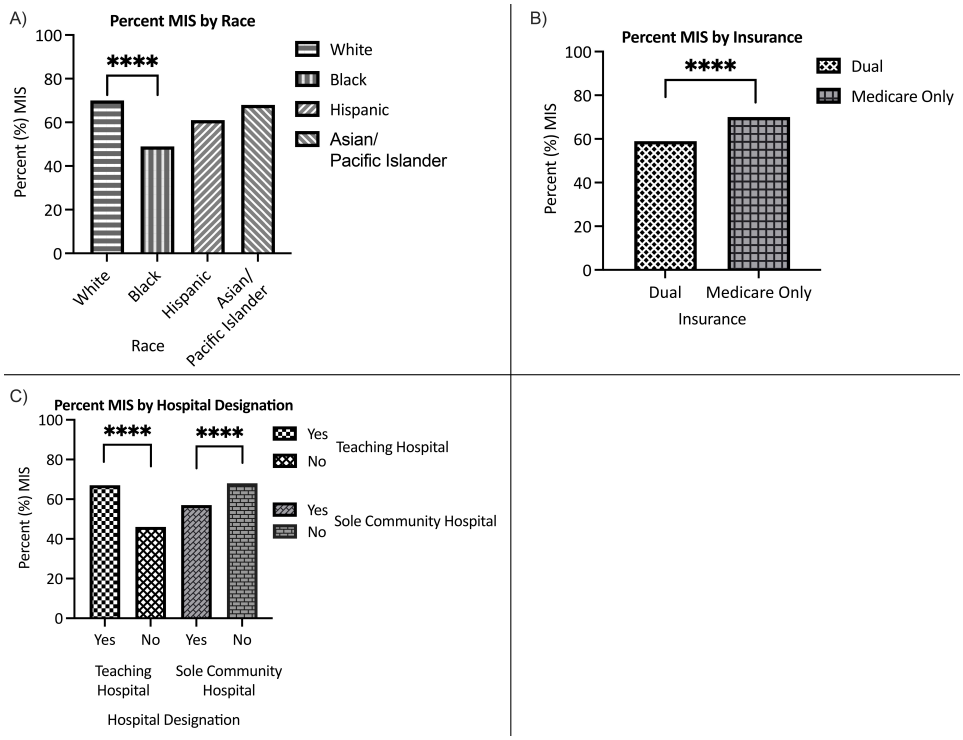

FIGURE 2. Percent MIS by patient and organization level data. (A) Percent MIS by Race, (B) Percent MIS by insurance, (C) Percent MIS by Hospital Designation. MIS: minimally invasive surgery. ****: statistically significant difference.

3.3 Complications and survival

Readmissions for surgical complications within 30 days of surgery occurred significantly more frequently among women who underwent laparotomy ($p < 0.0001$, Table 1). Log-rank test of Kaplan-Meier estimates for overall survival was significantly different ($p < 0.0001$) and favored MIS (Fig. 3). Additionally, Kaplan-Meier estimates for overall survival by race within surgical approach was analyzed and regardless of surgical approach, compared to non-Hispanic Black women, survival significantly favored non-Hispanic White women ($p < 0.0001$ for MIS and Laparotomy) (Fig. 4). On multivariate analysis a significant increased hazard for death was seen among women undergoing laparotomy (HR 1.423; 95% CI 1.345–1.507; $p < 0.0001$), non-Hispanic Black women (HR 1.486; 95% CI 1.360–1.624; $p < 0.0001$), women with dual Medicare/Medicaid (HR 1.394; 95% CI 1.300–1.496; $p < 0.0001$), and women who received any radiation (HR 1.308; 95% CI 1.222–1.399; $p < 0.0001$) (Table 2). There was no increased hazard for death based on lymph node sampling (HR 1.006; 95% CI 0.937–1.079; $p = 0.8704$) (Table 2). These differences remained when analyzing patients who had localized and regional disease separately.

4. Discussion

We conducted a retrospective national database study to assess disparities in the surgical management, trends in surgical management over time, and re-admissions for surgical complications of women with early-stage EC. In our cohort of patients, we demonstrate both patient (race, insurance) and organization-level (teaching hospital, sole community hospital status) differences between those who received laparotomy versus MIS for surgical management of EC.

The Gynecologic Oncology Group-LAP2 randomized clinical trial, published in 2009, compared laparoscopy to laparotomy for comprehensive surgical staging of EC and found that laparoscopy was associated with fewer moderate to severe postoperative adverse events and there was no difference in overall detection of advanced stage, leading authors to conclude laparoscopic surgical staging for EC was feasible and safe [5]. This led to the practice changing pattern of increasing use of laparoscopy in the surgical management of EC since the time of publication. As demonstrated in previous studies [10], we found use of MIS has continued to significantly increase over time for both non-Hispanic White and non-Hispanic Black patients; however, the rates between non-Hispanic White and non-Hispanic Black patients remain disparate. These results are in line with a retrospective database study by Lee *et al.* [10], using the American College of Surgeons' National Surgical Quality Improvement Project database (ACS NSQIP) of women with EC who underwent hysterectomy from 2010–2015. Their study included 17,692 patients and found that overall rates of laparoscopy increased over the 6-year period; however, rates consistently remained lower among non-Hispanic Black women [10]. Like our study, most non-Hispanic Black patients in their cohort underwent laparotomy (51%) [10]. They also demonstrated that non-Hispanic Black women had more postoperative complications compared to non-Hispanic White women; however, they found no difference in postoperative complication rates between non-Hispanic Black and non-Hispanic White women when examining only patients who received laparoscopy [10]. Our study supports previous findings where 30-day readmissions from surgical complications were significantly higher in the

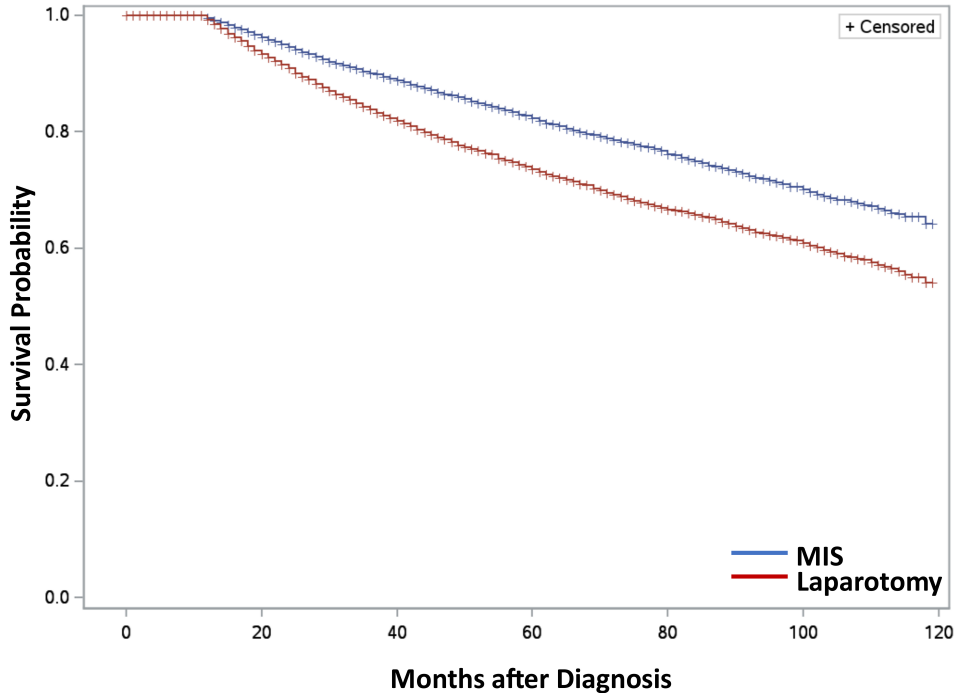

FIGURE 3. Kaplan-Meier analysis of Overall Survival for MIS *vs.* laparotomy ($p < 0.0001$). MIS: minimally invasive surgery.

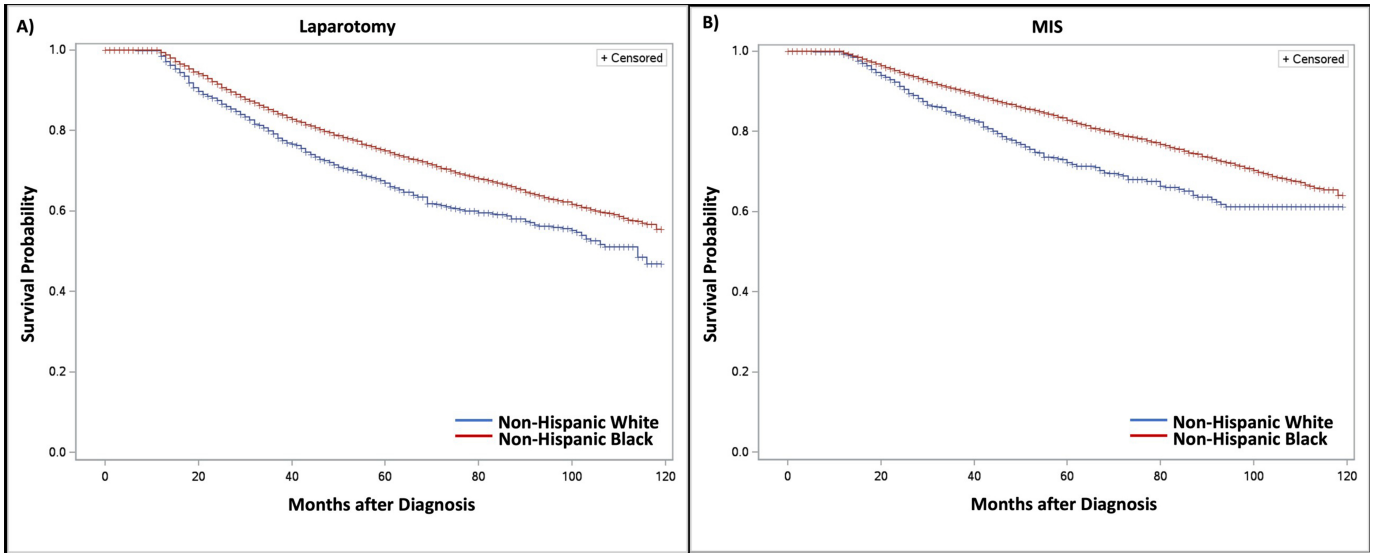

FIGURE 4. Kaplan-Meier analysis of Overall Survival by Race for patients undergoing. (A) Laparotomy, (B) MIS. MIS: minimally invasive surgery.

TABLE 2. Maximum likelihood estimates for hazard ratio of death*.

Variable	Hazard Ratio (HR)	95% CI	*p*-value
Laparotomy	1.423	1.345–1.507	<0.0001
Non-Hispanic Black race	1.486	1.360–1.624	<0.0001
Dual Medicare/Medicaid	1.394	1.300–1.496	<0.0001
Receipt of any radiation therapy	1.308	1.222–1.399	<0.0001
Any lymph node sampling	1.006	0.937–1.079	0.8704

**Multivariate analysis that included the following variables: hysterectomy type, race, age, year of diagnosis, health insurance type, teaching hospital, cancer center, adjuvant radiation, lymph node sampling. CI: Confidence Interval.*

laparotomy group as compared to the MIS group. However, the database we used did not allow us to control for risk factors that may have influenced the decision to perform a laparotomy and that may have also increased the risk for surgical complications.

The Laparoscopic Approach to Cancer of the Endometrium (LACE) randomized equivalence trial published in 2017 investigated whether total laparoscopic hysterectomy (TLH) is equivalent to total abdominal hysterectomy (TAH) in women with treatment-naïve endometrial cancer in terms of disease-free interval and overall survival [13]. At 4.5 years of follow up, disease-free survival was 81.3% in the TAH group and 81.6% in the TLH group with disease free survival rate difference of 0.3%, meeting criteria for equivalence [13]. There were no statistically significant differences in overall survival between TLH and TAH (risk difference of 0.6%, $p = 0.46$) [13]. In contrast to our findings, several retrospective, propensity matched studies have demonstrated no difference in oncologic outcomes comparing MIS to laparotomy among patients with EC [14–16]. Our large retrospective cohort study did find a significant overall survival difference between laparotomy and MIS, favoring MIS. We must highlight the worse survival of patients undergoing laparotomy may be due to selection bias toward laparotomy for patients with risk factors not included our analysis (*e.g.*, extent of lymph node dissection, uterine size, medical co-morbidities). Additionally, non-homogeneity and non-stratification of survival outcomes by adjuvant treatment should be considered when interpreting this finding. This is noted on multivariate analysis, where an increased hazard for death with receipt of any radiation; however, there was no increased hazard for death if lymph node sampling was performed or not.

A previous SEER analysis by Sud *et al.* [17] found that racial disparities in EC survival are driven by the increased proportion of advanced stage at time of diagnosis, aggressive histology and differential use of surgery. They report that Black women were less likely to undergo surgery (79.8% *vs.* 90.3%) and more likely to forgo operative management even when recommended (7.7% *vs.* 3.9%) as compared to White women [17].

In conclusion, our study adds to previous work as we demonstrate that when it comes to surgical management of EC, non-Hispanic Black patients are less likely to undergo MIS for presumed early-stage disease. Additionally, we demonstrate that non-Hispanic Black patients had worse overall survival, regardless of surgical approach. The difference in survival remained when analyzing patients who had localized and regional disease separately.

However, care must be taken when interpreting this finding since the SEER database does not allow us to analyze all factors that could influence survival.

The strengths of our study include use of a large, nationally validated database. With 26,398 patients, this is one of the largest studies evaluating surgical approach in loco-regional EC.

Limitations include de-identified nature of data, preventing further abstraction of patient information, as well as inability to further sub-divide MIS into laparoscopy and robotic-assisted surgery. Despite this limitation, this database provides robust insight into national practice patterns.

Even with considerable effort to understand and mitigate the causes, racial disparities in EC are pronounced and encompass many aspects of cancer care. Future studies should investigate strategies to address these persistent differences.

5. Conclusions

We demonstrate both patient and organization-level differences between those who received laparotomy versus MIS for surgical management of EC.

AVAILABILITY OF DATA AND MATERIALS

The Surveillance, Epidemiology and End Results Program (SEER)-Medicare linked resource (https://healthcaredelivery.cancer.gov/seermedicare/) used for this study is publically available.

AUTHOR CONTRIBUTIONS

EHu and EHe—developed the study concept, drafted the manuscript. MTH—acquired the data. EB—performed statistical analysis. All authors were involved in revising the manuscript for important intellectual content and approving the final version for publication (This includes SA, AC, KH).

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

As this is a study of de-identified data from SEER-Medicare database it was deemed exempt from Institutional Review Board (IRB) review after submission to the Temple University IRB.

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Not applicable.

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This research received no external funding.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at https://oss.ejgo.net/files/article/1735538861358891008/attachment/Supplementary%20material.docx.

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