Racial Disparities in the Utilization of Preventive Health Services among Older Women with Early Stage Endometrial Cancer Enrolled in Medicare

Jovana Y. Martin

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Committee:

Melissa A. Schiff

Noel S. Weiss

Renata R. Urban

Program Authorized to Offer Degree:

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University of Washington

Abstract

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Jovana Y. Martin

Chair of Supervisory Committee:
Melissa A. Schiff, M.D., M.P.H.
Epidemiology

Objective: To assess differences in the receipt of preventive health services by race/ethnicity among older women with endometrial cancer enrolled in Medicare.

Methods: We conducted a retrospective population-based cohort study of women diagnosed with endometrial cancer from 2001 to 2011 in the Surveillance Epidemiology and End Results (SEER)-Medicare database. Women with stage I or II endometrial cancer of epithelial origin were included. The exposure was race/ethnicity (Non-Hispanic (NH) White, NH Black, Hispanic, and NH Asian/Pacific Islander (PI)). The services examined were receipt of influenza vaccination and screening tests for diabetes mellitus, hyperlipidemia, and breast cancer. We used multivariate logistic regression to estimate odds ratios with 95% confidence intervals (CI) adjusted for age, region, and year of diagnosis.

Results: 13,054 women were included in this study. In the two years after diagnosis, receipt of any influenza vaccine ranged from 45% among NH Black women to 67% among NH White women; receipt of any mammogram ranged from 65% among NH Black women to 74% among

NH White women. Relative to NH White women, NH Black women had a lower likelihood of receiving both influenza vaccination (adjusted odds ratio (aOR) 0.40, 95% CI 0.33-0.44) and screening mammography (aOR 0.64, 95% CI 0.52-0.79). Hispanic women were also less likely to receive influenza vaccination than NH White women (aOR 0.61, 95% CI 0.51-0.72). There were no significant differences across racial groups for diabetes or cholesterol screening services.

Conclusion: Among older US women with early stage endometrial cancer, racial disparities exist in the utilization of some preventive services.

Background

Endometrial cancer is the most common gynecological malignancy among women in the US, with an anticipated 60,050 incident cases and 10,470 deaths in 2016 (1). The majority of women with endometrial cancer are diagnosed at an early stage and have a favorable cancer-related prognosis, with 83% of such women alive 5 years after diagnosis (1). After primary endometrial cancer treatment, surveillance with review of symptoms and physical exam is initiated to detect the occurrence of recurrent cancer (2). Women with endometrial cancer have a high prevalence of concurrent comorbid conditions, and according to a population-based study using the Surveillance Epidemiology and End Results (SEER) data, women with low-grade endometrial cancer are more likely to die from cardiovascular disease than endometrial cancer (3, 4). Given this, addressing medical comorbidities and endorsing health promotion during the period following a cancer diagnosis is likely to be of substantial benefit.

Preventive health care utilization in the survivorship period for various cancers has been examined and the quantity of preventive services that cancer survivors receive has varied (5-14). As outlined in the Anderson Behavior Model of Health Service Utilization, reasons for variation in the utilization of preventive services include predisposing patient characteristics such as gender or race, enabling factors such as health insurance, social support, proximity to healthcare facilities, or the perceived need for services by the patient and/or the provider (15). At the age of 65, all United States citizens and permanent legal residents are eligible to receive Medicare benefits, eliminating the lack of insurance aspect of access to healthcare. Despite this, racial disparities in the utilization of preventive health services exist among Medicare

beneficiaries (16). Compared to Whites, Blacks and Hispanics are less likely to receive screening mammography and colonoscopy as well as influenza vaccination (17-22).

The utilization of preventive services by women with early stage endometrial cancer immediately after their cancer diagnosis has not been well described. Given that women with early stage endometrial cancer have a favorable cancer prognosis, our objective was to assess differences in the receipt of preventive care among Medicare beneficiaries under surveillance for early stage endometrial cancer by race and ethnicity in the survivorship period.

Methods

We conducted a retrospective population-based cohort study of women who were diagnosed with early stage endometrial cancer between 2001 and 2011 in the SEER registries linked to the Medicare database to evaluate the association between race/ethnicity and the receipt of preventive services in the survivorship period. The cancer registries that participate in the SEER program are estimated to cover 28% of the US population (23). Each registry collects data on patient demographics, primary tumor site, stage at diagnosis, cancer markers, first course of cancer treatment, and survival information (23). The Medicare files include demographic information, inpatient and outpatient billing claims. The first SEER-Medicare linkage was completed in 1991 and it is updated every two years, with the last update being released in 2014. With each linkage, 93% of individuals 65 and older in the SEER files are successfully matched to the Medicare files (24).

The linked dataset for this analysis included women diagnosed with uterine cancer (International Classification of Disease (ICD)-0-3 site recode numbers C540-C549 and C559)

from January 1, 2001 through December 31, 2011 with analysis of billing claims from January 1, 2000 through December 31, 2013. The University of Washington Human Subjects Division granted this project as exempt from human subject's research.

Women were included in the study if they were diagnosed with stages I through II (early stage) endometrial carcinoma of epithelial origin, at least 66 years of age at diagnosis, had a hysterectomy as part of the management for their endometrial cancer, had Medicare Part A & Part B for at least 1 year prior to their endometrial cancer diagnosis, and had continuous enrollment in both Medicare parts A and B during the study period. Women were excluded if they had a managed care plan in addition to Medicare, were missing information on tumor stage at diagnosis, or had a major secondary cancer diagnosis excluding non-melanoma skin cancer before their endometrial cancer diagnosis. Additionally, for the analysis of receipt of preventive services within two years of endometrial cancer diagnosis, women were excluded if they had a second cancer diagnosis within the two years after their endometrial cancer diagnosis. Similarly, for analysis of receipt of preventive services within five years of endometrial cancer diagnosis, women were excluded if they had a second cancer within the five years after their endometrial cancer diagnosis.

Our exposure of interest for receipt of preventive services was patient race/ethnicity, categorized as Non-Hispanic (NH) White, NH Black, Hispanic, and NH Asian/Pacific Islander (PI). Information for race was derived from the Patient Entitlement and Diagnosis Summary (PEDSF) File which has variables for race that originated from the Medicare enrollment database (EDB) and SEER. Priority was given to the race variable from the EDB and missing values were filled in

from the SEER race variables. Furthermore, we used the Hispanic origin variable from SEER to categorize subjects as Hispanic ethnicity, regardless of their race. Women of any other race/ethnicity were excluded from our analysis.

To determine the utilization of preventive services, we examined receipt of preventive health care through two time points, two years and five years after endometrial cancer diagnosis. The preventive care services we examined included well visits, influenza vaccination, breast cancer screening, cholesterol screening in those without a diagnosis of hyperlipidemia one year prior to endometrial cancer diagnosis, and diabetes mellitus screening in those without a diagnosis of diabetes mellitus one year prior to endometrial cancer diagnosis. In addition, to qualify for diabetes mellitus screening, a woman had to have a diagnosis of obesity, hypertension or hyperlipidemia one year prior to endometrial cancer diagnosis. In all instances, we followed the United States Preventive Services Task Force (USPTSF) recommendations for frequency of screening and the Centers for Disease Control (CDC) recommendations for frequency of vaccination (Appendix 1).

We assessed the inpatient and outpatient Medicare billing claims to identify the receipt of prevention services utilized using Current Procedural Terminology (CPT), International Classification of Diseases (ICD) 9th edition, and Healthcare Common Procedure Coding System (HCPCS) codes outlined in Appendix 2. Additionally, for receipt of preventive services that were age-specific, we accounted for the patient's age at the time of endometrial cancer. For example, breast cancer screening is not recommended over the age of 74. To account for this, in our assessment for breast cancer screening, women diagnosed with endometrial cancer who

were over the age of 72 were excluded from analysis. This was to allow women sufficient time at risk to have each respective screening service.

We collected information on the following demographic variables: age at diagnosis, marital status (married vs never married or previously married), geographic type of residence (urban vs rural as defined in SEER), geographic region of diagnosis (Northeast, Midwest, South, and West as defined by the SEER registry region), and year of diagnosis. Additionally, from the 2000 census tract we determined the median household income, the percent below the poverty level and the percent with less than a high school education. Each of the variables from the 2000 census tract were categorized into quartiles; the lowest quartile (less than 25^{th} percentile), low through middle (25^{th} – 50^{th} percentile), middle to high (>50^{th} percentile – 75^{th} percentile), and the highest quartile (> 75^{th} percentile). We determined the Charlson comorbidity index score from the medical comorbidities located in inpatient and outpatient Medicare claims 1 year prior to cancer diagnosis using the Charlson comorbidity index with the Deyo modification for administrative databases (25, 26). Cancer was excluded from Charlson comorbidity index score. Tumor-related variables from SEER included tumor stage, histology, and grade. Cancer treatment determined from Medicare billing claims 6 months after diagnosis were adjuvant radiation therapy and adjuvant chemotherapy.

We compared demographic and clinical characteristics among women with endometrial cancer who did and did not have at least two years of Medicare follow-up. Demographic factors, clinical factors, and treatment factors were compared between race/ethnic groups using chi-squared tests. We used logistic regression to estimate adjusted odds ratios (aOR) with

95% confidence intervals (CI) to determine the association between race/ethnicity and the receipt of each preventive service. For each preventive service, we modeled the outcome in two ways. First, we modeled the receipt of the service at least once in two years or five years. Second, we modeled receipt of the service if it was received at the recommended frequency during the two year and five year follow-up time period by the USPSTF (Figure 1). Within two years of diagnosis we looked at receipt of two influenza vaccinations within two years and within five years of diagnosis we looked at the receipt of five influenza vaccinations in five years and two screening mammography's within five years. We chose to examine the following variables as potential confounders: year of cancer diagnosis, age at the time of diagnosis, SEER region, obesity, and Charlson comorbidity index score using a causal diagram (Figure 2) (27). Age at the time of diagnosis, SEER region, and year of diagnosis were the variables that were considered to be true confounders.

Results:

From 2001-2011, we identified 77,292 women with cancer of the uterine corpus in the SEER-Medicare database. After applying our inclusion and exclusion criteria, 13,054 patients were eligible for analysis (Figure 3). Women with less than two years of Medicare follow-up time were more likely to be older, of NH Black race/ethnicity, and more likely to be unmarried. They also had higher Charlson comorbidity scores, a higher proportion of stage II cancers, worse tumor grade and histology, were more likely to have received adjuvant radiotherapy, and had a higher likelihood of death from any cause.

NH Black, Hispanic, and NH Asian/PI women were more likely to be diagnosed with endometrial cancer at a younger age compared to NH white women (Table 1). NH Black women were less likely to be married and more likely to have stage II cancer compared to all other race/ethnic groups. A greater proportion of NH Blacks and Hispanics were obese compared to NH whites. More NH Blacks, Hispanics, and Asian/PI had diabetes and hypertension compared to NH Whites. Both NH Black and Hispanics were overrepresented in the lowest quartiles for median census tract income and high school education, and also were overrepresented in the highest quartile of percent below poverty level. A similar proportion of women in all groups had undergone adjuvant radiotherapy, but NH Blacks were more likely to have received adjuvant chemotherapy than women in other groups.

Influenza vaccination

We found that receipt of any influenza vaccination varied by race, with 67% of NH White women, 45% of NH Black women, 53% of Hispanic women, and 66% of NH Asian/PI women receiving at least one influenza vaccination in two years (Table 2). After adjusting for confounders, year of diagnosis, region of diagnosis, and age, we found that relative to NH White women, the odds of receiving any influenza vaccination were 0.40 for NH Black women (95% CI 0.33-0.44) and 0.61 for Hispanic women (95% CI 0.51-0.72). The corresponding odds ratios for receipt of two influenza vaccinations in two years were 0.33 (95% CI 0.27-0.39) and 0.47 (95% CI 0.39-0.57) for NH Black women and Hispanic women compared to NH White women, respectively.

Within five years after an endometrial cancer diagnosis, the proportion of women having received any influenza vaccination also differed across race/ethnicity categories (Table 3). The proportion of NH White women and NH Asian/PI women who received at least one influenza vaccination was 79% and 78%, respectively. Sixty percent of NH Black women and 69% of Hispanic women had at least 1 influenza vaccination within five years after diagnosis. The adjusted odds ratio for receiving any influenza vaccination in the five years after cancer diagnosis relative to NH White women was 0.39 for NH Black women (95% CI 0.31-0.48) and 0.65 for Hispanic women (95% CI 0.51-0.83). The proportion of women who received five influenza vaccinations within those five years was 26% for NH White women, 8% for NH Black women, 11% for Hispanic women, and 22% for NH Asian/PI women. Within five years of endometrial cancer diagnosis, the odds of receiving five influenza vaccinations within five years were 0.23 for NH Black women (95% CI 0.16-0.34) and 0.39 for Hispanic women (95% CI 0.27-0.56).

Breast cancer screening

Within two years of endometrial cancer diagnosis, the proportion of women who received at least one screening mammogram ranged from 65% for NH Black women to 74% for NH White women (Table 2). Compared to NH White women, the odds for receiving any screening mammogram within two years of endometrial cancer diagnosis was 0.64 for NH Blacks (95% CI 0.52-0.79). Within five years of diagnosis, the odds for receiving of any screening mammogram for Hispanic women was 0.61 (95% CI 0.42-0.88) and 0.65 for NH Black women (95% CI 0.49-0.92) compared to NH White women (Table 3). We examined the frequency of

having at least two mammograms within five years of endometrial cancer diagnosis, and found that the odds were 0.84 for Hispanic women (95% CI 0.60-1.18) and 0.56 for NH Black women (95% CI 0.41-0.75) compared to NH White women (Table 3).

Medicare well visits

The proportion of women who had at least one Medicare well visit within two years after endometrial diagnosis was 12% for NH White women, 10% for NH Black women, 12% for Hispanic women, and 15% for NH Asian/PI women (Table 2). Less than 1% of all women had between four and five visits within five years from endometrial cancer diagnosis. The proportion of women with at least one Medicare well visit within five years after endometrial diagnosis was 21% for NH White women, 21% for NH Black women, 20% for Hispanic women, and 18% for NH Asian/PI women.

Diabetes mellitus Screening

The proportion of women who had at least one diabetes mellitus screening test within two years after endometrial cancer diagnosis was 32% for NH White women, 38% for NH Black women, 38% for Hispanic women and 40% for NH Asian/PI women (Table 2). Relative to NH White women, NH Black women (aOR 1.34 95% CI 1.06-1.71), Hispanic women (aOR 1.35 95% CI 1.03-1.77), and NH Asian/PI women (aOR 1.47 95% 1.02-2.10) had a higher likelihood of receiving at least one diabetes mellitus screening test within two years. After restricting to women who were eligible for diabetes mellitus screening, over 50% of women in each race/ethnicity category received at least one diabetes mellitus screening test within five years of endometrial cancer diagnosis, with a range of 51% for NH White women to 64% for Asian/PI

women (Table 3). Relative to NH White women, Hispanic women (aOR 1.59 95% CI 1.14-2.23), NH Black women (aOR 1.38 95% CI 1.00-1.91), and NH Asian/PI women (aOR 1.85 95% CI 1.11-3.09) had a higher likelihood of receiving at least one diabetes mellitus screening test within five years.

Cholesterol Screening

Receipt of cholesterol screening was similar between race/ethnicity groups, with 90% of women in each group having at least one cholesterol screening test within five years of endometrial cancer diagnosis (Table 3). On multivariate logistic regression, we found no statistically significant differences in cholesterol screening by race/ethnicity.

Discussion:

Among women with newly diagnosed early-stage endometrial cancer who were identified in the SEER-Medicare database from 2001-2011, we found that racial disparities existed in the utilization of influenza vaccinations, screening mammography, and screening for diabetes. During the first five years following an endometrial cancer diagnosis, relative to NH White women, NH Black and Hispanic women had a lower likelihood of receipt of influenza vaccination, and NH Black women had a lower likelihood of receipt of screening mammography. Relative to NH White women, NH Black women, Hispanic women and NH Asian/PI women had a higher likelihood for receipt of diabetes mellitus screening.

The Healthy People 2020 target for vaccination is 90% (28), and we have shown that early stage endometrial cancer survivors in the US are receiving influenza vaccinations well below this target, with a range of 45% for NH Black women to 67% for NH White women.

McBean et al analyzed endometrial cancer survivors more than five years after diagnosis to determine if they received mammography, colon cancer, influenza vaccine and bone density testing preventive services at the same frequency as women without a history of cancer (9). They found that compared to women without cancer, survivors had a similar frequency of influenza immunization and bone density testing but a higher likelihood for receipt of mammogram and colon cancer screening. They found that Black women had a 48% lower odds for receipt of influenza vaccination compared to White endometrial cancer survivors five years after cancer diagnosis (9). Comparatively, McBean et al looked at the frequency of preventive services among endometrial cancer survivors more than five years after endometrial cancer diagnosis while in our analysis we looked at the frequency of services from the time of diagnosis up until five years in order to gain understanding of the preventive service utilization when survivors would be undergoing surveillance for endometrial cancer. Snyder et al, in a five year longitudinal study of breast cancer survivors, found that Black compared to Whites with breast cancer had a 55% lower odds of receiving an influenza vaccination. Possible explanations for these findings may relate to health beliefs, provider recommendations and provider bias. Cross-sectional surveys among Medicare beneficiaries that have attempted to identify the differences in influenza vaccine status by race/ethnicity found that Blacks and Hispanics were more likely to have negative beliefs and attitudes towards the influenza vaccine compared to Whites (18, 19, 21). Regardless of patient attitudes towards vaccination, provider recommendation of an influenza vaccination has been shown to positively influence vaccination rates (19, 21). Furthermore, other studies have shown that if a provider recommends an

influenza vaccination, regardless of a patient's race or attitude towards the vaccine, the likelihood of receipt of the vaccination is increased (19, 21, 29). Conversely, a provide may not recommend a vaccine due to lack of familiarity with vaccine recommendations in the elderly (30) or because they assume the patient will refuse.

In the two years after endometrial cancer diagnosis, receipt of any mammogram ranged from 66% for NH Black women to 74% for NH White women, and the frequency of two screening mammograms in five years ranged from 57% for NH Black women to 67% for NH Asian/PI women. McBean et al examined preventive health service utilization for endometrial cancer survivors more than 5 years after cancer diagnosis and noted Blacks had a 26% lower odds for receipt of mammography (9). Snyder et al found that Black breast cancer survivors 1 year after breast cancer diagnosis had a 54% lower odds for receiving a mammogram compared to Whites (14). Borrayo et al found that Hispanic women had a 26% lower odds for breast screening compared to NH White women (31). Reasons for disparities in breast cancer screening may include enabling factors such as geographic barriers to mammography screening locations or the perception of the patient and provider of the necessity of breast cancer screening. Onega et al used Zip-code level data and Medicare claims to determine travel times to the nearest mammography center for Medicare beneficiaries, and found that approximately 85% of women had median travel times of less than 20 minutes (32). When they evaluated travel time to mammography centers by race, they found that Black, Hispanic, and Asian women had shorter median travel times compared to White women (32), suggesting that barriers to screening mammography among minority women were not geographic ones.

Mobley et al examined socio-ecological predictors for mammography use among SEER-Medicare beneficiaries in California, and found that women who lived in urban areas, segregated Hispanic neighborhoods, communities with high poverty rates, or areas where workers travel a long distance between work and home were less likely to utilize screening mammography (33). In the present study we found that a greater proportion of NH Black women and Hispanic women were classified as living in poverty, but we were unable to directly measure how poverty contributes to disparities in breast cancer screening. It is conceivable that poverty is a surrogate for other factors that are contributing to a lack of screening, such as reliable transportation to mammography centers and/or social support within in the community. Furthermore, we were unable to measure the frequency at which providers recommended screening mammography. It has been documented that providers may fail to recommend preventive services because of lack of knowledge regarding age-based recommendations and concerns regarding the usefulness of screening among the elderly (34). Given that obesity is associated with the development of numerous cancers, including both endometrial cancer and breast cancer (35), it is concerning that many US women with early stage endometrial cancer are not being appropriately screened for breast cancer.

The proportion of women screened for diabetes mellitus within five years of endometrial cancer diagnosis was higher among Hispanic and Asian/PI women compared to NH White women. Medicare beneficiaries over age 65 are eligible for diabetes mellitus screening if they are overweight, have a history of high blood pressure, dyslipidemia, elevated serum blood glucose, or have a family history of diabetes (36). Prior studies have shown disparities among

Asian and White Medicare beneficiaries, with Asians less likely to have had diabetes screening (37). A plausible reason for the difference between their finding and ours is that we combined Pacific Islanders with Asians and it is well-known that Pacific Islanders have a high prevalence of obesity and medical comorbidities (38). Additionally, one indication for diabetes mellitus screening is a family history of diabetes, which we were not able to measure in our dataset. The well-known higher prevalence of diabetes mellitus in minority populations (39) could have prompted providers to screen these women.

In the five years after endometrial cancer diagnosis we found that over 90% of women of all races and ethnicity received screening tests for cholesterol. The Healthy People 2020 target for cholesterol screening during a five-year time span is 82% (28), and we found that early stage endometrial cancer survivors across all racial groups are being screened well above that target. These findings are consistent with other national reports that have shown that approximately 90% of women over age 65 receive cholesterol screening without regard to race (40).

There are limitations in using the SEER-Medicare database to address the question of receipt of preventive services. First, there is the potential for measurement error. If any screening test were ordered with a diagnostic billing code we would not be able to correctly identify that test as a screening test. For example a screening mammogram could be converted to a diagnostic mammogram during the same visit if a lesion were detected during the exam (41). However, we expect this to be non-differential misclassification by race, and it would bias any association with race towards the null. Furthermore, there is the possibility for residual

confounding given that we were not able to account for individual level socioeconomic characteristics which can be associated with race/ethnicity as well as the utilization of preventive services. Lastly, the results may have limited external validity as we were only able to study women 66 years and older with Medicare of whom the majority are concentrated in urban areas. There may be differences in the utilization of preventive services for endometrial cancer survivors who are younger, have private insurance, or live in rural areas.

Conclusions:

Women with early stage endometrial cancer have a low likelihood of death from the cancer itself (1, 4), and so measures available to prevent other medical comorbidities are no less important in them than in other women. We found that in the US Medicare population, women with early stage endometrial cancer had a relatively low utilization of several preventive measures recommended by the USPTSF and the CDC, namely influenza immunization and screening mammography. The reasons behind these observed gaps are complex; likely influenced by practice patterns as well as economic, social, and behavioral factors. Future work should focus on understanding how these influences interact to create barriers that sustain inequities in care. Suggestions to improve compliance and reduce disparities in utilization of preventive services following a diagnosis of endometrial cancer include educating patients and providers about general health screening and screening that is based on comorbidities such as obesity. Additionally, the use of cancer survivorship plans that include screening recommendations can be implemented to help with the advocacy for preventive care by both oncologists and primary care providers.

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Figure 1: Preventive services by survivor years

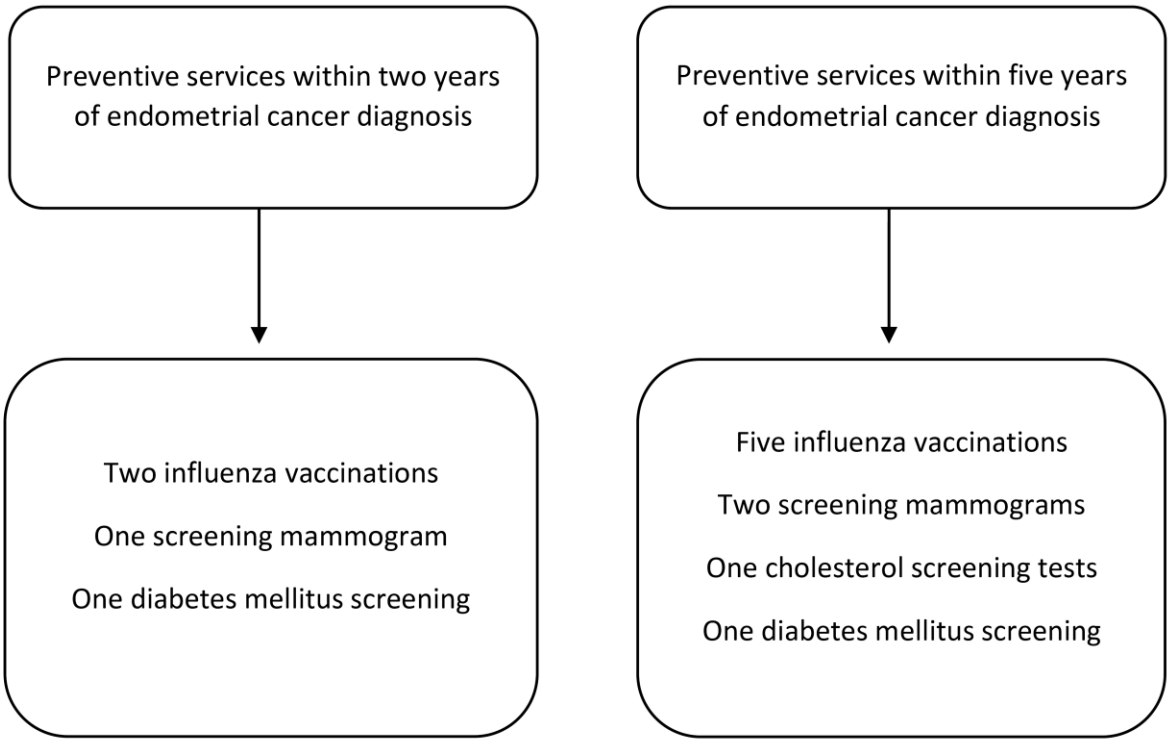

Figure 2: Causal diagram of potential confounders

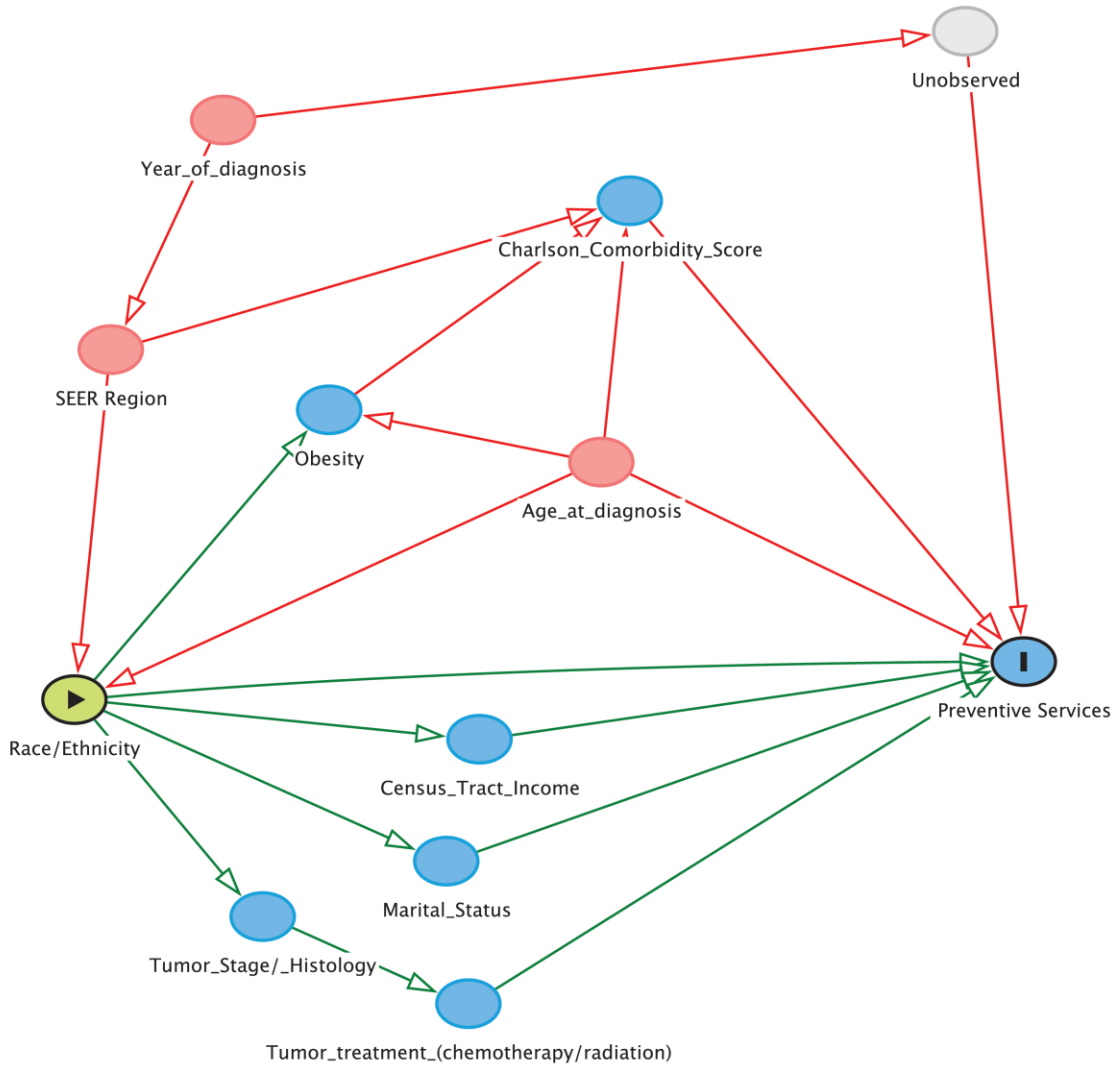

Figure 3: Study Flow Chart

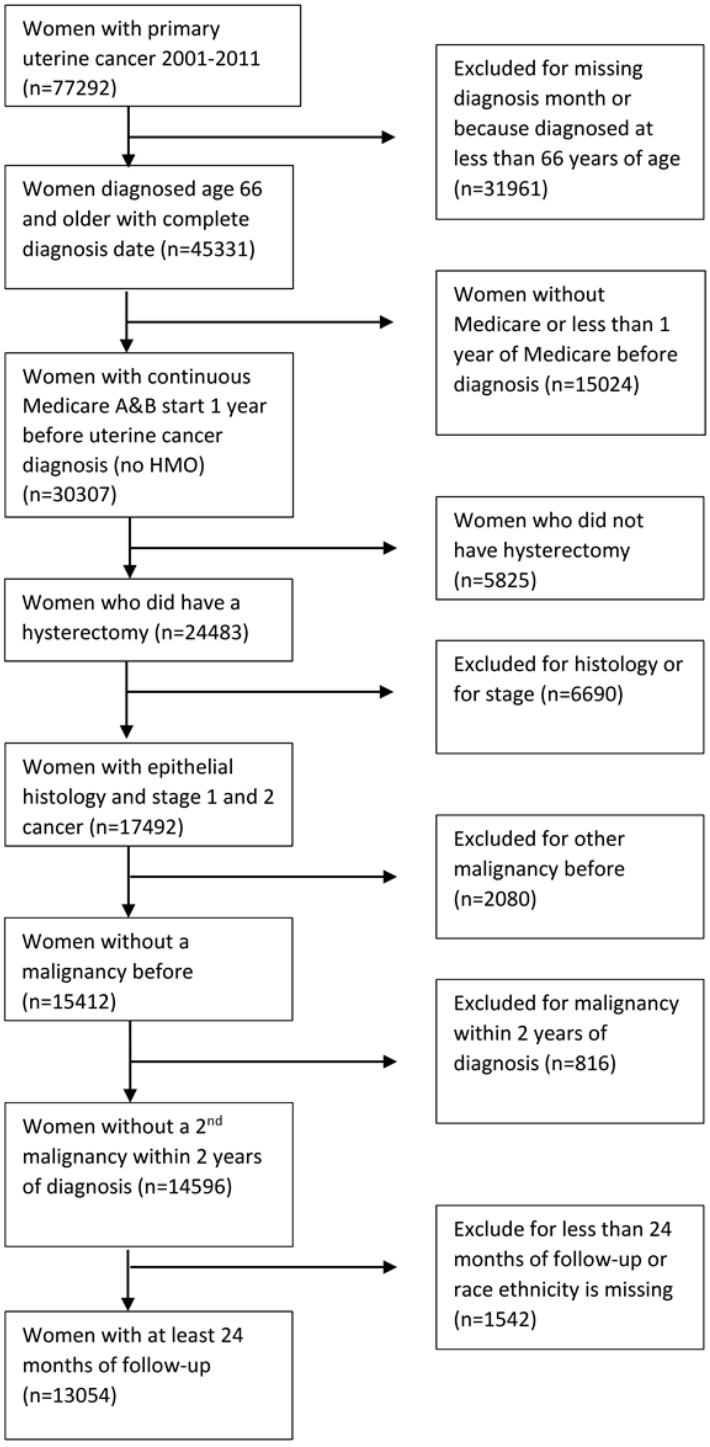

Table 1: Characteristics of women diagnosed with endometrial cancer 2001-2011 SEER-Medicare with at least 2 years of Medicare follow-up								
n=13054	**NH White**		**NH Black**		**Hispanic**		**Asian/PI**	
	n	%	n	%	n	%	n	%
	11347		772		601		334	
Age at diagnosis								
66-74	6439	56.75	521	67.49	388	64.56	211	63.17
75-79	2417	21.30	151	19.56	118	19.63	88	26.35
80+	2491	21.95	100	12.95	95	15.81	35	10.48
Year of diagnosis								
2001-2004	4614	40.66	273	35.36	235	39.10	107	32.04
2005-2007	3007	26.50	218	28.24	139	23.13	85	25.45
2008-2011	3726	32.84	281	36.40	227	37.77	142	42.51
Marital Status								
Married (yes)	5508	48.54	227	29.40	253	42.10	187	55.99
Unknown	390	3.44	27	3.50	18	3.00	9	2.69
Stage at diagnosis								
I	10218	90.05	653	84.59	533	88.69	302	90.42
II	1129	9.95	119	15.49	68	11.31	32	9.58
Charlson comorbidity score								
0	7739	68.20	388	50.26	347	57.74	197	58.98
1	2426	21.38	237	30.70	172	28.62	91	27.25
>=2	1055	9.30	138	17.88	75	12.48	36	10.78
Obese								
Yes (%)	894	7.88	129	16.71	67	11.15	15	4.49
Hypertension*								
Yes (%)	7730	68.18	647	83.81	443	73.71	249	74.55
Diabetes*								
Yes (%)	2983	26.29	345	44.69	237	39.43	128	38.32
Grade								
1: Well differentiated	4551	40.11	240	31.09	237	39.43	110	32.93
2: Moderately. Differentiated	3712	32.71	228	29.53	189	31.45	106	31.74
3: Poorly differentiated	1662	14.65	177	22.93	108	31.45	75	22.46
4: Undifferentiated	284	2.50	45	5.83	18	3.00	18	5.39
Histology								
Endometroid	10108	89.08	613	79.40	510	84.86	287	85.93
Clear Cell	119	1.05	18	2.33	7	1.16	7	2.10
Mucinous	124	1.09	6	0.78	4	0.67	1	0.30
Serous	445	3.92	88	11.40	38	6.32	24	7.19

Other	551	4.86	47	6.09	42	6.99	15	4.49
Radiotherapy								
Yes (%)	3049	26.87	214	27.72	161	26.72	77	23.05
Chemotherapy								
Yes (%)	547	4.82	70	9.07	42	6.99	22	6.59
SEER region at diagnosis								
Northeast	2950	26.00	179	23.19	132	21.96	19	5.69
Midwest	1754	15.46	126	16.32	14	2.33	5	1.50
South	2190	19.30	319	41.32	22	3.66	4	1.20
West	4453	39.24	148	19.17	433	72.05	306	91.62
Urban								
Yes (%)	9367	82.55	687	88.99	567	94.34	317	94.91
Median census tract income								
Quartile 1 (lowest)	2501	22.18	465	60.39	214	35.67	60	17.96
Quartile 2 (low-mid)	2888	25.61	143	18.57	145	24.17	70	20.96
Quartile 3 (high-mid)	2917	25.87	106	13.77	130	21.67	91	27.57
Quartile 4 (highest)	2971	26.35	56	7.27	111	18.50	113	33.83
% below poverty								
Quartile 1 (lowest)	3025	26.82	63	8.18	88	14.67	86	25.75
Quartile 2 (low-mid)	3015	26.74	74	9.61	82	13.67	71	21.26
Quartile 3 (high-mid)	2901	25.72	114	14.81	145	24.17	81	24.25
Quartile 4 (highest)	2336	20.71	519	67.40	285	47.50	96	28.74
% less than HS education								
Quartile 1 (lowest)	3052	27.06	44	5.71	75	12.50	80	23.95
Quartile 2 (low-mid)	2991	26.52	92	11.95	93	15.50	68	20.36
Quartile 3 (high-mid)	2908	25.79	145	18.83	119	19.83	75	22.46
Quartile 4 (highest)	2326	20.63	489	63.51	313	52.17	111	33.23
Death								
Yes (%)	2996	26.14	220	28.50	145	24.13	64	19.16

*Diagnosed 1 year prior to endometrial cancer

Table 2: Preventive services and adjusted Odds ratios by race/ethnicity for women diagnosed with endometrial cancer 2001-2011 SEER-Medicare with at least 2 years of follow-up								
	NH White		**NH Black**		**Hispanic**		**Asian/PI**	
	n=11347		n=772		n=601		n=334	
Screening Service								
Well visit (n=13,054)								
Yes (%)	1374	12.11	78	10.10	70	11.65	49	14.67
aOR(95% CI)	ref	ref	0.82	0.64,1.05	0.81	0.62,1.05	0.98	0.72,1.35
Influenza vaccination (n=13,054)								
Yes (%)	7643	67.36	347	44.95	317	52.75	222	66.47
aOR(95% CI)	ref	ref	0.40	0.33,0.44	0.61	0.51,0.72	1.15	0.91,1.45
2 Influenza vaccinations #(n=13,054)								
Yes (%)	4828	42.55	155	20.08	143	23.79	136	40.72
aOR(95% CI)	ref	ref	0.33	0.27,0.39	0.47	0.39,0.57	1.08	0.86,1.36
Breast cancer screening* (n=6,145)								
Yes (%)	3876	74.15	283	65.36	218	69.21	117	68.82
aOR(95% CI)	ref	ref	0.64	0.52,0.79	0.82	0.64,1.05	0.82	0.58,1.14
Diabetes screening (n=5,933)**								
Yes (%)	1684	32.23	123	37.85	94	37.75	54	40.30
aOR(95% CI)	ref	ref	1.34	1.06,1.71	1.35	1.03,1.77	1.47	1.02,2.10

#restricted to women that had 2 influenza vaccinations within 2 years of endometrial cancer diagnosis

* restricted to women diagnosed age 72 and younger

**restricted to those without a diagnosis of diabetes 1 year prior to cancer diagnosis and with history of obesity, hypertension or hyperlipidemia

adjusted for year of diagnosis, region, and age at diagnosis

Table 3: Preventive services and adjusted Odds ratios by race/ethnicity for women diagnosed with endometrial cancer 2001-2011 SEER-Medicare with at least 5 years of follow-up								
	NH White		**NH Black**		**Hispanic**		**Asian/PI**	
	n=6638		n =391		n=328		n=167	
Screening service								
Well visit (n=7,524)								
Yes (%)	1403	21.14	82	20.97	65	19.82	30	17.96
aOR (95% CI)	ref	ref	1.04	0.80,1.34	0.81	0.61,1.08	0.65	0.43,0.98
Influenza vaccination (n=7,524)								
Yes (%)	5245	79.01	233	59.59	226	68.90	130	77.84
aOR (95% CI)	ref	ref	0.39	0.31,0.48	0.65	0.51,0.83	1.09	0.75,1.59
5 Influenza vaccination # (n=7,524)								
Yes (%)	1758	26.48	32	8.18	36	10.98	37	22.16
aOR (95% CI)	ref	ref	0.23	0.16,0.34	0.39	0.27,0.56	0.95	0.65,1.39
Breast cancer screening* (n=3,595)								
Yes (%)	1981	85.28	132	77.65	102	80.95	56	80.00
aOR (95% CI)	ref	ref	0.65	0.49,0.92	0.61	0.42,0.88	0.80	0.46,1.38
At least 2 breast cancer screenings (n=3,595)**								
Yes (%)	1697	73.05	102	60.00	90	71.43	49	70.00
aOR (95% CI)	ref	ref	0.56	0.41,0.75	0.84	0.60,1.18	1.01	0.63,1.62
Diabetes screening* (n=3,455)**								
Yes (%)	1551	50.54	95	57.58	94	61.04	43	64.18
aOR (95% CI)	ref	ref	1.38	1.00,1.91	1.59	1.14,2.23	1.85	1.11,3.09
Cholesterol screening# (n=7,524)								
Yes (%)	6058	91.26	361	92.33	300	91.46	154	92.22
aOR (95% CI)	ref	ref	1.14	0.77,1.68	0.95	0.64,1.43	1.01	0.56,1.80

#restricted to women that had 5 influenza vaccinations within 5 years of endometrial cancer diagnosis

* Screening mammogram; restricted to women diagnosed age 72 and younger

**At least 2 screening mammograms; restricted to women diagnosed age 72 and younger

***restricted to those without a diagnosis of diabetes 1 year prior to cancer diagnosis and with hx of obesity, hypertension or hyperlipidemia

#restricted to those without diagnosis of hyperlipidemia 1 year prior to endometrial cancer diagnosis

adjusted for year of diagnosis, region, and age at diagnosis

Appendix 1: Preventative health and vaccine recommendations for adults >= 65 years			
Screening/Prevention	Year implemented	Age	Method
Medicare well visit[1]	2011	65 years and older	Annually
Breast cancer[2]	2002	50-74 years	Biennial Mammography
Influenza Vaccine[4]	1993	65 and older	Once annually
Diabetes Mellitus type 2[2]	2008	Asymptomatic adults with sustained BP 135/80 mmHg,	FPG, 2 hour post load, Hemoglobin A1C (ideal interval unknown: ADA recommendations Q3yrs). Note consider 10 year CHD risk and if DM screen will be helpful
Lipid disorder[2]	2008	Women >=45 at increased risk for CHD	Optimal interval not known, 5 year interval reasonable, sooner if levels borderline

[1]Centers for Medicare and Medicaid Services/Affordable Care Act

[2]U.S. Preventive Services Task Force

[3] American Association of Clinical Endocrinologists

[4] Centers for Disease Control and Prevention Advisory Committee on Immunization Practices

Appendix 2: Codes for Screening tests or procedures up to 5 years after endometrial cancer diagnosis				
Test/procedure	**CPT* code**	**ICD-9~ Diagnosis code**	**ICD-9 Procedure code**	**HCPCS^ code**
Influenza vaccine				
	90654-90664 90666-90668 90672 90685-90686 90724	V04.81	99.52	G0008
Lipid screen	**CPT code**	**ICD-9 Diagnosis code**	**ICD-9 Procedure code**	**HCPCS code**
	80061 82465 84478 83718 83719 83721	V77.91 V81.0 V81.1 V81.2	272.2 272.3	G0054
Mammography	**CPT code**	**ICD-9 Diagnosis code**	**ICD-9 Procedure code**	**HCPCS code**
	76092 77057	V76.12 V76.11	87.37 89.36	G0202
Diabetes Screening	**CPT code**	**ICD-9 Diagnosis code**	**ICD-9 Procedure code**	**HCPCS code**
	82946 82947 82948 82950 82951 82952 82960	V77.1		

	82962 83036 83021			
Well visit	**CPT code**	**ICD-9 Diagnosis code**	**ICD-9 Procedure code**	**HCPCS code**
		V70.0		G0402 G0438 G0439

*Current Procedural Terminology
~International Classification of Diseases Ninth Edition
^ Healthcare Common Procedure Coding System