Published in final edited form as:

Int J Gynecol Cancer. 2020 February ; 30(2): 187–192. doi:10.1136/ijgc-2019-000999.

Body mass index and attitudes towards health behaviors among women with endometrial cancer before and after treatment

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Abstract

Introduction—Some experts have argued that obesity-related malignancies such as endometrial cancer are a “teachable moment” that lead to meaningful changes in health behaviors. It is unclear if endometrial cancer survivors lose weight following treatment. Our goal with this investigation was to evaluate post-treatment changes in body mass index (BMI) and attitudes towards health behaviors in endometrial cancer survivors.

Methods—Incident endometrial cancer cases undergoing surgery between 2009–2015 were identified in the MarketScan Commercial database and linked with BMI data and health behavior questionnaires from the MarketScan Health Risk Assessment database. Patients were excluded for insufficient BMI data. Standard statistical methods, including the two-sample Wilcoxon rank sum test, χ^2 test, and McNemar’s test, were used.

Results—655 patients with a median age of 54 (IQR 49–58) were identified and analyzed. Median duration of follow-up was 595 days (IQR 360–1091). Mean pre- and post-treatment BMI was 35.5 kg/m² (median 35.0; IQR 27.0–42.3) and 35.6 kg/m² (median 34.3; IQR 28.0–42.0),

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Contributors All authors made substantial contributions to the conception or design of the work, or the acquisition, analysis or interpretation of data. All authors were involved in drafting the work or revising it critically for important intellectual content. All authors agree to be held accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Competing interests Outside the scope of the current work, Dr Sun reports research support from AstraZeneca. Outside the scope of the current work, Dr Westin reports research support from ArQule, AstraZeneca, Bayer, Clovis Oncology, Cotinga Pharmaceuticals, Novartis, Roche/Genentech, and Tesaro. Outside of the scope of the current work, SNW reports consulting fees from AstraZeneca, Clovis Oncology, MediVation, Merck, Ovation, Pfizer, Roche/Genentech, Takeda, and Tesaro. Outside the scope of the current work, Dr Meyer reports research support from AstraZeneca.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available.

respectively. Median BMI change in the entire cohort was 0 kg/m² (IQR −1.0 to 2.0). Weight gain (n=302; 46.1%) or no change in weight (n=106; 16.2%) was seen in most patients. Among the 302 patients who gained weight, the mean pre-treatment BMI was 34.0 kg/m² and mean increase was 2.8 kg/m² (median 2.0; IQR 1.0–3.4). Among the 247 cases who lost weight, the mean pre-treatment BMI was 38.6 kg/m² and mean decrease was 3.2 kg/m² (median 2.0; IQR 1.0–4.0). No pre- to post-treatment differences were observed in health behavior questionnaires regarding intention to better manage their diet, exercise more, or lose weight.

Discussion—Most endometrial cancer survivors gain weight or maintain the same weight following treatment. No post-treatment changes in attitudes regarding weight-related behaviors were observed. The systematic delivery of evidence-based weight loss interventions should be a priority for survivors of endometrial cancer.

INTRODUCTION

The relationship between obesity and endometrial cancer risk is well-described.¹ Nearly half of the incident endometrial cancer cases in the USA can be attributed to excess weight.² For each five unit increase in body mass index (BMI; kg/m²), a woman's lifetime endometrial cancer risk increases by more than 50%.³ Contrasted against decreasing trends observed in many other cancers, endometrial cancer incidence has risen with the rise in the prevalence of obesity.⁴ The rate of new diagnoses is expected to increase further over the next decade to as many as 49 cases per 100 000 women—an 81% increase over 2010 rates.⁵

The 5 year survival following endometrial cancer diagnosis is >80% for patients with low-risk disease.^{6,7} Obesity-related conditions including cardiovascular disease, chronic renal dysfunction, and complications from diabetes have and will remain the major drivers of mortality in this population.^{8,9} Just as obesity predisposes patients to developing endometrial cancer, it persists as a risk factor for premature mortality in survivors, underscoring the importance of addressing excess weight during survivorship.^{10,11}

A perception exists that an obesity-related cancer diagnosis serves as a “teachable moment”—an impetus for patients to pursue health behavior changes that mitigate their health risks from excess weight.^{12–16} Addressing lifestyle and health behaviors following endometrial cancer treatment is an area of substantial academic interest.^{17–21} However, there is uncertainty over whether an endometrial cancer diagnosis alone motivates patients to accomplish lifestyle changes or meaningful weight loss.^{22,23} In a large single-institution review, Matsuo et al found that most endometrial cancer patients had gained weight at 1 year post-treatment and post-treatment weight gain predicted worse disease-specific and overall survival.²³ Our goal with this investigation was to evaluate post-treatment BMI trends by examining a national-level sample using a linked dataset of health insurance claims and health risk assessments.

METHODS

Data source

We performed a retrospective cohort study by analyzing data from the Truven Health Analytics MarketScan Commercial Database (IBM Watson Health, Cambridge, MA). Since

1995, this database has collected enrollment data, hospital admission records, outpatient services, and outpatient prescription drug claims for 250 million health insurance beneficiaries from more than 300 employer-sponsored health plans including fee-for-service coverage, fully capitated and partially-capitated health plans, preferred provider organizations, indemnity plans, health maintenance organizations, and other managed care-type insurance. In the most recent data year, the MarketScan Commercial Database contained information on 43.6 million covered individuals.²⁴ The core MarketScan Commercial Database was linked to the supplementary MarketScan Health Risk Assessment (HRA) Database that contains a subset of those patients found in the larger dataset. The HRA dataset includes self-reported height, weight, and health behavior questionnaire data that are unavailable in the primary database. These datasets are constructed from health insurance claims submitted to the health plans that participate as data contributors. Because the databases are developed from health insurance claims, patient details pertaining to their cancer diagnosis, such as grade and stage, are often unavailable. This investigation was approved by our Institutional Review Board (Protocol No. PA 14–0949).

Cohort selection

Eligibility for inclusion into our study cohort was all women with endometrial cancer (ICD-9-CM 182.0; ICD-10-CM C54.x) who were identified in both the MarketScan Commercial Database and MarketScan HRA Database and who underwent hysterectomy between 2009 to 2015 (n=3273 included). A standard approach to identify cancer cases from insurance claims data was utilized.²⁵ Cases identified based on diagnosis codes associated with outpatient insurance claims were included only if the codes appeared two or more times with at least 30 days between claims. Diagnoses based on inpatient claims were included if a single claim was observed, as inpatient claims, particularly those that include a diagnosis-associated surgical procedure, have a high sensitivity for incident endometrial cancer cases.²⁵ As the surgical date was designated as the index date, patients who lacked an insurance claim for hysterectomy were not included. Patients with claims in the 3 year washout period (2006–2008) were considered prevalent cases and excluded (n=34). Patients with prior diagnoses of other malignancies were excluded from the cohort (n=695). Finally, patients without adequate BMI measurements for the purpose of the analysis were excluded—specifically one pre-treatment BMI measurement and at least one post-treatment BMI measurement at least 6 months following the index date (n=1946). The requirement of a post-treatment BMI measurement at least 6 months following the index date was to avoid possible short-term weight changes related to treatment and to provide sufficient time for behavioral changes to result in meaningful weight loss. A subset of patients in the primary BMI analysis cohort had pre- and post-treatment health behavior questionnaire responses available regarding intention to adopt a healthier diet (n=286), exercise more frequently (n=314), and better manage their weight (n=292). Cohort selection is depicted in Figure 1.

Statistical analysis

The primary objective was to determine the proportion of patients who lost weight before and after endometrial cancer treatment. We hypothesized that on average no difference in weight would be observed based on clinical experience and review of currently available literature.²⁶ Secondary outcomes of interest included pre- and post-treatment BMI among

subgroups of patients in whom a BMI change was observed, and pre- and post-treatment responses to health behavior questionnaires. For individuals with more than one pre-treatment BMI measurement available, the BMI measurement selected for the purpose of the analysis was the measurement that occurred at the shortest interval preceding the index date. For individuals with more than one post-treatment BMI measurement available, the measurement selected for the purpose of the analysis was the measurement that occurred at the longest interval following the index date. Duration of follow-up was defined as the time from the index date until the BMI measurement occurring at the longest interval following it. Individuals were classified as having gained weight or lost weight if they experienced any pre- to post-treatment BMI increase or decrease, respectively. Individuals whose BMI measurement did not change were considered to have maintained the same weight. The Likert-scaled responses to the aforementioned behavioral health questionnaire items were grouped into three categories: currently acting on a behavioral change, intending to act on a behavioral change, or not intending to act on a behavioral change. The Wilcoxon rank sum test was used to compare median values for non-normally distributed numerical variables. The χ^2 test was used to compare distribution of counts for categorical variables. McNemar's test was used to compare paired categorical data. Statistical analyses were performed with the SAS statistical software program (version 9.3, SAS Institute, Cary, NC).

RESULTS

We identified 655 individuals diagnosed with endometrial cancer during the observation period with pre- and post-treatment BMI measurements adequate for the analysis (Figure 1). The demographic characteristics of this group are shown in Table 1. The median age of patients on the index date was 54 years (IQR 49–58). The median duration of follow-up between the index date and post-treatment BMI measurement was 595 days (IQR 360–1091). The mean pre-treatment BMI of the entire cohort was 35.5 kg/m² (SD 10.0).

A majority of patients either gained weight (46.1%; 302/655) or maintained the same weight (16.2%; 106/655) (Table 2). The remaining 37.7% (247/655) of patients lost weight. The mean post-treatment BMI of the entire cohort was 35.6 kg/m² (SD 9.8). The mean change between pre- and post-treatment BMI was an increase of 0.1 kg/m² (SD 4.0). The median pre- to post-treatment BMI change was 0 kg/m² (IQR –1.0 to 2.0).

Among the 302 patients who gained weight, the mean pre- and post-treatment BMI measurements were 34.0 kg/m² (SD 9.7) and 36.7 kg/m² (SD 10.5), respectively. These patients' BMI increased, on average, 2.8 kg/m² (SD 2.6; median increase 2 kg/m²; IQR 1–3 kg/m²). Among the 247 patients who lost weight, the mean pre- and post-treatment BMI measurements were 38.6 kg/m² (SD 10.0) and 35.3 kg/m² (SD 9.0), respectively. These patients' BMI decreased, on average, 3.2 kg/m² (SD 3.9; median decrease 2.0 kg/m²; IQR 1.0–4.0). The mean pre-treatment BMI of patients who lost weight was significantly higher than patients who gained weight (38.6 kg/m² vs 34.0 kg/m²; $p < 0.0001$).

Of the patients analyzed for BMI change following treatment, 43.7% (286/655) had answered pre- and post-treatment health behavior questionnaires related to their intention to improve the health of their diet; no differences were seen in the pattern of responses pre- to

post-treatment ($p=0.09$) (Table 3). Pre- and post-treatment health behavior questionnaires related to their intention to increase the amount of exercise they perform was available on 47.9% of patients (314/655); no differences were seen in the pattern of responses pre- to post-treatment ($p=0.38$). We identified 44.6% of patients (292/655) with pre- and post-treatment health behavior questionnaires related to their intention to better manage their weight; no differences were seen in the pattern of responses pre- to post-treatment ($p=0.65$).

DISCUSSION

In this investigation, we found that most patients diagnosed with endometrial cancer gained weight or maintained the same weight following treatment. Among the minority who did lose weight, the average amount of weight lost led to a BMI change of 3.2 kg/m^2 , an amount that may mitigate some obesity-related health risks. However, on average, the group of patients who lost weight nonetheless tended to remain within the same WHO classification of class II obesity (BMI $35\text{--}39 \text{ kg/m}^2$). These findings corroborate previously reported findings in the literature. In a large, single-institution review, Matsuo et al reported that 60% of endometrial cancer patients treated gained weight during the 2 years following treatment, observing a 5% increase in BMI on average, and post-treatment weight gain was associated with worse overall survival.²³ This study suggests the post-treatment BMI trends observed may be generalizable across a broader population.

We did not observe differences in patients' attitudes and intentions towards weight-related health behaviors before and after endometrial cancer treatment. Behavioral interventions during survivorship have led to weight loss among endometrial cancer survivors.^{17,21} Von Gruenigen et al described a 6 month long protocol of group education sessions promoting self-efficacy in "physical activity, nutrition and improving diet quality, and behavior modification."²¹ The intervention was associated with a 3% weight loss on average at 12 month follow-up. Haggerty et al reported the results of a randomized controlled trial using technology-based interventions, finding the intervention groups lost more weight than the control arm.¹⁷ In each of these investigations, <20% of those individuals approached for enrollment were randomized. This pre-randomization selection bias is not a weakness of those investigators' trial design but may rather represent the challenge in delivering lifestyle interventions in this population.

Although behavioral interventions can produce modest weight loss, bariatric surgery outcomes are more clinically meaningful.²⁶⁻³⁰ Long term follow-up from a multicenter prospective cohort study found mean weight loss of as high as 30% for certain types of bariatric procedures.²⁸ Further, the risk of cardiovascular mortality, the leading cause of death in endometrial cancer survivors, is significantly decreased following bariatric surgery.^{26,27} Notably, a history of cancer is *not* considered a contraindication to pursuing bariatric surgery.³¹ While we do not examine the use of bariatric surgery in this analysis, referral for weight-loss surgery may be an underutilized strategy for addressing weight in the endometrial cancer survivorship setting.

Lack of awareness of the relationship between endometrial cancer and obesity may also be an obstacle to the diagnosis becoming a "teachable moment". Soliman et al surveyed 1545

women and found that most had no knowledge of a relationship between obesity and endometrial cancer.³² Even among obese women this finding persisted, suggesting that even those at increased risk are unaware.³² Among endometrial cancer survivors, Haggerty et al found that a third of patients were unaware that obesity was a risk factor for their cancer.¹⁷ Oncologists may lack confidence in discussing weight and miss an opportunity to promote understanding.⁷ Clark et al reported only a quarter of endometrial cancer survivors had been counseled by their gynecologic oncologist regarding their weight.¹⁸ In that same study, the investigators also found that about half of survey respondents reported making lifestyle changes after endometrial cancer diagnosis and that attempting weight loss was significantly associated with physician counseling.¹⁸ Our analysis was unable to determine which patients may have been counseled by their oncologist regarding weight loss. National organizations have developed clinical guidelines and made resources available for how clinicians can address this topic before and after treatment.¹⁶³³³⁴

This work strengthens existing literature describing the post-treatment endometrial cancer survivorship population. By using a large insurance claims database, this investigation offers a more generalized characterization regarding the post-treatment BMI trajectory of endometrial cancer patients than previously reported. We were able to achieve a relatively long median follow-up in our analyzed cohort. A potential source of bias, our cohort selection algorithm included only a subset of patients with complete BMI and health questionnaire data relative to the total number of endometrial cancer patients identified in the linked MarketScan Commercial and HRA dataset. We required at least 6 months of post-treatment follow-up for patients to be included in the analysis for BMI change. While some excluded patients may have had BMI measurements available in the 6 months immediately following treatment, we felt that this duration of follow-up would be too short to observe for health behavior changes that lead to differences in our health outcome of interest. Stage, oncologic outcomes, and adjuvant treatment were not ascertained by our study methodology—all of which could potentially affect patients' post-treatment weight trajectory. Arguably, weight loss during survivorship is most relevant to patients with early stage, low grade endometrial cancer. While most of the patients included in this investigation likely had low risk disease, our data source does not allow us to select and exclusively analyze these patients.

There are some limits to the generalizability of these findings. The MarketScan database is populated by patients with employer-based health insurance. While approximately two-thirds of individuals under the age of 65 in the USA have this type of health insurance coverage, the applicability of these findings to individuals who do not have employer-based health insurance is uncertain. The analyzed cohort represents a convenience sample that is small relative to the total number of women in the USA annually diagnosed with endometrial cancer. Individuals treated without surgery were not included, as we used the date of hysterectomy as an index date for endometrial cancer treatment. As MarketScan contains few patients enrolled in Medicare, our sample's median age of 54 is lower than the typical age of endometrial cancer diagnosis at 60. Despite this, these findings may be most relevant to younger endometrial cancer survivors, who face ongoing risk for obesity-related health consequences. Only a subset of the cohort analyzed for BMI change had health behavior questionnaire responses available for analysis, so the results may not be

generalizable to non-responders. Differences in the survey instruments distributed to patients may contribute to this, but it could also represent response bias against questionnaires addressing lifestyle, health behaviors, and weight. Our methodology did not attempt to identify interventions that may have been attempted by patients or recommended by their physicians related to weight loss.

To conclude, obesity during endometrial cancer survivorship remains an unanswered priority for our specialty. In this study, only a minority of endometrial cancer patients in this national-level sample lost weight following treatment. We did not observe differences in attitudes towards health behaviors from pre- to post-treatment. While oncologic outcomes may be favorable for low-risk endometrial cancer, we fail to help these patients mitigate their ongoing risk of premature death from cardiovascular disease and other obesity-related chronic conditions. An endometrial cancer diagnosis does not seem to be a “teachable moment” without effort by a patient’s gynecologic oncologist to make it so. Further work is necessary to determine best practices for addressing weight and lifestyle during endometrial cancer survivorship.

Acknowledgments

Funding Financial support for this research investigation was provided in part by grant funding to the following individuals and organizations: Ross Harrison: National Institutes of Health T32 grant (#5T32 CA101642). Shannon Armbruster: National Institutes of Health T32 grant (#5T32 CA101642). Shannon Westin: National Cancer Institute SPORE for Uterine Cancer (2P50 CA098258-13); Andrew Sabin Family Fellowship. Sharon Giordano: CPRIT RP160674; Susan Komen SAC150061. Larissa Meyer: National Cancer Institute K award (#K07 CA201013). MD Anderson Cancer Center: National Cancer Institute Cancer Center Support Grant (P30 CA016672).

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HIGHLIGHTS

- Most endometrial cancer survivors gain weight (46%) or maintain the same weight (16%) following treatment.
- Attitudes towards weight-related behaviors did not change from pre- to post-treatment.
- Clinicians must be proactive if an endometrial cancer diagnosis is to become a teachable moment for survivors.

Figure 1.
Cohort identification. BMI, body mass index.

Table 1

Demographic characteristics (n=655)

Variable	Value
Age in years at index date, median (IQR)	54 (49–58)
Diagnosis year	
2009	24 (3.7%)
2010	73 (11.1%)
2011	91 (13.9%)
2012	114 (17.4%)
2013	115 (17.6%)
2014	132 (20.2%)
2015	106 (16.1%)
Insurance type	
Preferred provider organization	349 (53.3%)
Health maintenance organization	171 (26.1%)
Point of service	55 (8.4%)
Consumer-directed health plan	51 (7.8%)
Other *	29 (4.4%)
Region	
Northeast	105 (16.0%)
North-Central	237 (36.2%)
South	219 (33.4%)
West	94 (14.4%)
Pre-treatment BMI	
Median, kg/m ² (IQR)	35.0 (27.0–42.3)
Mean, kg/m ² (SD)	35.5 (10.0)
Post-treatment BMI	
Median, kg/m ² (IQR)	34.3 (28.0–42.0)
Mean, kg/m ² (SD)	35.5 (9.8)
Pre- to post-treatment BMI change	
Increased	302 (46.1%)
Decreased	247 (37.7%)
No change	106 (16.2%)
Health behavior questionnaire responses available	
Intention to attempt to lose weight	292 (44.6%)
Intention to exercise	314 (47.9%)
Intention to adopt a healthier diet	286 (43.7%)

* Other includes individuals' health insurance through comprehensive insurance plans, exclusive provider organizations, point-of-service with capitation plans, and high-deductible health plans. Index date was defined as the date of hysterectomy. Data presented represent numerical frequencies with proportions in parenthesis, unless otherwise indicated.

BMI, body mass index.

Table 2

Characteristics of patients classified by post-treatment BMI change

	Lost weight n=247	Gained weight n=302	No weight change n=106	Total cohort n=655
Age at index date, years	54 (48–58)	54 (49–58)	55 (50–59)	54 (49–58)
Pre-treatment BMI, kg/m ²				
Mean (SD)	38.6 (10.0)	34.0 (9.7)	32.7 (9.0)	35.5 (10.0)
Median (IQR)	38.0 (31.8–45.0)	33.0 (26.0–41.0)	31.0 (25.1–39.0)	35.0 (27.0–42.3)
Post-treatment BMI, kg/m ²				
Mean (SD)	35.3 (9.0)	36.7 (10.5)	32.7 (9.0)	35.6 (9.8)
Median (IQR)	34.0 (29.0–41.0)	35.2 (28.0–44.0)	31.0 (25.1–39.0)	34.3 (28.0–42.0)
BMI change, kg/m ²				
Mean (SD)	–3.2 (3.9)	2.8 (2.6)	N/A	0.1 (4.0)
Median (IQR)	–2.0 (–4.0–1.0)	2.0 (1.0–3.4)	N/A	0 (–1.0–2.0)
Duration of follow-up, days	559 (364–1126)	677 (404–1153)	494 (314–811)	595 (360–1091)

Data represented in the table are median values followed by IQR in parentheses, unless otherwise indicated. Index date was defined as the date of hysterectomy. Duration of follow-up was defined as the duration from the index date until the BMI measurement occurring at the longest interval following it.

BMI, body mass index.

Table 3

Pattern of responses to questionnaires regarding weight-related health behaviors

	Improving diet n=286/655 (43.7%)		Exercising more n=314/655 (47.9%)		Better managing weight n=292/655 (44.6%)	
	Pre-diagnosis	Post-diagnosis	Pre-diagnosis	Post-diagnosis	Pre-diagnosis	Post-diagnosis
Currently acting on behavioral change	141 (49.3%)	156 (55.6%)	88 (28.0%)	104 (33.1%)	112 (38.4%)	120 (41.1%)
Intending to act on behavioral change	126 (44.1%)	107 (37.4%)	209 (66.6%)	193 (61.5%)	160 (54.8%)	153 (52.4%)
Not intending to act on behavioral change	19 (6.6%)	23 (8.0%)	17 (5.4%)	17 (5.4%)	20 (6.8%)	19 (6.5%)
	p=0.09		p=0.38		p=0.65	

How respondents described their activity towards health behaviors is represented in the left-most column. The three health behaviors are listed in the top row. Data represent numerical frequencies of respondents with proportion in parentheses. Note that a total of 655 patients had complete variables of interest for the primary analysis on body mass index change. Included in the first row is the number and proportion from that cohort for whom pre- and post-treatment questionnaire response data were available in the three domains shown. P values represent McNemar's test for paired categorical data.