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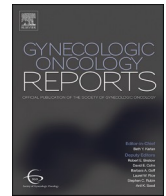
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Survey article



Obese endometrial cancer survivors' perceptions of weight loss strategies and characteristics that may influence participation in behavioral interventions

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ABSTRACT

We aimed to evaluate obese endometrial cancer (EC) survivors' perceptions of weight loss barriers and previously attempted weight loss methods and to identify characteristics that predicted willingness to enroll in a behavioral intervention trial. We administered a 27-question baseline survey at an academic institution to EC survivors with body mass index ≥ 30 kg/m². Survivors were asked about their lifestyles, previous weight loss attempts, perceived barriers, and were offered enrollment into an intervention trial. Data was analyzed using Fisher's Exact, Kruskal-Wallis, and univariate and multivariate regressions. 155 of 358 (43%) eligible obese EC survivors were surveyed. Nearly all (n = 148, 96%) had considered losing weight, and 77% (n = 120) had tried two or more strategies. Few had undergone bariatric surgery (n = 5, 3%), psychological counseling (n = 2, 1%), or met with physical therapists (n = 9, 6%). Lower income was associated with difficulty in accessing interventions. Survivors commented that negative self-perceptions and difficulties with follow-through were barriers to weight loss, and fear of complications and self-perceived lack of qualification were deterrents to bariatric surgery. 80 (52%) of those surveyed enrolled in the trial. In a multivariate model, adjusting for race and stage, survivors without recurrence were 4.3 times more likely to enroll than those with recurrence. Most obese EC survivors have tried multiple strategies to lose weight, but remain interested in weight loss interventions, especially women who have never experienced recurrence. Providers should encourage weight loss interventions early, at the time of initial diagnosis, and promote underutilized strategies such as psychological counseling, physical therapy, and bariatric surgery.

1. Introduction

Nearly 90% of U.S. endometrial cancer (EC) survivors are obese, and the prevalence of obesity among these survivors continues to rise (Bhaskaran et al., 2014; Fader et al., 2011; Raglan et al., 2019). While cancer-specific survival for EC is high, obesity increases survivors' risks of morbidity and mortality, and EC survivors often die of obesity-linked cardiovascular diseases rather than from direct causes of EC (Ward et al., 2012; Calle et al., 2003). Effecting durable lifestyle changes has proved challenging for healthcare providers, including gynecologic oncologists,

despite professional toolkits developed for weight loss education (Wilkinson et al., 2020; Basen-Engquist et al., 2014; Oncology, 2014). Given that patient perceptions of the costs and benefits of behavioral changes can determine their responsiveness to lifestyle change recommendations (Leventhal et al., 2016), better understanding EC survivors' perceptions of weight loss may help guide gynecologic oncologists when discussing weight loss.

Recently, technology-based interventions included in a National Institutes of Health initiative improved EC survivors' quality of life (Haggerty et al., 2017). This motivated our clinic to offer a behavioral

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weight loss intervention trial to EC survivors. Data from this larger investigation have not yet matured. Entry began with a survey. Hypothesizing that perceptions may be influenced by previous weight loss attempts, our primary survey study aims were to identify motivators for and barriers to weight loss and to solicit EC survivors' perceptions of weight management strategies. Our secondary aim was to identify characteristics predicting EC survivors' willingness to enroll in the behavioral intervention.

2. Methods

2.1. Participants

We administered a baseline survey approved by the Washington University in St. Louis Institutional Review Board to EC survivors during surveillance visits to gynecologic oncology clinics May 1 - December 1, 2017. Survivors were eligible if they had a BMI ≥ 30 kg/m²; were age ≥ 18 years; had a history of EC of any stage or grade; were without evidence of disease; had completed all surgical, chemotherapeutic, or radiation treatment; had a clinician-determined life expectancy of at least one year and an ECOG performance status of 0 to 2; and were able to read English. Survivors with a history of recurrence without current disease were included, provided they met the above criteria. Survivors gave written informed consent and completed the survey through Research Electronic Data Capture on an iPad.

2.2. Survey administration

The 27 question survey (Supplemental Table 1) was based on validated, available questionnaires and previously published work, combined and modified for EC survivors (Haggerty et al., 2017; Silva et al., 2019). Input was provided by members experienced in weight loss trials, in addition to members of the Patient and Family Advisory Council at the Siteman Cancer Center at Washington University. Survivors who expressed interest in the behavioral intervention were contacted about randomized trial participation; thus, we offered the survey until the target accrual (n = 80) for the trial was achieved. Free text comments solicited at the survey's end were categorized by themes. Survivors did not need to fully complete the survey to be included in the analysis.

2.3. Data collection and analysis

After survey completion, survivors' electronic health records were reviewed. Differences between intervention participants and non-participants were analyzed using Kruskal-Wallis tests for continuous variables and chi-squared or Fisher's exact tests for categorical variables. Univariate and multivariate regression models with 95% confidence intervals (CI) were used to predict which survivors would participate in the intervention, using demographic covariates. A significance level of 0.35 allowed a predictor into the multivariate model, and a significance level of 0.2 maintained inclusion. Fisher's Exact tests were used to analyze associations between perceptions of weight loss (motivators, barriers, successfulness) and BMI (≥ 40 kg/m² vs. < 40 kg/m²), race (white vs. non-white), age (≥ 60 years vs. < 60 years), and socioeconomic status (annual household income \geq \$50,000/year vs. $<$ \$50,000/year, approximated from the 2017 median US household income (Guzman, 2017). All tests were two-sided with a significance level of $P < 0.05$.

3. Results

Of 358 obese EC survivors identified, 155 (43%) agreed to survey participation. Mean age was 60.6 years (range, 30 to 86). Survivors were predominantly white survivors who had survived early stage, grade 1–2 endometrioid cancers (Table 1). Most had household incomes of at least \$50,000. Only 10% had previously experienced recurrence, and most

Table 1

Baseline demographics of surveyed endometrial cancer survivors stratified by intervention trial participants and non-participants.

	All Surveyed (n = 155)	Enrolled in a behavioral intervention trial		P value
		Yes (n = 80)	No (n = 75)	
Age, mean (range)	60.6 (30–86)	59.3 (31–86)	62.1 (30–79)	0.03
Race^[1], n (%)				0.09
White				
Black	127 (83.0)	62 (77.5)	65 (89.0)	
Asian	21 (13.7)	14 (17.5)	7 (9.6)	
Other	2 (1.3)	2 (2.5)	0 (0)	
Mixed	2 (1.3)	2 (2.5)	0 (0)	
1 (0.7)	1 (0.7)	0 (0)	1 (1.4)	
Baseline BMI in kg/ m², median (range)	39.2 (30.1–73.7)	39.33 (30.1–73.7)	39.22 (30.2–64.2)	0.46
Cancer stage^[2], n (%)				0.01
IA				
IB	87 (58.4)	49 (63.6)	38 (52.8)	
II	30 (20.1)	9 (11.7)	21 (29.2)	
III	6 (4.0)	1 (1.3)	5 (6.9)	
IV	20 (13.4)	14 (18.2)	6 (8.3)	
6 (4.0)	6 (4.0)	4 (5.2)	2 (2.8)	
Cancer histology, n (%)				0.71
Endometrioid, grade 1–2	127 (81.9)	65 (81.3)	62 (82.7)	
9 (5.8)	9 (5.8)	6 (7.5)	3 (4.0)	
Endometrioid, grade 3	5 (3.2)	1 (1.3)	4 (5.3)	
2 (1.3)	2 (1.3)	1 (1.3)	1 (1.3)	
Serous	10 (6.5)	6 (7.5)	4 (5.3)	
Clear cell	2 (1.3)	1 (1.3)	1 (1.3)	
Carcinosarcoma				
Mixed endometrioid/ serous				
Recurrent cancer^[3], n (%)				0.03
Yes	16 (10.4)	4 (5.1)	12 (16.0)	
No	138 (89.6)	75 (94.9)	63 (84.0)	
Annual household income from all sources^[3], n (%)				0.75
Less than \$25,000	27 (17.5)	12 (15.0)	15 (20.3)	
\$25,000 to less than \$50,000	49 (31.8)	29 (36.3)	20 (27.0)	
\$50,000 to less than \$75,000	36 (23.4)	18 (22.5)	18 (24.3)	
\$75,000 to less than \$75,000 or greater	37 (24.0)	18 (22.5)	19 (25.7)	
5 (3.3)	5 (3.3)	3 (3.8)	2 (2.7)	
Unsure				
Medical comorbidities, n (%)				
Hypertension	81 (52.3)	45 (56.3)	36 (48.0)	0.34
Type II Diabetes	39 (25.2)	19 (23.8)	20 (26.7)	0.71
Mellitus	14 (9.0)	9 (11.3)	5 (6.7)	0.41
Depression	2 (1.3)	1 (1.3)	1 (1.3)	1.00
Coronary Artery Disease	29 (18.7)	14 (17.5)	15 (20.0)	0.84
35 (22.6)	35 (22.6)	16 (20.0)	19 (25.3)	0.45
Arthritis				
Hyperlipidemia				

Note: The denominator for the percentages is the sum of patients across all categories, excluding missing values. Percentages might not total 100% due to rounding.

^[1] Missing response data for 2 survivors.

^[2] Missing response data for 6 survivors.

^[3] Missing response data for 1 survivor.

had multiple comorbidities. Median BMI was 39.2 kg/m² (range 30.1 to 73.7 kg/m²). 63.2% of survivors completed the entire survey, with a median of 25/27 questions completed.

3.1. Motivators and barriers to weight loss

Almost all (n = 148, 96%) EC survivors expressed a desire to lose weight. They reported feeling more comfortable discussing weight with

medical personnel than with family and friends, and 86% considered discussing weight an important aspect of care. Most felt they had strong support systems to support weight loss. Weight loss motivators included concerns regarding long-term obesity risks (66%) and a desire to feel better (77%). Only 28% were motivated by having an obesity-linked cancer. Although 58% of survivors believed excess weight affected the risk of developing EC, only 33% believed obesity could affect their survival after an EC diagnosis.

Survivors noted multiple barriers to weight loss, including lack of

motivation (30%), joint pain (27%), time constraints (23%), cost of weight loss programs (26%), cost of healthy food (18%), and lack of support systems (18%). Half of survivors were sedentary for six or more hours daily but reported engaging in exercise some (43%) or most (21%) weeks. Only 47% of survivors reported daily intake of two or more servings of fruit and vegetables, and 57% consumed at least one soft drink on most days.

Preferences varied by age, ethnicity, degree of obesity, and socio-economic status. EC survivors under 60 years reported being more

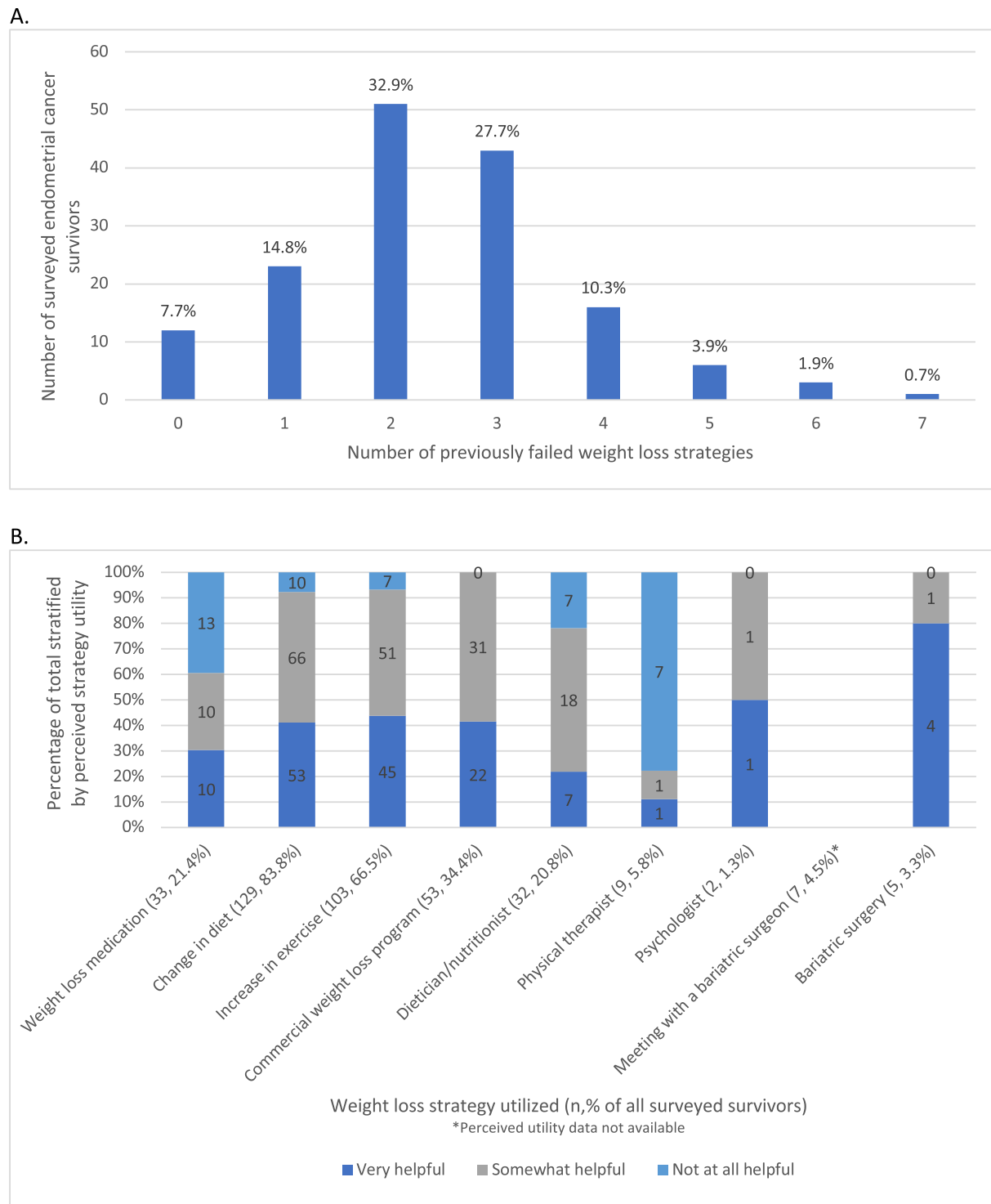


Fig. 1. (A) Number of previously failed weight loss strategies self-reported by obese endometrial cancer survivors (n = 155). (B) Types of previously failed weight loss strategies self-reported by obese endometrial cancer survivors (n = 155) stratified by perceived strategy utility.

comfortable discussing weight with family ($P = 0.048$) and friends ($P = 0.01$) and more frequently reported family as a motivator for weight loss ($P = 0.019$) than older survivors. These women also cited lack of time as a barrier to weight loss more frequently ($P = 0.0497$) than older survivors. White EC survivors reported more sedentary hours than non-white survivors ($P = 0.01$). Survivors with a BMI ≥ 40 kg/m² reported being more motivated by learning they had a weight-related cancer ($P = 0.02$), but exercised less ($P = 0.002$) and found shortness of breath ($P = 0.0004$) and financial concerns ($P = 0.01$) to be greater barriers to weight loss than women with lower BMIs. Compared to EC survivors with annual incomes $\geq \$50,000$, those with lower incomes were more likely to report that financial concerns hampered transportation to weight loss programs ($P = 0.0007$) and ability to purchase healthy foods ($P < 0.0001$). Survivors with lower incomes also considered joint pain ($P = 0.04$) and shortness of breath ($P = 0.021$) to be comparatively greater barriers.

3.2. Previous weight loss strategies

Almost all EC survivors reported having tried to lose weight, many through multiple weight loss methods. The most common methods attempted were diet changes (84%) and increasing exercise (67%). Less common methods included physical therapy (6%), bariatric surgery consultations (4%), undergoing bariatric surgery (3%), and psychological counseling (1%). Fig. 1A and B illustrates survivors' perceptions of method successfulness. We received 28 comments on barriers, citing difficulties with adhering to a chosen weight loss intervention (32%), with maintaining weight loss (29%), self-perception barriers (29%), and logistical barriers (11%), detailed in Table 3.

Older EC survivors were more likely than younger survivors to report weight loss medications were helpful ($P = 0.03$). Additionally, white survivors and those with a higher annual household income were more likely than non-white survivors ($P = 0.04$) and lower income survivors ($P = 0.04$), respectively, to report weight loss medications were helpful.

Only five EC survivors (3%) had undergone bariatric surgery. In response to the question, "If your doctor suggested you might be a candidate for bariatric surgery, would you be interested?", most survivors ($n = 103$, 67%) answered "no". Table 3 lists a selection of 69 survivors' written comments regarding their attitudes toward bariatric surgery. Nearly half of commenters (49%) reported a fear of complications.

3.3. Enrollment predictors

Of the 155 surveyed survivors, 106 (68%) expressed interest in a formal weight loss program. Of those, 80 enrolled in the technology-based behavioral intervention trial. In univariate analyses, race, disease stage, and history of recurrence met criteria for inclusion in the multivariate model. Those who enrolled in the trial were more likely to not have recurrence (odds ratio [OR] 3.57, 95% CI 1.10–11.62). In the multivariate model, controlling for race and stage, survivors were 4.3 times more likely to enroll in the intervention trial if they had never had recurrent disease (Table 2).

4. Discussion

Although most obese EC survivors have repeatedly attempted weight loss and continue to face barriers, almost all surveyed desired to lose weight and more than half were willing to commit to an intervention. After controlling for race and stage, obese EC survivors without recurrence were 4.3 times more likely to enroll in a weight-loss intervention than those who had experienced a recurrence. This is likely because worry about cancer recurrence understandably and appropriately supplants worry of sequelae of obesity. Therefore, education regarding long-term obesity-related comorbidities is likely most beneficial soon after EC diagnosis and treatment.

Table 2

Univariate and multivariate regression analyses of those interested vs. not interested in participating in a weight loss behavioral intervention trial.

	Univariate Model		Multivariate Model	
	P value	Odds Ratio (95% CI)	P value	Odds Ratio (95% CI)
Age, mean (range)	0.10	0.97 (0.95–1.01)		
Race, n (%)	0.06	2.36 (0.96–5.82)	0.09	2.30 (0.88–6.01)
White				
Black				
Asian				
Other				
Mixed				
Baseline BMI in kg/m², median (range)	0.64	1.01 (0.97–1.05)		
Cancer stage, n (%)	0.32	1.49 (0.67–3.29)	0.13	0.51 (0.22–1.21)
IA				
IB				
II				
III				
IV				
Cancer histology, n (%)	0.82	0.91 (0.40–2.06)		
Endometrioid, grade 1–2				
Endometrioid, grade 3				
Serous				
Clear cell				
Carcinosarcoma				
Mixed endometrioid/serous				
Recurrent cancer, n (%)	0.35	3.57 (1.10–11.62)	0.02	4.28 (1.27–14.45)
Yes				
No				
Annual household income from all sources, n (%)	0.57	0.83 (0.44–1.58)		
Less than \$25,000				
\$25,000 to less than \$50,000				
\$50,000 to less than \$75,000				
\$75,000 or greater				
Unsure				
Medical comorbidities, n (%)				
Hypertension	0.30	1.39 (0.74–2.62)		
Type II Diabetes	0.68	0.86 (0.41–1.77)		
Mellitus	0.32	1.78 (0.57–5.56)		
Depression	0.96	0.94 (0.06–15.25)		
Coronary Artery Disease	0.69	0.85 (0.38–1.90)		
Arthritis	0.43	0.74 (0.35–1.57)		
Hyperlipidemia				

Note: 8 observations were excluded due to missing values for the response or explanatory variables.

Despite desiring to lose weight, only 27% of our survivors were motivated to make health changes by having survived an obesity-related cancer, and only 33% knew that obesity worsened EC survival. As providers, we must continue to communicate the significant risk of long-term cardiovascular morbidity to our survivors in a manner that promotes meaningful weight loss and improved all-cause survival.

Our survey participants noted substantial weight loss barriers, including lack of motivation, time and income constraints, comorbidities that lead to deconditioning and joint pain, unhealthy diets, sedentary lifestyles, fears about bariatric surgery, and lack of support systems. These barriers can deter survivors from committing to weight loss interventions. Given that most survivors felt comfortable discussing weight loss with their clinicians, via multidisciplinary team approaches

Table 3
Selected survivor-reported themes and supporting free-response comments.

Self-perception barriers to weight loss (8 of 28 comments, 28.6%)
– “I am my own worst enemy”
– “Motivation”
– “I have been up and down with my weight my entire life”
– “Everything failed. Do not even mention ‘diet & exercise”
– “Genetics impacts”
– “Lost all my willpower”
Logistical barriers to weight loss (3 of 28 comments, 10.7%)
– “I don’t like to cook so I stop at fast food restaurants”
– “Live far...I need to be more into it”
Difficulty with maintaining weight loss (8 of 28 comments, 28.6%)
– “Everything failed. Do not even mention ‘diet and exercise”
– “Every year I eat less and less and still cannot lose weight”
– “Back and hips bother me”
– “Exercising flares back”
– “Has been more difficult the older I get”
Difficulty with adhering to weight loss method (9 of 28 comments, 32.1%)
– “At one time Weight Watchers worked well for me...probably the accountability”
– “Went to work sedentary job and didn’t maintain”
– “Some success with nutritionist...and Weight Watchers...neither lasted very long”
Fear of complications related to bariatric surgery (34 of 69 comments, 49.2%)
– “Don’t want unnecessary surgeries”
– “Too risky and I prefer diet changes and exercise”
– “Don’t want elective/unnecessary surgery”
– “Surgical risks”
– “I’m tired of surgeries”
– “Most have not had good results and some have had bad results”
– “Don’t think altogether safe”
Lack of qualification for weight loss surgery (18 of 69 comments, 26%)
– “I don’t think I weigh enough”
– “Don’t feel I need such a dramatic intervention”
– “I don’t think I need it”
– “I can do this on my own”
– “Too old”
– “Too severe a step”
– “I like to eat”
Difficulty with cost of bariatric surgery (2 of 69 comments, 2.9%)
– “Cannot afford”
Lifestyle change concerns related to bariatric surgery (8 of 69 comments, 11.6%)
– “I do not like what this surgery does to a person”
– “Personal reasons”
– “I’m just too old to change”
– “Prefer diet changes and exercise”
– “Don’t like the amount of food you can eat”
– “I like to eat”
– “Not sure it would be worth it”

Note: Participants provided 28 total comments on weight loss and 69 total comments on bariatric surgery.

and motivational counseling, clinicians may play a critical role in addressing barriers and enhancing survivors’ commitment to weight loss.

In our survey, EC survivors had underutilized several weight management strategies, most notably psychological counseling, physical therapy (PT), and bariatric surgery. Almost half of our survivors reported an annual income below \$50,000/year, impairing affordability of some interventions. However, survivors who had engaged in psychological support and PT reported finding these services helpful. This represents an easily actionable finding, as psychological support, through motivational counseling and goal setting, can improve weight loss outcomes and modify maladaptive relationships with weight and food (Jacob et al., 2018). Integrating psychological care into post-surgical survivorship programs may improve accountability and weight management support. Similarly, while regular exercise should be widely promoted, PT can provide a useful adjunct specifically for EC survivors with joint pain or mobility limitations (Sabbahi et al., 2018). Bariatric surgery was the most underutilized strategy in this survey. Although bariatric surgery is effective and safe in obese women (Modesitt et al., 2015), few survivors in our survey were interested in this approach, with some identifying fear of complications as a barrier. Educating EC survivors about bariatric surgery during cancer surveillance visits may

promote its use.

Our study has several limitations. First, our survey was not externally validated. However, we note the suboptimal methodological quality of weight loss questionnaires across published literature and lack of a gold-standard validated comparator. Thus, we created this survey from existing questionnaires (Silva et al., 2019), and validated the survey by content experts prior to administration. Second, survivors did not answer every question, which might introduce bias. To overcome this limitation, we used Likert scales when appropriate and elicited survivors’ commentary in their own words. Third, our survey participation rate was 43%, and surveyed survivors could represent a biased proportion of highly motivated survivors interested in weight management; true willingness to engage in weight loss may be even lower than we report. Similarly, providers may have encouraged participation in more motivated survivors. Furthermore, our population of surveyed survivors was overwhelmingly white and may not have fully reflected minority women’s perceptions.

In conclusion, our survey results reveal multiple barriers EC survivors face implementing weight loss strategies. Gynecologic oncologists can use these results to provide more tailored weight loss education to survivors. Interventions should be targeted to women who have not had recurrence, as they are more likely to have early stage disease with a low recurrence risk, and can focus on addressing obesity, compared to women with recurrence who must focus on immediate survival needs. We can work to research best practices and streamline access to referrals for PT, psychological support, bariatric surgery, and medical weight management.

CRediT authorship contribution statement

Elise M. Wilson: Investigation, Data curation, Formal analysis, Writing - original draft. **Abigail S. Zamorano:** Investigation, Data curation, Writing - review & editing. **Jingxia Liu:** Methodology, Formal analysis, Writing - review & editing. **David Morris:** Writing - review & editing. **Andrea Leon:** Data curation, Investigation. **Lindsay M. Kuroki:** Investigation. **Premal H. Thaker:** Investigation. **Carolyn K. McCourt:** Investigation. **Katherine C. Fuh:** Investigation. **Matthew Powell:** Investigation. **David Mutch:** Investigation. **Graham Colditz:** Conceptualization, Methodology, Writing - review & editing. **Andrea R. Hagemann:** Conceptualization, Funding acquisition, Methodology, Formal analysis, Writing - review & editing.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Dr. McCourt reports fees from UpToDate outside the submitted work; Dr. Fuh reports grants from Merck, personal fees from Myriad, personal fees from Aravive, personal fees from Immunogen, personal fees from GSK, personal fees from Genentech all outside the submitted work; Dr. Powell reports personal fees from Tesaro, personal fees from Merck, personal fees from Roche/ Genentech, personal fees from Clovis Oncology, personal fees from AstraZeneca, personal fees from Johnson & Johnson, and personal fees from Eisai all outside the submitted work. Dr. Thaker reports personal fees from Stryker, grants and personal fees from Merck, personal fees from Astra Zeneca, personal fees from Aravive, grants and personal fees from Glaxo Smith Kline, personal fees from Celsion, and personal fees from Iovance all outside the submitted work. Ms. Leon and Drs. Wilson, Zamorano, Liu, Morris, Mutch, Colditz and Hagemann have nothing to disclose.

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Appendix A. Supplementary material

Supplementary data (survey questionnaire) to this article can be found online at <https://doi.org/10.1016/j.gore.2021.100719>.

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