


# Perceived importance of weight loss and exercise among endometrial cancer survivors with overweight or obesity: Implications for lifestyle modification interventions

Erin K. Tagai<sup>1</sup> | Gina M. Mantia-Smaldone<sup>2</sup> | Andrew Belfiglio<sup>1</sup> | Christina S. Chu<sup>2</sup> | Emmanuel Lapitan<sup>1</sup> | Heather Santos<sup>1,3</sup> | Enrique Hernandez<sup>4</sup> | David B. Sarwer<sup>5</sup> | Suzanne M. Miller<sup>1</sup> 

<sup>1</sup>Cancer Prevention and Control, Fox Chase Cancer Center/Temple University Health System, Philadelphia, Pennsylvania, USA

<sup>2</sup>Division of Gynecologic Oncology, Fox Chase Cancer Center/Temple University Health System, Philadelphia, Pennsylvania, USA

<sup>3</sup>Department of Epidemiology and Biostatistics, Dornsife School of Public Health, Drexel University, Philadelphia, Pennsylvania, USA

<sup>4</sup>Obstetrics, Gynecology, and Reproductive Sciences, Lewis Katz School of Medicine at Temple University, Philadelphia, Pennsylvania, USA

<sup>5</sup>College of Public Health, Center for Obesity Research and Education, Temple University, Philadelphia, PA, USA

## Correspondence

Suzanne M. Miller, Cancer Prevention and Control, Fox Chase Cancer Center/Temple University Health System, 333 Cottman Avenue, Philadelphia, PA 19111, USA.  
Email: [Suzanne.Miller@fccc.edu](mailto:Suzanne.Miller@fccc.edu)

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## Abstract

**Objective:** Type 1 endometrial cancer (EC) survivors who are overweight or obese are at increased risk of comorbidities and reduced quality of life. Lifestyle modification interventions (e.g., healthy eating, exercise) may help these women reduce excess weight and improve their quality of life. However, existing interventions have shown limited success. Guided by Self-Determination Theory, the proposed study sought to identify factors associated with perceived importance of weight loss and exercise as well as interest in lifestyle modification interventions (components of extrinsic and intrinsic motivation) among EC survivors with overweight or obesity to inform future intervention development.

**Methods:** One hundred type 1 EC survivors [body mass index (BMI)  $\geq 25$  kg/m<sup>2</sup>] completed a cross-sectional survey assessing sociodemographics, medical factors, exercise, risk perceptions and provider communication, quality of life, barriers to dieting and exercise, perceived importance of healthy lifestyles, and desired intervention content.

**Results:** EC survivors who were aware obesity is a risk factor for EC were significantly more likely to perceive weight loss as important and were interested in weight loss programs and receiving information about exercise ( $p < 0.05$ ). Additionally, EC survivors who reported their provider discussed the importance of a healthy weight after their diagnosis were significantly more likely to perceive exercise as important and were interested in receiving dieting information.

**Conclusions:** EC survivors expressed interest in lifestyle modification interventions. Increasing awareness about the risk of obesity and provider discussions about healthy weight during routine appointments may motivate EC survivors to engage in lifestyle modification interventions.

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## KEYWORDS

diet, endometrial cancer, exercise, weight loss

## 1 | INTRODUCTION

Endometrial cancer (EC) is the most common gynecologic malignancy and its incidence has been rising in the US since 1988.<sup>1</sup> The majority of patients are diagnosed with type 1 EC, which is typically low grade, has endometrioid histology, is diagnosed among younger women compared to other EC types ( $M = 61$  years),<sup>2</sup> and is significantly associated with obesity.<sup>3,4</sup> While type 1 EC recurrence in early stage cancer is rare,<sup>5</sup> EC survivors are at greater risk of obesity-related comorbidities (e.g., diabetes, cardiovascular disease)<sup>6,7</sup> and reduced quality of life (QoL).<sup>8</sup> Indeed, cardiovascular disease is the leading cause of death among EC survivors<sup>6</sup> and EC survivors who have obesity [body mass index (BMI)  $\geq 30$  kg/m<sup>2</sup>] at diagnosis have three times greater risk for developing type II diabetes after their EC diagnosis compared to the general population.<sup>7</sup> Additionally, EC survivors who are overweight or obese often have decreased general health status, physical-function, ability and fulfillment of work, enjoyment with life, and closeness with friends.<sup>9</sup> Importantly, EC survivors generally do not meet exercise and dietary guidelines (e.g., fruit and vegetable intake), which is linked with both reduced QoL and obesity or overweight in these women.<sup>10,11</sup> The majority of EC survivors maintain or gain excess weight after treatment and healthy lifestyle behaviors do not significantly differ from pre-treatment intentions.<sup>12</sup> As weight loss and lifestyle modification are associated with improved QoL among EC survivors,<sup>13</sup> the development of efficacious interventions to promote clinically significant weight loss has the potential to positively impact their physical and psychosocial well-being.<sup>14</sup>

However, there are limited evidence-based interventions to promote weight loss among EC survivors with excess body weight. The few studies available have evaluated a variety of lifestyle modification strategies (e.g., exercise, dieting) for behavior change, including home-based,<sup>15,16</sup> group-based in-person,<sup>17-20</sup> technology-based,<sup>21-23</sup> or one-on-one health coaching with meal replacements<sup>24</sup> focused on exercise and/or dieting. While some interventions significantly improved exercise<sup>15,19,22,23</sup> and QoL,<sup>15,17,18,21,22,25</sup> many did not show statistically significant changes in weight<sup>16,18,21,23</sup> or waist circumference.<sup>15,16,21</sup> In other studies, weight losses were not sufficiently large<sup>17,19,22</sup> to ultimately impact clinical outcomes.<sup>26,27</sup> One-on-one health coaching in combination with meal planning involving meal replacements demonstrated a clinically significant weight loss<sup>24</sup>; however, the long-term sustainability of this approach is unknown.

Nonetheless, the data support the feasibility and acceptability of exercise and dieting interventions among EC survivors with excess body weight as demonstrated by intervention attendance<sup>16,18,19,22</sup> or usage rates<sup>22</sup> and positive feedback from participants.<sup>16,19,23</sup> However, the intervention content and delivery may not be optimal to improve QoL and reduce excess weight. EC survivors may require strategic support to overcome barriers to healthy lifestyle behavior

changes<sup>28,29</sup> and intervention content and delivery methods tailored to participants' preferences.<sup>30</sup> Therefore, research is needed to better identify methods to engage EC survivors in lifestyle interventions, including factors associated with increased motivation to partake in a healthy behavior change.

Guided by Self-Determination Theory, this study sought to identify factors associated with perceived importance of weight loss and exercise as well as interest in lifestyle modification interventions among type 1 EC survivors with overweight or obesity. Self-Determination Theory posits that humans have three psychological needs (i.e., autonomy, competence, relatedness) that must be fulfilled before an individual obtains intrinsic motivation to partake in a particular behavior.<sup>31</sup> Therefore, we sought to identify participant characteristics and modifiable risk factors related to autonomy and competence associated with (a) perceived importance of weight loss and exercise (a component of identified regulation within extrinsic motivation) and (b) interest in intervention content for healthy lifestyle change (a component intrinsic motivation) among type 1 EC with overweight or obesity.

## 2 | MATERIALS AND METHODS

### 2.1 | Study design and population

A convenience sample of type 1 EC survivors with overweight or obesity [body mass index (BMI)  $\geq 25$  kg/m<sup>2</sup>] who were scheduled for a routine follow-up appointment were recruited from Fox Chase Cancer Center between 2017 and 2018. Eligible participants were identified through providers' schedules in the electronic medical record and approached at the time of appointment by the study staff. Women were eligible for the study if they were (a) diagnosed and treated for biopsy proven type 1 EC, (b) receiving follow-up care for their EC at Fox Chase Cancer Center, (c) BMI  $\geq 25$  kg/m<sup>2</sup>, (d) aged 18 or older, (e) communicate in English, and (f) competent to give consent. Enrolled participants signed the informed consent and HIPAA authorization forms and completed a cross-sectional survey developed by content experts in psycho-oncology and gynecologic oncology with a combination of validated and author-constructed items. The study was approved by the Fox Chase Cancer Center Institutional Review Board.

### 2.2 | Measures

*Participant characteristics.* Sociodemographic variables included age, race/ethnicity, education, income, marital status, and employment status. Medical variables include BMI (assessed via medical chart abstraction from the most recent follow-up visit) and a three-item health literacy scale.<sup>32</sup> Overall QoL was assessed using the 43-item

Functional Assessment of Cancer Therapy—Endometrial (FACT-En) version 4.<sup>33</sup> This scale asks participants to indicate their response to quality of life items (e.g., “I have a lack of energy,” “I get support from my friends,” “I feel sad,” “I am sleeping well,” “I have been short of breath”) in the last 7 days on a 5-point Likert-type scale of 0 (*not at all*) to 4 (*very much*). A total score is calculated with reverse coding of certain items with a possible range of 0–172, with higher scores indicating better QoL.

**Modifiable risk factors.** *Autonomy* was assessed through perceived barriers to diet and exercise, awareness about obesity as a risk factor for EC, and provider communication about the importance of weight loss. Perceived barriers to dieting were assessed using an author constructed index item asking “what would or could get in the way of you trying to diet” with response options of other health problems, money, difficulty buying health food, don't know how to, no time to prep food, family and friends are not supportive, and “other.” A similar index item asked participants “what would or could get in the way of you trying to exercise” with response options of other health problems, money, don't know what to do, no time to exercise, no safe place to exercise, family and friends are not supportive, and “other.” A single author constructed an item asking if obesity affects the risk of developing EC with response options of “decreases your risk,” “does not change your risk,” “increases your risk,” and “not sure.” Responses were recoded to correct (“increases your risk”) and incorrect (all other responses). An author constructed item asked participants if their doctor had discussed the importance of achieving and maintaining a healthy weight (response options: “yes” or “no”). *Competence* was assessed through current exercise via metabolic equivalent of tasks (METs) calculated from a participant self-report index of the average hours per week over the past 2 months for various activities<sup>34</sup> and a single author constructed an item assessing attempts to lose weight in the past year.

**Dependent variables.** Participants were asked two items assessing how important they thought weight loss and exercise were after their EC diagnosis, with response options of “critically important” to “not important.” Based on response distributions, the items were recoded to: “very important” (critically and very important), “moderately important” (somewhat and moderately important), and “not important.” Participants were also asked about their interest in EC-related and healthy lifestyle behavior information and support, including (a) a formal weight loss program, as well as receiving information about (b) EC-related information (e.g., emotional support, coping with physical side effects, how to communicate with your medical team dieting, exercising), (c) dieting, and (d) exercise. Finally, participants were asked how they would like the information to be delivered with response options of text message, voice mail, in-person, telephone, email, or other.

## 2.3 | Statistical analyses

Data analyses were completed using SPSS Statistics 26 (Armonk, NY). Descriptive statistics were first completed for all variables.

Univariate linear regression was completed to compare participant characteristics and modifiable risk factors for exercise with perceived importance of (a) weight loss and (b) exercise. Findings with a  $p$ -value  $< 0.10$  were included in a multivariable linear regression model evaluating the relationship of the participant characteristics and modifiable risk factors with perceived importance of weight loss and exercise. Additionally, univariate logistic regression was completed to identify significant relationships between the modifiable risk factors with interest in EC-related and healthy lifestyle behavior information. The Benjamini-Hochberg Procedure was completed with a false discovery rate of 0.20 for all univariate and multivariable regression analyses. Listwise deletion was used for all analyses and no a priori power calculation was completed for this analysis as sample sizes were based on the available data.

## 3 | RESULTS

### 3.1 | Patient characteristics

A total of 194 patients were approached in the clinic by the study staff and introduced to the study and 119 patients consented and completed the survey (62%). There were 19 screen failures (all had a BMI lower than 25 kg/m<sup>2</sup>), leaving a total of 100 eligible patients who completed the survey. Participants were predominantly non-Hispanic White (79%) with a mean age of 62.25 years (SD = 11.23) and mean BMI of 37.71 kg/m<sup>2</sup> (SD = 9.86). Most participants had at least some college (33%) or a bachelor's degree (35%) and reported moderately high health literacy ( $M = 13.34$ ,  $SD = 2.19$ , maximum score = 15). Patients were mean 3.1 years (SD = 2.8 years; Range = < 1–13 years) from treatment completion. Approximately half of the participants were aware that obesity is a risk factor for EC (53%) and reported that their doctor discussed the importance of having a healthy weight (47%). See Table 1 for additional details.

### 3.2 | Perceived importance of weight loss and exercise

A majority of participants said weight loss was very important or moderately important after their EC diagnosis (33% and 47%, respectively). After correcting for a false discovery rate using the Benjamini-Hochberg Procedure, individuals who were retired were significantly less likely to perceive weight loss as important compared to those who were employed ( $\beta = -0.310$ ,  $p = 0.039$ ). Additionally, individuals who were aware that obesity is a risk factor for developing EC were significantly more likely to perceive weight loss as important compared to those who were not aware that obesity is a risk factor for EC ( $\beta = 0.248$ ,  $p = 0.030$ ). Further, additional variables within the multivariable regression analysis were not significant, including age, race/ethnicity, marital status, provider discussion about a healthy weight, or attempt to lose weight in past year. See Table 2 for additional details.

**TABLE 1** Endometrial cancer survivor demographics (N = 100).

| Characteristic  | N (%) or M (SD) |
|---|-----------------|
| Age   | 62.25 (11.23)   |
| Race/ethnicity  |                 |
| Non-Hispanic White  | 79 (79.0)       |
| Non-Hispanic Black  | 10 (10.0)       |
| All other race/ethnicities                                    | 11 (11.0)       |
| Education   |                 |
| High school diploma or less                                   | 31 (31.3)       |
| Some college  | 33 (33.3)       |
| Bachelor's degree   | 35 (35.4)       |
| Employment status   |                 |
| Employed  | 47 (50.0)       |
| Retired   | 36 (38.3)       |
| Unemployed/disabled   | 11 (11.7)       |
| Annual household income                                       |                 |
| < \$25,000  | 12 (13.3)       |
| \$25,000 to less than \$50,000                                | 23 (25.6)       |
| \$50,000 to less than \$75,000                                | 18 (20.0)       |
| \$75,000 or more  | 37 (41.1)       |
| Married or living with partner                                | 58 (58.6)       |
| Health literacy (maximum score = 15; range = 6–15)            | 13.34 (2.19)    |
| Body mass index (kg/m <sup>2</sup> )                          | 37.71 (9.86)    |
| Overweight (25.0 < 30 kg/m <sup>2</sup> )                     | 26 (26.0)       |
| Class 1 obese (30 < 35 kg/m <sup>2</sup> )                    | 22 (22.0)       |
| Class 2 (35 < 40 kg/m <sup>2</sup> )                          | 18 (18.0)       |
| Class 3 (40+ kg/m <sup>2</sup> )                              | 34 (34.0)       |
| Total METs per week   | 12.34 (9.56)    |
| Aware of obesity as risk factor for endometrial cancer        | 53 (53.0)       |
| Doctor discussed importance of healthy weight                 | 46 (47.4)       |
| Total barriers to dieting (maximum score = 7; range = 0–6)    | 1.23 (1.26)     |
| No time to prep food  | 26 (26.8)       |
| Other health problems   | 20 (20.6)       |
| Don't know how to   | 18 (18.6)       |
| Total barriers to exercise (maximum score = 7; range = 0–5)   | 1.61 (0.99)     |
| Other health problems   | 65 (69.1)       |
| No time to exercise   | 33 (35.1)       |
| Don't know what to do   | 17 (18.1)       |
| Tried to lose weight in past year                             | 72 (74.2)       |
| Overall quality of life (maximum score = 172; range = 83–168) | 137.76 (18.42)  |

**TABLE 1** (Continued)

| Characteristic   | N (%) or M (SD) |
|--|-----------------|
| Perceived importance of weight loss after EC diagnosis |                 |
| Very important   | 31 (33.3)       |
| Moderately important                                   | 44 (47.3)       |
| Not important  | 18 (19.4)       |
| Perceived importance of exercise after EC diagnosis    |                 |
| Very important   | 35 (35.7)       |
| Moderately important                                   | 52 (53.1)       |
| Not important  | 11 (11.2)       |

Note: Frequencies not adding to N = 100 due to missing data.

Abbreviations: EC, endometrial cancer; METs, metabolic equivalent of tasks.

Similarly, most participants said exercise was very important or moderately important after their EC diagnosis (36% and 53%, respectively; Table 1). After completing the Benjamini-Hochberg Procedure for the multivariable linear regression model, non-Hispanic Black participants were significantly more likely to perceive exercise as important compared to non-Hispanic White participants ( $\beta = 0.375$ ,  $p < 0.001$ ). Additionally, total METs per week were positively associated with perceived importance of exercise ( $\beta = 0.365$ ,  $p = 0.001$ ). Furthermore, additional variables within the multivariable regression analysis were not significant, including age, employment, marital status, barriers to dieting, or attempt to lose weight in the past year. See Table 3 for additional details.

### 3.3 | Interest in weight loss program and EC-related or healthy lifestyle behavior information

Most participants were interested in receiving information and helpful tips for women with EC (67%) as well as information about diet and exercise (60% and 46%, respectively). Additionally, many participants were interested in a formal weight loss program (51%). After completing the Benjamini-Hochberg Procedure, participants who were aware that obesity is a risk factor for developing EC had significantly greater odds of reporting interest in a weight loss program (OR = 2.69, 95% CI [1.17, 6.16]) and receiving exercise information (OR = 2.82, 95% CI [1.23, 6.45]). Barriers to exercise or dieting or attempts to lose weight in the past year were not significantly associated with interest in a weight loss program or any intervention content (e.g., EC-related information). See Figure 1 for additional details.

## 4 | DISCUSSION

The present study aimed to identify participant characteristics and modifiable risk associated with (a) perceived importance of weight loss and exercise and (b) interest in intervention content for a healthy

TABLE 2 Regression analyses for perceived importance of weight loss after endometrial cancer diagnosis.

| Characteristic                                | Univariate regression |       |         |                   | Multivariable regression |       |         |              |
|---|-----------------------|-------|---------|-------------------|--------------------------|-------|---------|--------------|
|   | B                     | SE    | $\beta$ | p-value           | B                        | SE    | $\beta$ | p-value      |
| Age   | -0.017                | 0.006 | -0.269  | <b>0.010</b>      | 0.015                    | 0.010 | 0.253   | 0.110        |
| Race/ethnicity                                |                       |       |         |                   |                          |       |         |              |
| Non-Hispanic White                            | Ref                   |       |         |                   | Ref                      |       |         |              |
| Non-Hispanic Black                            | 0.586                 | 0.257 | 0.230   | 0.025             | 0.496                    | 0.265 | 0.201   | 0.066        |
| All other race/ethnicities                    | 0.516                 | 0.244 | 0.214   | 0.037             | 0.465                    | 0.257 | 0.189   | 0.075        |
| Education                                     | 0.170                 | 0.091 | 0.192   | 0.065             | -0.008                   | 0.093 | -0.010  | 0.929        |
| Employment status                             |                       |       |         |                   |                          |       |         |              |
| Employed                                      | Ref                   |       |         |                   | Ref                      |       |         |              |
| Retired                                       | -0.413                | 0.158 | -0.282  | 0.011             | -0.444                   | 0.211 | -0.310  | <b>0.039</b> |
| Unemployed/disabled                           | 0.068                 | 0.233 | 0.032   | 0.771             | 0.048                    | 0.256 | 0.021   | 0.850        |
| Household income                              | 0.089                 | 0.068 | 0.142   | 0.196             |                          |       |         |              |
| Married or living with partner                | 0.158                 | 0.150 | 0.110   | 0.296             |                          |       |         |              |
| Health literacy                               | -0.007                | 0.036 | -0.020  | 0.851             |                          |       |         |              |
| BMI   | 0.006                 | 0.007 | 0.084   | 0.425             |                          |       |         |              |
| Total METs per week                           | 0.014                 | 0.008 | 0.187   | 0.074             |                          |       |         |              |
| Aware obesity is risk factor                  | 0.433                 | 0.413 | 0.303   | <b>0.003</b>      | 0.345                    | 0.156 | 0.248   | <b>0.030</b> |
| Doctor discussed importance of healthy weight | 0.451                 | 0.144 | 0.318   | <b>0.002</b>      | 0.266                    | 0.150 | 0.192   | 0.081        |
| Barriers to dieting                           | 0.076                 | 0.058 | 0.135   | 0.196             |                          |       |         |              |
| Barriers to exercise                          | 0.068                 | 0.076 | 0.096   | 0.368             |                          |       |         |              |
| Tried to lose weight in past year             | 0.588                 | 0.160 | 0.365   | <b>&lt; 0.001</b> | 0.346                    | 0.174 | 0.219   | 0.051        |
| Overall quality of life                       | -0.003                | 0.004 | -0.078  | 0.481             |                          |       |         |              |

Note: Bolded *p*-values are significant after Benjamini-Hochberg Procedure with a false discovery rate of 0.20.

Abbreviations: BMI, body mass index; METs, metabolic equivalent of tasks.

lifestyle change among type 1 EC patients with overweight or obesity. Overall, participants were interested in receiving information about exercise and dieting, and over two-thirds were interested in a formal weight loss program. EC survivors preferred to receive information through email or in-person. Previous studies have demonstrated the feasibility and acceptability of interventions using technology or in-person sessions in this patient population.<sup>21,35</sup> However, several barriers to dieting and exercise have been reported that would limit successful engagement in traditional weight management programs. Interventions to reduce excess weight and positively impact QoL among EC survivors must carefully consider participant preferences,<sup>30</sup> as well as barriers to the uptake of exercise and healthy eating behaviors.<sup>28,29,36,37</sup>

EC survivors who were aware that obesity is a risk factor for EC were significantly more likely to perceive weight loss as important and were interested in a weight loss program as well as receiving information about exercise. These findings are consistent with previous research reporting that gynecologic cancer patient preferences (38% of whom were EC patients) who understood the importance of weight loss and obesity-related health risks were more likely to

believe that weight management counseling would be effective.<sup>38</sup> As a majority of women in the US are not aware of the association between obesity and EC,<sup>39-41</sup> these results suggest that increasing obesity-related risk perceptions may increase positive beliefs toward (and ultimate uptake of) lifestyle modification and weight loss programs.

Notably, participants who reported that their doctor discussed the importance of a healthy weight were more interested in receiving helpful tips for EC survivorship and information about dieting. Indeed, among those who received a provider recommendation, EC survivors were more likely to attempt weight loss.<sup>42</sup> Unfortunately, EC survivors report infrequent provider recommendations about body weight and indicate that receiving provider recommendations would influence their behavior.<sup>28,38,42</sup> Notably, among participants in our study, those who had a higher BMI were significantly more likely to report their provider discussed the importance of a healthy weight ( $M = 41.3 \text{ kg/m}^2$ ,  $SD = 9.92 \text{ kg/m}^2$ ) compared to those whose provider did not discuss the importance of a healthy weight ( $M = 34.69 \text{ kg/m}^2$ ,  $SD = 8.97 \text{ kg/m}^2$ ;  $p = 0.001$ ), suggesting that providers may be only discussing healthy weight with patients who

TABLE 3 Regression analyses for perceived importance of exercise after endometrial cancer diagnosis.

| Characteristic                                | Univariate regression |       |         |              | Multivariable regression |       |         |                   |
|---|-----------------------|-------|---------|--------------|--------------------------|-------|---------|-------------------|
|   | B                     | SE    | $\beta$ | p-value      | B                        | SE    | $\beta$ | p-value           |
| Age   | -0.013                | 0.006 | -0.240  | 0.019        | 0.016                    | 0.008 | 0.290   | 0.054             |
| Race/ethnicity                                |                       |       |         |              |                          |       |         |                   |
| Non-Hispanic White                            | Ref                   |       |         |              | Ref                      |       |         |                   |
| Non-Hispanic Black                            | 0.624                 | 0.212 | 0.287   | <b>0.004</b> | 0.822                    | 0.215 | 0.375   | <b>&lt; 0.001</b> |
| All other race/ethnicities                    | 0.446                 | 0.202 | 0.215   | 0.030        | 0.319                    | 0.213 | 0.146   | 0.139             |
| Education                                     | 0.141                 | 0.078 | 0.181   | 0.076        |                          |       |         |                   |
| Employment status                             |                       |       |         |              |                          |       |         |                   |
| Employed                                      | Ref                   |       |         |              | Ref                      |       |         |                   |
| Retired                                       | -0.312                | 0.141 | -0.238  | 0.029        | -0.355                   | 0.178 | -0.267  | 0.049             |
| Unemployed/disabled                           | -0.006                | 0.211 | -0.003  | 0.978        | -0.068                   | 0.212 | -0.033  | 0.750             |
| Household income                              | 0.109                 | 0.059 | 0.195   | 0.067        |                          |       |         |                   |
| Married or living with partner                | 0.320                 | 0.127 | 0.250   | <b>0.013</b> | 0.228                    | 0.119 | 0.176   | 0.060             |
| Health literacy                               | 0.010                 | 0.030 | 0.035   | 0.736        |                          |       |         |                   |
| BMI   | -0.010                | 0.007 | -0.156  | 0.126        |                          |       |         |                   |
| Total METs per week                           | 0.024                 | 0.007 | 0.343   | <b>0.001</b> | 0.025                    | 0.007 | 0.365   | <b>0.001</b>      |
| Aware obesity is risk factor                  | 0.247                 | 0.129 | 0.193   | 0.057        |                          |       |         |                   |
| Doctor discussed importance of healthy weight | 0.057                 | 0.134 | 0.044   | 0.671        |                          |       |         |                   |
| Barriers to dieting                           | 0.124                 | 0.050 | 0.246   | 0.016        | 0.111                    | 0.047 | 0.228   | 0.021             |
| Barriers to exercise                          | 0.103                 | 0.065 | 0.164   | 0.117        |                          |       |         |                   |
| Tried to lose weight in past year             | 0.394                 | 0.149 | 0.264   | <b>0.010</b> | 0.273                    | 0.144 | 0.187   | 0.061             |
| Overall quality of life                       | 0.004                 | 0.004 | 0.126   | 0.245        |                          |       |         |                   |

Note: Bolded *p*-values are significant after Benjamini-Hochberg Procedure with a false discovery rate of 0.20.

Abbreviations: BMI, body mass index; METs, metabolic equivalent of tasks.

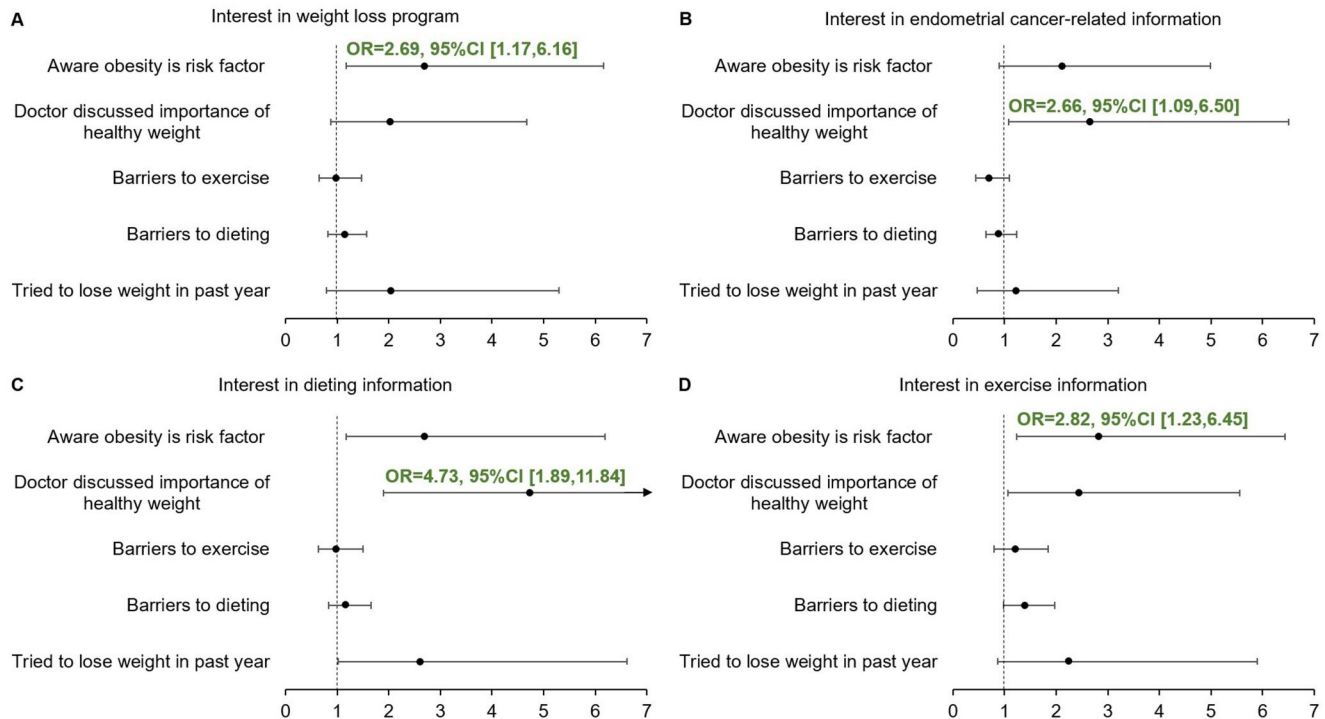
have higher BMI rather than all patients who may benefit from lifestyle modification. Furthermore, while gynecologic oncologists agree that discussing lifestyle modification and weight with patients is important, few undergo formal training in obesity management or discuss goal weight with survivors; in fact, providers spend less than 10 min on average discussing lifestyle modification.<sup>43</sup> Among those who counsel their patients during follow-up visits, most refer patients to other providers for weight management interventions.<sup>43</sup> Additionally, along with poor provider communication, many EC patients experience weight stigma from providers, reducing healthcare quality and safety.<sup>44</sup> Provider training must incorporate building communication skills to reduce weight stigma and to reduce barriers to quality care.<sup>43,44</sup> These findings suggest that discussions about weight and lifestyle modification from gynecologic oncologists would be well-received by some EC survivors and may motivate them to initiate weight loss strategies. Formal training for gynecologic oncologists and increased referral to evidence-based interventions may be needed to bolster provider-led discussions.

EC survivors who reported more exercise (i.e., greater METs per week) reported greater perceived importance of exercise. These

individuals have experience integrating exercise into their daily lives, enhancing their perceived congruence of exercise into their identity as a cancer survivor.<sup>31</sup> Furthermore, non-Hispanic Black participants had greater perceived importance of exercise compared with non-Hispanic White participants. Black women experience a disproportionate burden of obesity compared to White women<sup>45</sup> and female Black cancer survivors often report lower levels of exercise. While our findings suggest that Black women may perceive exercise to be important after their cancer diagnosis, research has identified barriers that limit Black women's exercise.<sup>46</sup> Therefore, intervention development should consider individuals' existing exercise levels alongside the cultural, socioeconomic, and community factors that impact obesity and lifestyle behaviors across racial/ethnic groups.<sup>47,48</sup>

Limitations of this study include the exclusion of certain eHealth-based intervention delivery channels (e.g., telemedicine, smartphone app) in the identification of delivery preferences. As has been seen with the COVID-19 pandemic<sup>49</sup> and existing weight loss interventions,<sup>21,35</sup> mHealth channels are generally acceptable and feasible intervention modalities. Additionally, recruitment was limited to a comprehensive cancer center patient population with a range of





**FIGURE 1** Univariate regression of modifiable factors and interest in lifestyle modification intervention content: weight loss program (Panel A), endometrial cancer-related information (Panel B), dieting information (Panel C), and exercise information (Panel D). Odds ratios are provided for factors statistically significant after the Benjamini-Hochberg Procedure.

<1–13 years from treatment completion. Therefore, findings may not be generalizable to EC survivors from other clinic settings and patients may have differing perceptions on weight loss during survivorship. We also did not capture reasons for declining to participate and the 40% decline rate may also impact generalizability. Furthermore, many of our measures were single, author constructed items that may reduce our ability to detect significant effects or impact reliability. Nonetheless, this study's targeted assessment of type 1 EC survivors highlights the perceived needs of this patient population, helping to inform intervention development to improve QoL and reduce obesity-related comorbidities.

## 5 | CONCLUSION

EC survivors with excess body weight expressed interest in enhanced support and information for weight loss. Findings suggest that modifiable risk factors such as awareness about the risk of obesity and provider discussions about healthy weight during routine appointments are associated with perceived importance of weight loss and exercise and is associated with interest in a healthy lifestyle modification. Targeting these modifiable factors through patient-provider communication interventions may bolster EC survivors' interest in healthy lifestyle changes. Further, future research should incorporate culturally-sensitive provider training to ensure equitable and non-stigmatizing weight-related communication for EC survivors.

## AUTHOR CONTRIBUTIONS

Conceptualization: Erin K. Tagai, Suzanne M. Miller, Gina M. Mantia-Smaldone, Andrew Belfiglio, Christina S. Chu. Methodology: Erin K. Tagai, Suzanne M. Miller, Andrew Belfiglio, Heather Santos. Data analysis: Erin K. Tagai, Andrew Belfiglio, Emmanuel Lapitan, Heather Santos. Writing: Erin K. Tagai, Suzanne M. Miller, Gina M. Mantia-Smaldone, Andrew Belfiglio, Christina S. Chu, Emmanuel Lapitan, Heather Santos, Enrique Hernandez, David B. Sarwer. Supervision: Suzanne M. Miller.

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## CONFLICT OF INTEREST STATEMENT

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## ORCID

Suzanne M. Miller  <https://orcid.org/0000-0002-7296-9318>

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