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The effects of restaurant menu calorie labeling on hypothetical meal choices of females with disordered eating

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Abstract

Concerns have been raised that obesity public policy measures may have harmful effects on individuals with eating disorders. However, little research has investigated this topic. We examined the impact of a popular obesity public policy, menu calorie labeling, on hypothetical food choices of women with disordered eating. Seven hundred sixteen adult females completed an online survey in which they were randomly assigned to receive a restaurant menu with or without calorie information listed. Participants selected foods representative of a meal they would choose to consume and answered questions on restaurant ordering and menu labeling. Participants completed the Eating Disorder Examination Questionnaire (Fairburn & Beglin, 1994) to assess global eating pathology. Diagnoses of anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorder (BED) were also derived from this measure. Generalized linear modeling examined the impact of menu label condition, disordered eating, and the menu label by disordered eating interaction on hypothetical food selection and related variables. When disordered eating was examined continuously, menu labeling did not differentially affect food selections of those with elevated disordered eating ($p = .45$). However, when examined by eating disorder diagnosis, participants with AN or BN ordered significantly fewer ($p < .001$) and participants with BED ordered significantly more ($p = .001$) calories in the menu label versus no label condition. Menu labeling may decrease the calories ordered among individuals with AN or BN and increase calories ordered among individuals with BED.

KEYWORDS

anorexia nervosa, binge eating disorder, bulimia nervosa, obesity prevention, public policy

1 | INTRODUCTION

There is an increasing focus among public health officials on implementing policies designed to address obesity, but much less attention has been given to how these policies might impact those with disordered eating, despite the fact that millions suffer with such illnesses (Hudson, Hiripi, Pope, & Kessler, 2007). Concerns have been raised that obesity prevention efforts might inadvertently promote or exacerbate eating disorder symptoms (Cogan, Smith, & Maine, 2008; O'Dea, 2005). However, to date, there has been little research to support or refute such concerns.

One national obesity prevention policy that has been viewed with apprehension among eating disorder advocates is menu labeling, which requires chain restaurants to post kilocalorie (calorie) information on menus (FDA, 2014). Menu labeling has been implemented in several U.S. cities and is expected to be rolled out nationally by May 2017. The evidence regarding the effect of menu labeling on consumer choices is mixed. Although data from several real-world studies suggest that menu labeling may promote lower calorie purchases at full-service chain restaurants, certain coffee shops, and cafeterias, other studies indicate that menu labels might have little impact on fast-food purchases (Sinclair, Cooper, & Mansfield, 2014; VanEpps, Roberto, Park, Economos, & Bleich, 2016). The majority of the U.S. population supports menu labeling (Gollust, Barry, & Niederdeppe, 2014); however, there is some worry that calorie labels might negatively impact the eating or emotional state of individuals at high risk of disordered eating (O'Dea, 2005; Schwartz & Henderson, 2009). In a survey of undergraduates, approximately one-third endorsed believing that menu labeling could exacerbate eating disorder symptoms (Roberto, Kim, Schwartz, & Brownell, 2013). Indeed, Harvard University removed nutrition labels

from their dining halls several years ago when students complained about their perceived potential for negative impact (Hu, 2008).

There is very little research on how menu labels impact those at risk for eating disorders. One the one hand, highlighting calorie information might lead some at-risk individuals to engage in disordered eating (e.g., caloric restriction) or to experience greater distress when dining out (Hu, 2008; Roberto, Kim, Schwartz, & Brownell, 2013). Some cross-sectional research suggests that individuals who use nutrition information to guide food choices have more weight concerns and unhealthy weight control behavior compared with those not utilizing such information (Fawkes, Levy, Terry, & Edelstein, 2010; Laz, Rahman, & Berenson, 2015). On the other hand, studies of virtual restaurant environments have found that dining out results in increases in negative affect and poor body image among individuals with eating disorders (Ferrer-García, Gutiérrez-Maldonado, Caqueo-Urízar, & Moreno, 2009; Gutiérrez-Maldonado, Ferrer-García, Caqueo-Urízar, & Moreno, 2010) and other data suggest that individuals with binge eating perceive restaurant meals to be uncontrolled and excessive (Timmerman, 2006). Thus, providing information on the caloric content of restaurant food might help to increase a sense of control and, therefore, reduce stress for these groups. Further, individuals with eating disorders poorly estimate caloric intake (Bartholome, Peterson, Raatz, & Raymond, 2013; Sysko, Walsh, Schebendach, & Wilson, 2005), suggesting calorie labels could help them more appropriately estimate calories and adjust consumption.

To date, only one study has investigated the influence of menu labels on individuals with elevated symptoms of disordered eating (Lillico, Hanning, Findlay, & Hammond, 2015). In this study, eating disorder and affective symptoms were assessed before and after the introduction of menu labels into a real-world cafeteria setting. The researchers did not observe any alteration in disordered eating, body image, mood, or anxiety associated with the policy change. Although this study provided important correlational data on the effect of calorie labels in a naturalistic setting, no studies have examined a causal relationship between exposure to calorie labels and ordering or eating behaviors and attitudes among individuals with disordered eating. Research is needed to inform the decision-making of policy makers interested in implementing menu labeling, and to understand how the national policy may impact those at-risk for eating disorders. Such research can also help inform clinician efforts to support eating disorder clients exposed to this information when dining out.

To address this gap and conduct policy-relevant research on eating disorders, we examined the degree to which randomly assigned restaurant menus with or without calorie labels impacted hypothetical dinner choices of females based on: (1) global severity of disordered eating symptoms; and (2) diagnosis of anorexia nervosa (AN), bulimia nervosa (BN), or binge-eating disorder (BED). Our analyses examined disordered eating both continuously, to determine the influence of menu labels across a range of severity, and categorically, to identify nuanced differences between diagnostic presentations. As a secondary aim, we examined how menu labels influenced the accuracy of estimating calories ordered and decision-making regarding meal selection among these groups. Because there is limited research on the impact of menu labeling on consumption-related behaviors of individuals with eating disorders, no a priori hypotheses were set for this investigation. The goal of this study was to generate some of the first evidence to understand whether menu labeling negatively impacts restaurant dining indices among individuals with disordered eating and to determine whether further work in this area is warranted.

TABLE 1 Baseline sample characteristics ($n = 716$)

Dependent variable	M (*SD*) or *n* (%)	Range
Age (yr)	21.52 (5.66)	18 to 71
Race (% White)	455 (63.6)	—
Body mass index (kg/m^2)	23.94 (5.00)	15.96 to 46.98
EDE-Q restraint score	2.15 (1.52)	0.00 to 6.00
EDE-Q eating concern score	1.30 (1.26)	0.00 to 5.60
EDE-Q shape concern score	3.13 (1.66)	0.00 to 6.00
EDE-Q weight concern score	2.86 (1.68)	0.00 to 6.00
EDE-Q global score	2.36 (1.38)	0.00 to 5.80
Anorexia nervosa diagnosis	7 (1.0)	—
Bulimia nervosa diagnosis	23 (3.2)	—
Binge eating disorder diagnosis	66 (9.2)	—
Baseline hunger (0–100)	37.85 (27.54)	0 to 100
Support menu labels (% yes)	650 (90.8)	—
Look up calorie information (% yes)	509 (71.1)	—

Note. EDE-Q = Eating Disorder Examination Questionnaire (Fairburn & Beglin, 1994).

2 | METHODS

2.1 | Participants

Participants were 716 females ≥18 years old who participated in an online screening for a separate study advertised as investigating interventions for restrictive eating (Haynos, Hill, & Fruzzetti, 2016). All participants who completed the survey and selected at least one menu item were included in this analysis. Endorsement of restrictive eating was not a requirement for completing the screening survey. Participants were primarily young females within a normal BMI range (see Table 1). The self-identified racial/ethnic breakdown was as follows: 62.2% of participants identified as White, 16.3% Hispanic, 10.1% Asian/Pacific Islander, 5.7% more than one race/ethnicity, 2.8% Black, and 1.1% Native American (1.8% did not provide a race/ethnicity).

2.2 | Procedures

The university Institutional Review Board approved study procedures and all participants completed informed consent. Participants were primarily recruited through an online recruitment system used by

undergraduate psychology students at a mid-size university in the Western U.S. Participation in the online survey represented one of several options whereby undergraduate participants could obtain extra credit in psychology courses. Recruitment flyers were also distributed throughout campus and the community, with a focus on targeting locations where eating disorders are routinely treated. In addition, advertisements were run in local newspapers and Craigslist. Participation in the original study (Haynos et al., 2016) (i.e., investigating interventions for restrictive eating) occurred after the online procedures described in this manuscript had been completed.

At the beginning of this survey, participants were presented with a restaurant menu, and were randomized through the survey website to view the menu with or without calorie labels. The items on the menu were selected from two popular American-style full-service chain restaurants that had calorie information available online. The menu contained 71 items, including appetizers, salads, sandwiches, main entrees, desserts, side dishes, and drinks. Participants were provided the opportunity to request substitutions to the meal to more closely resemble the typical dining experience. All participants received the following instructions: *"Please imagine that you are going to go to an American-style sit-down family restaurant for dinner with a friend and that you will each be paying for whatever you order for yourself. Considering your budget and the amount you want to eat, please make your meal choice by clicking on the items that you would order on the menu below. You will not be sharing food items with anyone, so please select what you would order for yourself."* After making a hypothetical meal selection, participants were asked: "How many calories do you think you ordered for this meal?" Participants then answered questions about their experience of ordering from the menu and opinions towards menu labeling. These procedures were adapted from another study examining the effects of menu labeling on restaurant ordering, which can be referenced for further details regarding this paradigm (Liu, Roberto, Liu, & Brownell, 2012). Hypothetical menu selection has been used in several previous studies to investigate the effects of menu labeling on restaurant ordering behavior (Dowray, Swartz, Braxton, & Viera, 2013; Morley et al., 2013; Tandon, Wright, Zhou, Rogers, & Christakis, 2010). A final set of questions assessed disordered eating. The intention of this survey was concealed from participants to reduce the potential that the manipulation would alter participants' ordering behavior.

2.3 | Measures

2.3.1 | Disordered eating

The Eating Disorder Examination Questionnaire (EDE-Q) (Fairburn & Beglin, 1996) was used to assess *global eating disorder symptoms* and *eating disorder diagnosis*. The EDE-Q is a widely used self-report measure of eating behaviors and cognitions over the previous month. The measure provides four subscale scores (Restraint, Eating Concern, Shape Concern, and Weight Concern), and a Global score, which reflects the overall severity of eating pathology. It also assesses instances of objective binge eating and purging. In this study, the EDE-Q Global score was used as a measure of general eating disorder symptoms and demonstrated excellent reliability (Cronbach's $\alpha = .95$). Additionally, reliable and valid algorithms for generating DSM-5 eating disorder diagnoses using the EDE-Q have been established (Berg et al., 2012). We used these algorithms to identify participants with diagnoses of AN, BN, and BED. Given the small sample sizes for the AN ($n = 7$) and BN ($n = 23$) groups, we combined these participants into one category, resulting in three ED diagnostic groups (AN or BN, BED, or no eating disorder diagnosis).

2.3.2 | Restaurant ordering

The primary outcome was *calories ordered*, which was generated by summing the caloric content of all food and drink items selected from the menu. This calorie information was obtained from the restaurant's website.

We also assessed a series of secondary outcomes. First, the survey asked participants to estimate the number of calories in what they had ordered. An *accuracy of calorie estimate* variable was generated by subtracting the participant's calories ordered from the caloric estimate. Positive scores indicated overestimation and negative scores indicated underestimation of calories ordered. Participants also rated a number of items related to restaurant ordering on Likert-scales, including: (a) *Liking of menu items*: How much did you like the food and beverage options on the menu? (1 = Like Extremely to 9 = Dislike Extremely); (b) *Perceived healthiness*: How healthy or unhealthy do you think this restaurant was? (1 = Very Unhealthy to 7 = Very Healthy); (c) *Likelihood of going to the restaurant*: Having seen this menu, would you be likely to come to this restaurant? (1 = Definitely Will Not to 5 = Definitely Will); (d) *Importance of taste*: How important was taste to you in making this meal choice? (1 = Very Unimportant to 7 = Very Important); (e) *Importance of health/nutrition*: How important was health/nutrition to you in making this meal choice? (1 = Very Unimportant to 7 = Very Important); and (f) *Importance of emotion*: How important was your emotional reaction to you in making this meal choice? (1 = Very Unimportant to 7 = Very Important). Participants also answered whether they looked up calorie information from restaurants on their own (Yes/No) and whether they supported menu labeling (Yes/No).

2.3.3 | Covariates

Participants self-reported age, race/ethnicity, height, weight, and hunger level. Race/ethnicity was collapsed into a categorical variable (0 = White; 1 = non-White) because certain racial/ethnic groups were too small to derive an accurate estimate of their independent effect. Self-reported height and weight were used to calculate BMI. Participants reported hunger levels on a Likert scale (0 = not at all hungry to 100 = extremely hungry) after making ordering decisions. We made a priori decisions to control for these covariates because they have been found to affect food choices and/or consumption among individuals with disordered eating (Larson, Story, Eisenberg, & Neumark-Sztainer, 2007, 2016; Tanofsky-Kraff et al., 2009). Inclusion of covariates did not alter the primary study findings.

2.3.4 | Data analytic plan

Data screening was conducted to identify outliers. To preserve the maximum amount of data, but limit the undue influence of extreme

outliers on data analyses, extreme outliers (i.e., >2.5 standard deviations from the group mean) were retained in the analyses, but re-coded to fall within 2.5 standard deviations of the mean (Behrens, 1997). A similar method has been previously employed in studies investigating food consumption and disordered eating (Tanofsky-Kraff et al., 2009; Wolkoff et al., 2011). Extreme outliers were detected for the variables of calories ordered ($n = 10$, 1.4% of the data) and accuracy of calorie estimate ($n = 7$, 1.0% of the data) and adjusted according to this procedure.

Generalized linear modeling (GLM) was used to examine the main effect of menu label condition (calorie labels versus no calorie labels), the main effect of eating disorder symptoms or diagnosis, and the interaction of these variables on the primary outcome of calories ordered, as well as secondary outcomes of: (a) accuracy of calorie estimate; (b) indices related to restaurant decision-making and the ordering experience (liking of menu items, perceived healthiness, likelihood of going to the restaurant, importance of taste, importance of health/nutrition, importance of emotion). Age, race, BMI, and hunger were included as covariates. For variables that were continuous, but significantly skewed (i.e., calories ordered and accuracy of calorie estimate), a gamma distribution with a log link model, which statistically corrects for skew, was specified and for items ranked on a Likert scale, ordinal logistic models were specified. Two series of models were run for two different sets of eating disorder symptom predictors: (a) global eating disorder symptoms (EDE-Q Global score) and (b) specific eating disorder diagnoses (AN or BN, BED, no eating disorder diagnosis). Pairwise comparisons were conducted to examine significant differences between the eating disorder diagnostic groups. In the main analyses, we corrected for multiple comparisons using the Benjamini-Hochberg procedure with a 5% false discovery rate (Benjamini & Hochberg, 1995).

3 | RESULTS

The average EDE-Q Global score was higher than community norms (Fairburn & Beglin, 1994), but ranged considerably (see Table 1). This was expected because individuals engaging in restrictive eating were oversampled for the original study (Haynos, Hill, & Fruzzetti, 2016). Eating disorder prevalence rates matched community estimates (Lindvall, Dahlgren, & Wisting, 2016). The majority of participants reported supporting menu labeling and looking up calorie information on their own.

3.1 | Impact of menu labeling and global eating disorder symptoms on restaurant ordering

In this model, there was no main effect of menu label condition on calories ordered, but there was a significant main effect of menu label condition on accuracy of calorie estimate (see Table 2). Participants receiving menu labels underestimated calories ordered to a lesser extent ($M = -345.52$, $SD = 728.74$) than those who did not receive menu labels ($M = -639.06$, $SD = 796.80$, $d = .39$). There was also a significant main effect of global eating disorder symptoms on a number of outcomes. Independent of condition, elevated eating disorder symptoms were associated with fewer calories ordered, less liking of menu items, lower perceived healthiness of the restaurant, less likelihood of going to the restaurant, and lower ratings of the importance of taste, but higher ratings of the importance of health and emotion when making ordering decisions. Finally, there were no significant interactions between menu condition and global eating disorder symptoms on any outcome.

3.2 | Impact of menu labeling and eating disorder diagnosis on restaurant ordering

In this model, there was a significant main effect of menu label condition on calories ordered (see Table 3). Participants exposed to calorie labels ordered fewer calories ($M = 1{,}065.84$, $SD = 966.88$) than those not exposed to calorie labels ($M = 1{,}359.61$, $SD = 967.91$, $d = .30$). In addition, across conditions, participants with a diagnosis of AN or BN ordered significantly fewer calories ($M = 942.84$, $SD = 1402.16$) compared with those with BED ($M = 1{,}318.18$, $SD = 957.29$, $p = .015$, $d = .30$) or no eating disorder diagnosis ($M = 1{,}403.02$, $SD = 945.17$, $p < .001$, $d = .48$). Additionally, health/nutrition influenced food choices more for females with AN or BN ($M = 5.28$, $SD = 1.64$) compared with those without an eating disorder diagnosis ($M = 4.64$, $SD = 1.59$, $p = .033$, $d = .40$) and emotion influenced food choices more for females with AN or BN ($M = 4.80$, $SD = 1.56$, $p = .045$, $d = .51$) or BED ($M = 4.72$, $SD = 1.61$, $p = .009$, $d = .46$) compared with those without an eating disorder diagnosis ($M = 4.00$, $SD = 1.57$).

Finally, there was a significant interaction between menu label condition and eating disorder diagnosis for calories ordered. Participants with a diagnosis of AN or BN ordered significantly fewer calories in the menu label ($M = 550.41$, $SD = 263.42$) versus no label condition ($M = 1615.01$, $SD = 1669.24$, $p < .001$, $d = .89$), whereas individuals with a BED diagnosis ordered more calories in the menu label condition ($M = 1664.12$, $SD = 1150.03$) compared with the no label condition ($M = 1044.16$, $SD = 726.71$, $p = .006$, $d = .69$). In contrast, calories ordered did not differ significantly for individuals without an eating disorder diagnosis between the menu label ($M = 1{,}321.87$, $SD = 952.81$) and no label ($M = 1{,}490.41$, $SD = 932.54$, $p = .251$, $d = .18$) conditions.

4 | DISCUSSION

This study is one of the first to examine the impact of menu labeling on females with disordered eating symptoms. When eating disorder symptoms were measured continuously, we did not find evidence that calorie labels differentially affected hypothetical restaurant ordering decisions according to level of eating pathology. However, when specific eating disorder diagnoses were examined, participants with AN or BN ordered significant fewer calories and participants with BED significantly more calories for a hypothetical meal when presented with menu labels. There was no evidence that caloric information differentially impacted the ability of females with eating disorder symptoms and/or diagnoses to accurately estimate the calories they had ordered or affected other meal selection variables (e.g., how much participants

TABLE 2 Generalized linear models examining effects of menu label condition, eating disorder symptoms, and menu label condition by eating disorder symptom interactions on restaurant ordering variables

Dependent variable	Independent variables	χ^2	*B*	*SE*	95% CI	*p*
Calories ordered	Full model	71.39	—	—	—	<.001*
	Menu label condition[a]	0.4	−0.06	0.09	−0.13 to 0.24	0.53
	EDE-Q Global	39.94	−0.12	0.03	−0.17 to −0.07	<.001*
	Menu label condition × EDE-Q Global	0.57	0.03	0.02	−0.04 to 0.09	0.452
Accuracy of calorie estimate	Full model	28.56	—	—	—	<.001*
	Menu label condition[a]	6.73	0.11	0.04	−0.20 to −0.03	.009*
	EDE-Q Global	4.56	0.01	0.01	−0.01 to 0.03	0.033
	Menu label condition × EDE-Q Global	0.99	0.02	0.02	−0.02 to 0.05	0.319
Liking of menu items	Full model	17.66	—	—	—	.014*
	Menu label condition[a]	1.33	0.31	0.27	−0.83 to 0.22	0.249
	EDE-Q Global	9.24	−0.19	0.07	−0.33 to −0.04	.002*
	Menu label condition × EDE-Q Global	0.25	0.05	0.1	−0.15 to 0.25	0.615
Perceived healthiness	Full model	16.55	—	—	—	0.021
	Menu label condition[a]	0.59	0.2	0.26	−0.72 to 0.31	0.443
	EDE-Q Global	11.34	−0.21	0.07	−0.35 to −0.07	.001*
	Menu label condition × EDE-Q Global	0.51	0.07	0.1	−0.12 to 0.27	0.477
Likelihood of going to restaurant	Full model	29.44	—	—	—	<.001*
	Menu label condition[a]	0.69	0.24	0.29	−0.81 to 0.33	0.407
	EDE-Q Global	15.4	−0.27	0.08	−0.42 to −0.12	<.001*
	Menu label condition* EDE-Q Global	0.7	0.09	0.11	−0.12 to 0.30	0.403
Importance of taste	Full model	34.24	—	—	—	<.001*
	Menu label condition[a]	0	0	0.27	−0.53 to 0.54	0.995
	EDE-Q Global	18.88	−0.23	0.08	−0.38 to −0.09	<.001*
	Menu label condition × EDE-Q Global	0.01	0.01	0.1	−0.19 to 0.20	0.945
Importance of health/nutrition	Full model	101.34	—	—	—	<.001*
	Menu label condition[a]	0.05	−0.06	0.26	−0.46 to 0.57	0.828
	EDE-Q Global	84.37	0.55	0.07	0.40 to 0.69	<.001*
	Menu label condition × EDE-Q Global	0.89	−0.09	0.1	−0.29 to 0.10	0.345
Importance of emotion	Full model	99.69	—	—	—	<.001*
	Menu label condition[a]	0.17	0.11	0.26	−0.63 to 0.41	0.676
	EDE-Q Global	85.77	0.48	0.07	0.34 to 0.63	<.001*
	Menu label condition × EDE-Q Global	0.23	0.05	0.1	−0.15 to 0.24	0.63

Note. EDE-Q = Eating Disorder Examination Questionnaire (Fairburn & Beglin, 1994); SE = standard error; CI = confidence interval; all analyses controlling for self-reported age (years), BMI (kg/m^2), race/ethnicity (white versus non-white), and hunger (0–100).

[a]Menu label condition reference group = no menu labels.

*Statistically significant after Benjamini-Hochberg corrections.

liked menu items, perceived them as healthy, placed importance on taste, health/nutrition, or emotion when ordering, or would be willing to eat at the restaurant).

In the models examining eating disorder symptoms continuously, our findings were consistent with a correlational study that found no association between the introduction of calorie labels in a university cafeteria and disordered eating among students (Lillico et al., 2015). This suggests that calorie labels may not immediately negatively affect females with lower severity disordered eating. However, we did find evidence that menu labels may negatively impact individuals who meet

TABLE 3 Generalized linear models examining effects of menu label condition, restrictive eating, binge eating, and menu label condition by disordered eating interactions on restaurant ordering variables

Dependent variable	Independent variables	χ^2	*B*	SE	95% CI	*p*
Calories ordered	Full model	67.96	—	—	—	<.001*
	Menu label condition[a]	6.34	−0.12	0.05	−0.22 to −0.02	.012*
	ED diagnosis	11.25	−0.36	0.11	−0.57 to −0.15	.004*
	Menu label condition × ED diagnosis	29.68	0.59	0.17	0.26 to 0.92	<.001*
Accuracy of calorie estimate	Full model	27.26	—	—	—	.001*
	Menu label condition[a]	1.78	0.08	0.02	0.04 to 0.13	0.183
	ED diagnosis	0.93	0.08	0.05	−0.02 to 0.17	0.627
	Menu label condition × ED diagnosis	3.11	−0.13	0.08	−0.28 to 0.03	0.211
Liking of menu items	Full model	20.45	—	—	—	.015*
	Menu label condition[a]	2.78	0.12	0.14	−0.16 to 0.40	0.096
	ED diagnosis	6.83	−0.33	0.29	−0.90 to 0.25	0.033
	Menu label condition × ED diagnosis	6.98	1.24	0.48	0.30 to 2.18	0.03
Perceived healthiness	Full model	10.06	—	—	—	0.346
	Menu label condition[a]	0.84	0.04	0.14	−0.24 to 0.32	0.36
	ED diagnosis	3.91	−0.16	0.3	−0.75 to 0.44	0.142
	Menu label condition × ED diagnosis	1.03	−0.05	0.49	−1.01 to 0.92	0.598
Likelihood of going to restaurant	Full model	18.3	—	—	—	0.032
	Menu label condition[a]	1.18	0.01	0.16	−0.30 to 0.31	0.278
	ED diagnosis	3.96	−0.17	0.33	−0.81 to 0.47	0.138
	Menu label condition × ED diagnosis	1.07	0.42	0.51	0.59 to −1.42	0.586
Importance of taste	Full model	21.5	—	—	—	.011*
	Menu label condition[a]	0.2	0.03	0.15	−0.26 to 0.31	0.652
	ED diagnosis	5.96	−0.08	0.3	−0.67 to 0.52	0.051
	Menu label condition × ED diagnosis	0.64	0.07	0.49	−0.88 to 1.03	0.728
Importance of health/nutrition	Full model	24.27	—	—	—	.004*
	Menu label condition[a]	0.11	0.14	0.14	−0.14 to 0.42	0.744
	ED diagnosis	9.09	0.67	0.31	0.07 to 1.28	.011*
	Menu label condition × ED diagnosis	0.77	−0.4	0.51	−1.39 to 0.59	0.681
Importance of emotion	Full model	42.88	—	—	—	<.001*
	Menu label condition[a]	4.99	0.02	0.14	−0.26 to 0.30	0.026
	ED diagnosis	23.47	1.00	0.3	0.40 to 1.59	<.001*
	Menu label condition × ED diagnosis	7.37	0.07	0.48	−1.01 to 0.87	0.025

Note. SE = standard error; CI = confidence interval; all analyses controlling for self-reported age (years), BMI (kg/m^2), race/ethnicity (white versus non-white), and hunger (0–100).

[a]Menu label condition reference group = no menu labels.

*Statistically significant after Benjamini-Hochberg corrections.

diagnostic criteria for an eating disorder. Exposure to calorie information on menus led participants with AN or BN to greatly reduce the number of calories they ordered. In contrast, menu labels led participants with BED to order more calories than they otherwise would. It is unclear why menu labels had this paradoxical effect for females with BED. It is possible that exposure to this information led to heightened negative affect, increased attention to hedonic qualities of food, or an anticipated abstinence violation effect in the context of multiple high-calorie food options, all of which have been proposed as pathways to binge eating (Grilo & Shiffman, 1994; Lowe et al., 2016). More data are

needed to understand the mechanisms through which menu labels might encourage females with BED to order high-calorie meals.

There are several important implications of the findings. First, the results highlight a critical need to evaluate the impact of obesity prevention policies on individuals with eating disorders. Second, these results suggest that clinicians should assist eating disorder clients in devising and implementing plans for reducing the potential negative impact of calorie information on restaurant ordering. Finally, the findings raise important questions about of degree to which menu labels should be promoted or discouraged. On the one hand, menu labels are supported by most individuals (Gollust et al., 2014), including those with eating disorders (Roberto, Haynos, Schwartz, Brownell, & White, 2013), may encourage food choices that reduce obesity risk (Sinclair, Cooper, & Mansfield, 2014; VanEpps et al., 2016), and do not appear to negatively affect most females with disordered eating symptoms. On the other hand, menu labeling has not been associated with lower calorie choices at a number of restaurants (Sinclair et al., 2014; VanEpps et al., 2016) and the results of this study suggest that it may exacerbate eating disorder tendencies to order fewer or more calories. Further research is needed to inform the consideration of the relative risks and benefits of menu labels. Future studies should seek to understand why calorie labels promote different choices among different individuals and whether exposure to menu labels has negative psychological effects among individuals with an eating disorder diagnosis.

Unsurprisingly, participants with elevated eating disorder symptoms made lower calorie food selections regardless of menu label condition. They also considered taste less, liked food selections less, perceived selections as less healthy when making food selections, and reported being less inclined to go to the featured restaurant. Additionally, both participants with elevated eating disorder symptoms and those with an AN or BN diagnosis factored in health/nutrition and emotion more when making restaurant food selections than participants without an eating disorder. In line with prior research (Timmerman, 2006), we also found that restaurant dining may be a more emotional experience for females with BED than those without an eating disorder. These findings highlight specific challenges people with eating disorders face when dining out, and identify targets for promoting more flexible restaurant dining habits among these groups.

Finally, in line with the broader menu labeling literature (Sinclair et al., 2014; VanEpps et al., 2016), the findings did not clearly identify an impact of menu labeling on calories ordered across the sample. Although there was a small main effect of menu label condition on calories ordered in the model including eating disorder diagnosis, this effect was accounted for by the significant interaction between eating disorder diagnosis and condition and, therefore, not meaningful on its own. Further, although prior research suggests that menu labeling can promote more accurate calorie estimation (Liu, Roberto, Liu, & Brownell, 2012), we found inconsistent results on this point, with one model supporting and the other not supporting this conclusion. This inconsistency may be an artifact of including different variables to account for disordered eating in each model, especially since the discrepancy between the models was small in magnitude. These findings considered in context with the mixed literature on the impact of menu labels (Sinclair et al., 2014; VanEpps et al., 2016) suggest that the effects of menu labels may vary according to sample and contextual variables. More research is needed to identify the factors that determine whether menu labels influence calorie ordering and accuracy.

This study has several strengths. It examined an important, but under-researched topic with public policy implications. Further, it used a randomized experimental design and recruited a relatively large and ethnically diverse sample. Finally, disordered eating was examined dimensionally, as well as separated out by diagnosis, allowing for greater specification of the impact of menu labeling on different disordered eating subgroups and severities.

This study also has limitations. First, we examined hypothetical restaurant purchases; therefore, it is unknown whether the participants' responses would correspond with actual meal purchases or food consumption. Food selection is usually (Roberto, Larsen, Agnew, Baik, & Brownell, 2010), but not always (Hammond, Goodman, Hanning, & Daniel, 2013), highly correlated with food intake. Individuals with eating disorders often do not provide accurate estimates of food intake (Bartholome et al., 2013; Sysko et al., 2005) and may be motivated to misrepresent how much they would order (e.g., due to embarrassment, desire to appear in control). Therefore, actual ordering or eating may have differed from hypothetical ordering among these groups. Further, the study instructions encouraged participants to consider what they would eat in a social setting, which could vary considerably from solitary eating behavior. This especially warrants consideration among individuals who binge eat, because this behavior tends to be secretive and to occur when alone (Stein et al., 2007). In addition, this study only tested the influence of one menu labeling format, but different presentation styles may impact ordering behavior (Liu et al., 2012). Another limitation is that the sample consisted of nonclinical females who were primarily undergraduates; therefore, the findings may not extend to treatment-seeking individuals, males, or different demographic groups (e.g., adolescents, non-college educated individuals). We also oversampled individuals with restrictive eating, which may have further limited sample generalizability. Additionally, although the EDE-Q has been used to validly establish eating disorder diagnoses (Berg et al., 2012), this measure was not originally designed to assess diagnoses. A standardized diagnostic interview may have provided a more accurate assessment of eating disorder diagnosis. The sample sizes were also small for the eating disorder diagnostic groups in this sample, potentially limiting the ability to detect additional effects in these groups. Further, due to the limited sample sizes, the AN and BN groups were combined. It is possible that meaningful differences might be detected between these groups with a larger sample. Future studies investigating the impact of menu labeling on individuals with disordered eating should examine ordering and eating behavior in larger, more diverse, and clinically severe groups using varied menu formats and multiple eating contexts.

Researchers have called for deliberate coordination of obesity and eating disorder prevention (Haines & Neumark-Sztainer, 2006; Neumark-Sztainer, 2005), but few studies have examined the impact of

obesity-related public policies on those with disordered eating. This study was a preliminary effort to examine how menu labels might affect individuals with disordered eating. The findings suggest that menu labeling may exacerbate disordered eating tendencies among individuals with eating disorders. However, further investigation, examining actual eating behavior in clinical populations, is sorely needed.

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