2022

Screening for energy restriction in middle and late life

Kate Happel Krautbauer

Screening for Energy Restriction in Middle and Late Life

by

Kate Happel Krautbauer, MS

Dissertation

Submitted to the Department of Psychology

Eastern Michigan University

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Clinical Psychology

Dissertation Committee:

Claudia Drossel, PhD, PhD, Chair

Heather Hutchins-Wiese, PhD, RD

Tamara Loverich, PhD

Thomas Waltz, PhD, PhD

June 24, 2022

Ypsilanti, Michigan

Abstract

The most commonly used screening tools for disordered eating, the Eating Attitudes Test (EAT-26) and Eating Disorders Examination–Questionnaire (EDE-Q), rely on the detection of shape and weight concerns to identify potentially dangerous caloric restriction among adolescent girls and young adult women. It is unclear how accurate these measures are at detecting restriction among adults 40 years and older. These adults may be vulnerable to developing or maintaining restrictive eating patterns when healthcare providers recommend weight loss as a preventative health measure or when acute or chronic illnesses (e.g., diabetes or cancers) impact eating. The present online study (a) evaluated the accuracy of and suggested optimal cut-scores for the EAT-26 and EDE-Q in this age group and (b) examined the accuracy of a measure of restricted energy intake for health-related reasons, i.e., the Orthorexia Nervosa Inventory (ONI). Of 145 participants, 60 completed demographic and health history surveys, EAT-26, EDE-Q, and ONI, and dietary recalls to examine energy intake. Receiver operating characteristics analyses used dietary recall data as an index criterion to determine the three measures' accuracy at detecting participants who restricted their energy intake below estimated individual requirements. Results indicated that, contrary to initial hypotheses, the number of medical conditions did not affect energy restriction. Instead, participants who restricted their energy intake below requirements (n = 18) had higher BMIs and were more likely to have a medically prescribed diet than non-restrictors (n = 42). The EAT-26 and EDE-Q performed at the level of chance for detecting individuals whose dietary recalls indicated energy restriction, and the ONI performed in the acceptable range, using the cutoff score of ≥ 30 identified in the present study. Consequently, measures emphasizing altered eating patterns because of health concerns such as the ONI should be considered in clinical practice with middle and late life adults.

Table of Contents

List of Tables

List of Figures

Screening for Energy Restriction in Middle and Late Life

Once thought of as impacting only adolescent girls and young women, recent literature has emphasized that potentially problematic patterns of energy restriction occur across the lifespan (Elran-Barak et al., 2015; Mangweth-Matzek et al., 2016; Strategic Training Initiative for the Prevention of Eating Disorders & Academy for Eating Disorders, 2020; Thomas, 2007). Adults in middle and late life may be at increased risk for engaging in energy restriction, as there is an increased incidence of chronic illnesses that can impact eating patterns (e.g., diabetes or cancers; Krautbauer & Drossel, 2018; Kurnia et al., 2019; Quick et al., 2013). Preventative measures (e.g., prescribing restrictive diets) and/or treatment for these illnesses (e.g., dietary changes, medications, chemotherapy) may also contribute to disrupted eating patterns (Gallagher & Naidoo, 2009; Gibbs et al., 2016; Himmerich & Treasure, 2018; Marvanova & Gramith, 2018; Porreca & Ossipov, 2009; Skånland & Cieślar-Pobuda, 2019). Despite the increased risk for disrupted eating, it is unclear how current screening methods perform when used with adults in middle and later life (i.e., ≥ 40 years old).

Current Literature on Eating Screeners

There are currently over 100 measures available for assessing disordered eating patterns, including restriction (Piotrowski, 2018). The Eating Attitudes Test-26 (EAT-26; Garner et al., 1982) and the Eating Disorders Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994) are among the most commonly used tools in both research and practice settings (Dahlgren & Wisting, 2016; Piotrowski, 2018; Towne et al., 2017). Accordingly, a survey of practitioners' clinical screening practices found that 46% of clinicians used the EDE-Q and 22% the EAT-26 in early assessment (Towne et al., 2017). The EAT-26 and the EDE-Q are thus frequently used, yet little is known about their applicability to midlife and beyond (Elran-Barak et al., 2015;

Jenkins & Price, 2018; Mangweth-Matzek et al., 2016), especially considering traditional cutoff scores. The measures were developed and suggested cutoff scores of ≥ 20 on the EAT-26 (Garner et al., 1982) and ≥ 2.3 on the EDE-Q global scale (Fairburn, 2008) were derived from studies with adolescent girls and young adult women (see Table 1, next page, for a summary of relevant sample characteristics), whose shape and weight concerns are predictive of disordered eating patterns in this age group. Research on the utility of these measures to detect disordered eating among adults over 40 years of age is limited.

Eating Attitudes Test-26

The EAT-26 was the first questionnaire developed to evaluate the cognitive, emotional, and behavioral patterns that characterize restriction in the context of the proposed criteria for anorexia nervosa (Garner et al., 1982). It has since been evaluated as a measure of disordered eating patterns more broadly (Mintz & O'Halloran, 2000; Orbitello et al., 2006). The measure's cutoff scores have been discrepant from earlier suggestions when sampling adults at least 40 years as well as men, rather than younger women or adolescents (Hayakawa et al., 2019; Johnson & Bedford, 2004; Lee et al., 2002; Midlarsky & Nitzburg, 2008). For example, Orbitello et al. (2006) examined the measure with a sample of inpatients with eating disorders most of whom were over the age of 45 years, and derived a cutoff score of 11, substantially lower than the cutoff score of ≥ 20 recommended by Garner et al. (1982) for college-age women. This suggests there may be major differences in the measure's degree of accuracy and optimal cutoff score for detecting disordered eating patterns among different age groups.

Table 1

Overview of Sample Characteristics for Studies Representative of Research on the EAT-26 and EDE-Q

	Online vs in-person	Sample Characteristics				
		Location; setting	Age (years)*	Gender	Race/Nationality	Education
EAT-26						
Garner et al. (1982)	In-person	Canada; in-patient and college students	AN patients = 21 Students = 20	Women	Not reported	Not reported (control group were current college students)
Koslowsky et al. (1992)	In-person	Israel; soldiers	18-19	Women	Not reported	Not reported
Mintz & O'Halloran (2000)	In-person	United States; college students	19	Women	88% White	Current college students
Lee et al. (2002)	In-person	China; clinical and college students	ED patients = 14-29 Students = 18-19	Women	100% Chinese (Hong Kong)	Not reported
Johnson & Bedford (2004)	Not reported	Canada; community	18-94	Men (40%) and women (60%)	Not reported	Not reported
Midlarsky & Nitzburg (2008)	Online	United States; community	45-60	Women	91.8% White	79.6% completed undergraduate or higher education
Hayakawa et al. (2019)	In-person	Japan; college students	17-27	Men and women	Not reported	Current college students
EDE-Q						
Fairburn & Beglin (1994)	In-person	United Kingdom; in-patient and community	AN patients = 16 Community = 27	Women	Not reported	Not reported
Mond et al. (2004)	In-person	Australia; community	18-45	Women	81.7% born in Australia	34% undergraduate or higher education

Table 1 continued

	Online vs in-person	Sample characteristics				
		Location; setting	Age (years)*	Gender	Race/Nationality	Education
Orbitello et al. (2006)	In-person	Italy; clinical nutrition/eating disorders unit	15-65	Men (16.8%) and women (83.1%)	Not reported	Not reported
Aardoom et al. (2012)	In-person	Netherlands; clinical and community	ED patients = 29 Community = 32	Women	92.9% White	57.4% "high" education
Hilbert et al. (2012)	In-person	Germany; community	14-95	Men and women	Women = 97% German Men = 96% German	85.9% < 12 years (women) 81.1% < 12 years (men)
Brewin et al. (2014)	In-person (retrospective)	United Kingdom; clinical	28	Not reported	92.6% White	Not reported
Smith et al. (2017)	In-person	United States; inpatient	Men = 24 Women = 27	Men and women	Not reported	Average = 14 years

Note. AN = anorexia nervosa, ED = eating disorder
*Age range reported when available, otherwise age represents study the mean.

Eating Disorders Examination–Questionnaire (EDE-Q)

The EDE-Q was originally developed from the Eating Disorder Examination interview to increase its utility in clinical settings (Fairburn & Beglin, 1994). The questionnaire was validated using a patient sample of adolescent girls with an average age of 15 years and an age-matched community comparison group (Fairburn & Beglin, 1994). Given its relative brevity and ease of use, the EDE-Q has become among the most frequently used outcome measures in studies of disordered eating patterns in behavioral health settings (Linardon et al., 2017). Despite its widespread use, studies of the EDE-Q have relied primarily on samples of young adult women (i.e., under 40 years old; see Table 1). For example, recently established EDE-Q clinical norms for men are based on participants whose average age was 24 years, while the comparison group of women was only slightly older with an average age of 26 years (Smith et al., 2017). This study also aimed to establish normative data based on a sample of residential or partial hospitalization patients. For this reason, it did not include cutoff scores for screening for disordered eating patterns using the EDE-Q among men in a public health setting.

Eating Behavior, Health Conditions, and Medications

The prevalence of chronic health conditions and associated treatments increases substantially throughout middle and later life (Centers for Disease Control and Prevention, 2009) and can have long-lasting impacts on eating behavior. Specialized diets are tools in the management of common chronic health conditions, including diabetes, irritable bowel syndrome, and polycystic ovarian syndrome (Farshchi et al., 2007; Goodwin et al., 2003; Haque et al., 2011; Krystock, 2014; Midlarsky & Nitzburg, 2008; Wilkins et al., 2012). The changes in eating patterns designed to prevent or manage these chronic health conditions can contribute to the development or maintenance of disordered eating patterns (Quick et al., 2013; Smith et al., 2008).

Cancer provides an example, as the disease impacts over 39% of the population during their lifetime and new diagnoses are highest among those over 40 years of age (National Cancer Institute, 2018). Eating-related difficulties can stem from the disease itself or from its treatments via chemo or radiation. The disease itself can lead to motoric disruptions (e.g., head and neck cancers [Krautbauer & Drossel, 2018a]) or digestive disturbances accompanying gastrointestinal cancers (Kurnia et al., 2019). Cancer-related anorexia and cachexia are additional common phenomena related to disease processes, characterized by reduced appetite (Krautbauer & Drossel, 2018a; Laviano et al., 2003). On the other hand, food and taste aversions and gastrointestinal disturbances (e.g., nausea and vomiting) are common side effects of chemotherapy and radiation that can significantly change food preferences and eating patterns (Kim et al., 2020; Krautbauer & Drossel, 2018a; Mattes et al., 1987).

Furthermore, substantial changes in eating patterns may be recommended as prevention or management strategies related to cancer, such as colectomies following colorectal cancer (Kurnia et al., 2019) and other health conditions, as noted above. Inadvertently, the dietary changes recommended by health professionals to prevent or manage cancers and other chronic health conditions may result in rigid rule-following related to health maintenance (e.g., “my physician says I must eat less to be healthier;” see Ross Arguedas [2020] for a discussion of the social construction of rules regarding health and individual health behavior, particularly dietary choices).

In addition to eating complications that directly accompany various diseases and their management, many medication classes---including psychiatric medication---have affect eating-related functions (e.g., chemosensory function, appetite regulation, chewing, swallowing, digestion, excretion). Among psychiatric medications, serotonergic and dopaminergic agents, as well as stimulant medications, have been evaluated for their metabolic impact and their utility in treating disordered eating patterns, as changes in appetite and weight occur when these drugs are prescribed to alter behavior, mood, or sleep (Gibbs et al., 2016; Himmerich & Treasure, 2018; Marvanova & Gramith, 2018; Skånland & Cieślar-Pobuda, 2019). On the other hand, these medications can cause significant disruptions in processes critical to eating, including changes in appetite, swallowing problems, nausea, chemosensory changes, and decreased gastrointestinal lubrication and motility (Carl & Johnson, 2008; Gallagher & Naidoo, 2009).

Medications aimed at controlling a variety of health concerns can lead to significant disruption in eating and related processes. For example, muscle relaxants can lead to dry mouth and gastrointestinal disturbances, medications for osteoporosis can result in glossitis and swallowing difficulties (Gallagher & Naidoo, 2009), and opioids can cause loss of appetite, constipation, nausea, and vomiting (Berde & Nurko, 2008; McNicol et al., 2003; Porreca & Ossipov, 2009). Notably, recent research has suggested that the use of antibiotics and antivirals can precede admission to specialty treatment for disordered eating (Raevuori et al., 2016). The use of medications to manage acute and chronic conditions increases with age (Martin & Ogden, 2019), and problems in eating may show a commensurate increase.

Additionally, energy restriction among adults in middle or late life may result from disease-preventive advice given to those perceived to be at increased risk associated with falling into the overweight (BMI = 25-30) or obese (BMI > 30) categories. Cohort studies have indicated that increases in weight and higher BMI are common during midlife (Yang et al., 2021), which may contribute to provider urgency to advise patients to restrict their intake and lose weight. For example, physician recommendations to engage in energy restriction to promote weight loss as a form of health promotion and/or disease management or prevention are more common in this age group, compared to adults under 40 years old, and may unintentionally contribute to the development of problematic eating patterns (Flint, 2021; Greaney et al., 2020). Few patients advised to lose weight do so with targeted services by a healthcare professional (de Heer et al., 2019). If patient weight or BMI category overshadows primary care providers' attention to other conditions, weight loss advice may result in lack of access to healthcare such as cardiovascular or pulmonary specialty care---both as a result of advice to lose weight rather than recommending other treatment options and/or resulting from patients avoiding preventative care visits due to experiences with provider weight bias---and subsequent increased risk of morbidity and mortality (Jackson et al., 2015; Mensinger et al., 2018).

Changes in eating behavior, particularly energy restriction without follow-up monitoring from a healthcare professional, among midlife and older adults can be associated with significant decrements in functional status, poor disease prognosis, and substantially increased mortality (Cederholm et al., 2019; Elsner, 2002; Pirlich & Lochs, 2001; Volkert et al., 2019; White et al., 2012). Most healthy older adults do not show marked declines in nutrition-related health status (Pirlich & Lochs, 2001); however, eating and nutrition throughout midlife and older adulthood require careful monitoring when medical conditions are present. Early detection of energy restriction in this population is critical to preventing the development of malnutrition and subsequent functional decline.

Pilot Study

Considering the factors described above that may influence changes in eating patterns among adults in midlife and beyond, ensuring the accuracy of screening measures for detecting problematic energy restriction among this age group is critical. This author collected pilot data examining the EDE-Q and EAT-26 in a community sample of participants (N = 166) ranging from 40 to 88 years old (Krautbauer & Drossel, 2018b). Using the recommended cutoff scores (≥ 2.3 for the EDE-Q and ≥ 20 for the EAT-26), the results suggested significant differences between screeners, as the EDE-Q identified 36 participants as at risk for an eating problem (i.e., score was ≥ 2.3) and the EAT-26 identified only nine such participants (i.e., score was ≥ 20; see also Table 2, Rows 1 and 3). For this reason, further analyses using standard signal detection methods to study psychometric properties of screeners were applied.

Signal detection theory is a tool for examining the degree to which screening measures accurately classify cases by binning cases into four categories: hits, misses, false alarms, and correct rejections (see Figure 1). For the purposes of this pilot study, the signal detection matrix was populated as follows:

- Hits were cases of participants who self-reported lifetime diagnoses of disordered eating and scored above a measure's cutoff score.
- Missed detections were cases of participants with self-reported lifetime diagnoses who scored below a measure's cutoff score.
- False alarms were cases of participants who did not report lifetime diagnoses and scored above a measure's cutoff score.
- Correct rejections were cases of participants who did not report lifetime diagnoses and scored below the measure's cutoff score.

Figure 1

Signal Detection Paradigm

	Diagnosis: Yes	Diagnosis: No
Above the Cutoff Score	Hit	False Alarm
Below the Cutoff Score	Miss	Correct Rejection

Note. Rows represent the predictor; columns represent the index measure.

Note that the index criterion (here, whether a diagnosis was self-reported) is a pivotal element of signal detection paradigms. The selection of index criteria will be further discussed below.

Table 2 can be read as containing two signal detection tables (see Figure 1 above), one for the EDE-Q, the other for the EAT-26. It shows that the false alarm rate of the EDE-Q was higher than that of the EAT-26 (29 versus 2 false alarms, respectively). Notably, 27 of the 36 participants who scored above the cutoff on the EDE-Q also endorsed at least one medical condition and seven of the nine participants scoring above the EAT-26's cutoff score endorsed at least on medical condition. Table 3 provides additional summary statistics.

Table 2

Pilot Study Classification Table of EAT-26 ≥ 20 and EDE-Q ≥ 2.3 Accuracy

	Truth criterion	
	Self-reported lifetime eating disorder diagnosis	No self-reported lifetime eating disorder diagnosis
1. EDE-Q ≥ 2.3	7 (hits)	29 (false alarms)
2. EDE-Q < 2.3	3 (misses)	127 (correct rejections)
3. EAT-26 ≥ 20	7 (hits)	2 (false alarms)
4. EAT-26 < 20	3 (misses)	154 (correct rejections)

Note. EDE-Q = Eating Disorders Examination – Questionnaire; EAT-26 = Eating Attitudes Test – 26 items.

Table 3

Summary Statistics for the EDE-Q and EAT-26 Pilot Data

Statistics	EDE-Q	EAT-26
Sensitivity	70.0%	70.0%
Specificity	81.4%	98.7%
Positive Predictive Value	19.4%	77.8%
Negative Predictive Value	97.7%	98.1%
Prevalence (observed)	6.0%	6.0%
Accuracy	80.7%	97.0%
Diagnostic Odds Ratio	10.2	179.7

Regarding interpreting the summary statistics presented in Table 3, values between 50% and 70% are considered low, those between 70% and 90% represent the moderate/acceptable range, and values over 90% are interpreted as within the high range (Fischer et al., 2003; Streiner & Cairney, 2007). Sensitivity is defined as a measure's ability to alert to those who have a diagnosis (Youngstrom, 2014). Both measures' sensitivity barely fell into the acceptable range. Specificity denotes a measure's ability to exclude false alarms, i.e., to detect cases without a diagnosis. In this case, the measures diverged, and the EAT-26 performed better. The discrepancy between the measures in positive predictive value (percentage of true cases scoring above the cutoff score) indicates that a greater percentage of participants with a self-reported history of an eating disorder diagnosis scored above the cutoff score on the EAT-26 than on the EDE-Q (i.e., the EDE-Q produced a higher percentage of false alarms than the EAT-26 when using self-reported eating disorder history as the index criterion). Similarly, the diagnostic odds ratio (i.e., sensitivity divided by false alarm rate) for the EAT-26 was greater than for the EDE-Q, again reflecting the high false alarm rate for the EDE-Q. Examination of the values in Table 3 in combination with the data presented in Table 2 reveals that the EDE-Q produced a high number of potential false alarms (i.e., no self-reported diagnosis but scored above the cutoff), and three possible cases of problematic eating behavior were not identified by either screening measure (i.e., missed detections). In summary, the two screening measures had sensitivity, reflecting the measures' accuracy among those who do have a diagnosis, marginally within the acceptable range. Specificity (the measures' accuracy among those who do not have a diagnosis), and accuracy (raw percentage correct in the total sample) were in the acceptable range when the index criterion ("true" state of the world) was a diagnosis based on a classification system emphasizing overvaluation of weight and shape as central to disordered eating, for which these screeners were originally constructed.

For the pilot study, the index criterion for evaluating the accuracy of the measures was a self-report of lifetime (i.e., the participant was diagnosed at some point during their lifetime) eating disorder diagnoses. As clinical diagnoses consider shape and weight concerns, there was an overlap between some of the domains assessed by the EAT-26 and EDE-Q and the index criterion. Signal detection statistics are vulnerable to inflation when there is overlap between the index criterion (diagnostic categorization emphasizing shape and weight concerns) and the measure under evaluation (eating disorders screeners emphasizing overvaluation of shape and weight). Due to the screeners' focus on shape and weight, it is unclear how accurate they are at detecting self-reported behavioral patterns associated with disrupted eating, rather than cognitive aspects. A multi-method approach using a measure of current behavior, such as 24-hour dietary recalls, would decrease the likelihood of inflated estimates of screener accuracy by removing the overlap between the measures' focus on shape and weight concerns and the index criterion, which would focus on behavioral patterns of restriction.

For this reason, the pilot data suggested a need for further examination of the accuracy of these instruments for detecting disordered eating behaviors in this age group, to inform their use in practice. It was hypothesized that the relatively high numbers of participants with medical conditions scoring high on the eating screening measures (i.e., 27 of 36 on the EDE-Q and seven of nine of the EAT-26) indicated disrupted eating patterns related to preventing or managing health problems as described above, rather than cognitive patterns of overvaluation of shape or weight concerns, suggesting chronic disease may be an important factor in eating behavior for adults 40+ years old. As noted, a multi-method approach that evaluated screener accuracy in relation to a behavioral index criterion assisted in detecting cases of restriction occurring for reasons other than weight or shape concern.

Study Aims

Given the limited research on the EAT-26 and EDE-Q among adults 40 years of age and older, and the increasing incidence of health conditions that may impact eating patterns, the present study aimed to (a) evaluate the accuracy of and suggest optimal cut-scores for the EAT-26 and EDE-Q with a community sample of men and women over 40 years old and given the relationship between physical health conditions and/or preventative health advice and eating behavior described above, (b) examine the accuracy of an alternative measure of restricted energy intake for health-related reasons---the Orthorexia Nervosa Inventory (Oberle et al., 2020).

Method

Eligibility and Recruitment

All study procedures were reviewed and approved by Eastern Michigan University's institutional review board the ensure compliance with standards for research with human subjects. The present online survey study employed a cross-sectional design. Eligibility criteria for this study were (a) access to the internet and email, (b) age of 40 years or older, and (c) able to read and respond to questions in English. Recruitment materials were distributed online via social media, research trial databases, survey research databases, email newsletters (e.g., senior centers and libraries), and professional listservs, as well as via word-of-mouth to obtain a community sample of participants. Recruitment occurred between December 2020 and September 2021.

Receiver Operating Characteristics (ROC)

As described above, signal detection theory allows for the categorization of the performance of screening measures into true positives ("hits"), correct rejections, false positives ("false alarms"), and false negatives ("misses"; Riffenburgh, 2012). Signal detection analysis generates a table, similar to Figure 2, classifying the performance of a screener at each possible score, with correct detections, false alarms, correct rejections, and misses categorized based on an index measure (Swets, 1988, 2014). By examining such tables, the optimal cut-score can be determined based on the frequency with which true positive and true negative cases are appropriately classified (McFall & Treat, 1999; Youngstrom, 2014). Because ROC incorporates conditional Bayesian probabilities, the cut-point can be systematically adjusted depending on the anticipated prevalence of the phenomenon of interest in the population with which the screener is being used; in other words, cutoff scores may vary by setting (Brown & Davis, 2006; McFall & Treat, 1999; Swets, 2014). For example, in public health and community screening settings greater weight is given to avoiding misses (i.e., a type II error) rather than false alarms, because the consequences of misses are higher. Said another way, the sensitivity of the measure to detect positive cases is considered its primary virtue as a screener. All positives, including false positives, are marked for further assessment by the screening tool---that is, assessment does not stop after completion of a screener. True cases that are missed by screeners, however, will not access opportunities for additional assessment. Thus, missing true cases has a greater cost in a screening setting.

Figure 2

Example ROC Classification Table

		Reality/Truth	
		Case Positive	Case Negative
Measure Performance	Screen Positive	Hit Sensitivity	False Alarm 1 - specificity
	Screen Negative	Miss 1 - sensitivity	Correct Rejection Specificity

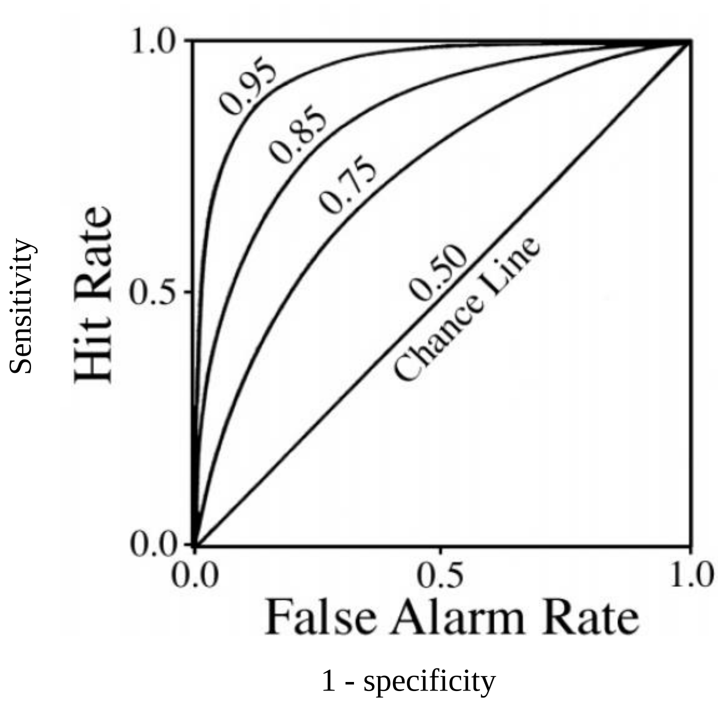
Note. Rows represent the predictor; columns represent the index measure.

Visual analysis of a measure's performance can be conducted by generating an ROC curve (several idealized ROC curves and corresponding area under the curve values are represented in Figure 3 on the next page) and the associated quantitative measure, the area under the curve (AUC). Each point on the ROC curve represents a coordinate consisting of hit (sensitivity, detection of cases among those who are positive) and false alarm points (1 – specificity, detection of cases among those who are negative) at all possible scores on a measure

(McFall & Treat, 1999; Westin, 2001). The AUC value represents the magnitude of the probability that a randomly chosen participant who engages in energy restriction (based on the selected index measure) would have a higher score on the EAT-26 or EDE-Q than a randomly chosen participant who does not restrict their intake (McFall & Treat, 1999; Westin, 2001; Youngstrom, 2014). This visualization and the associated AUC value assist with the selection of a cut-point that offers optimal utility (i.e., a tradeoff between detecting energy restriction when scores are high and detecting high scorers on a measure whose self-reported food intake does not suggest problematic energy restriction).

Figure 3

Idealized ROC Curve Associated with Various AUC Values



Adapted from the article "Quantifying the information value of clinical assessments with signal detection theory" by R.M. McFall and T.A. Treat, 1999, *Annual Review of Psychology*, *50*(1), 215–241. Copyright 1999 by Annual Reviews.

In the present study, ROC was used to determine the probability that the EDE-Q and EAT-26 accurately classify potentially problematic energy restriction of patients 40 years of age and older. As briefly mentioned in the context of the pilot data above, ROC analysis relies on an “index criterion” to determine which participants are restricting their energy intake. The index criterion, selected by the researcher, is relevant to the phenomenon of interest (in the present study, energy restriction). “True cases” of restricted eating were determined using participants’ 24-hour dietary recalls (see *Index of Restriction* below). To use a relevant example, if an ROC curve was generated based on the EDE-Q with an AUC value of .50, this value would indicate a 50% probability that a randomly selected participant who restricts calories below the daily recommended minimal energy level will score higher on the EDE-Q than a participant who does not (i.e., the EDE-Q is operating at the level of chance---only 50% of the cases are correctly classified). An AUC of .85 would indicate an 85% probability that participants with higher scores on the screener would be classified correctly.

Visual inspection of the ROC curve, in combination with the AUC, were used to determine optimal cut scores and the accuracy of each screener (Fan et al., 2006; Swets, 2014; Youngstrom, 2014). AUC values between .50 and .70 were considered low, with probability of detection at chance, those between .70 and .90 are in the moderate/acceptable range, and those over .90 are considered highly accurate (Fischer et al., 2003; Streiner & Cairney, 2007).

Index of Restriction–Estimated Energy Requirement (EER)

ROC analysis relies on the definition of an index criterion to identify “true” cases of the phenomenon of interest by which the performance of screening measures will be classified. The index criterion in the present study was the number of calories participants self-reported on three separate occasions, compared to their individualized estimated energy requirement (EER; see

Measures section for a description of this metric). Although a diagnostic interview is often used as the index measure in studies of the EAT-26 and EDE-Q (Mond et al., 2008; Rivas et al., 2010; Striegel-Moore et al., 2009; Youngstrom, 2014), the goal of the present study was to determine the ability of the EAT-26 and EDE-Q to detect a specific behavioral pattern (defined by energy restriction) rather than to examine their utility in making diagnostic classifications. Thus, the use of the EER and dietary recalls were preferrable index criterion measures for the purposes of the present study.

Measures

Demographics

Participants self-reported their age, gender identity, height, weight (current and self-reported ideal), relationship status, level of education, household income and financial status, number of people living in their household, caregiver status, and work status. Given the current pandemic, the impact of COVID-19 on work status was also assessed.

EERs were computed (described below) based on sex, age, weight, height, and activity level reported in this section.

Health Behavior History

Participants indicated their current and ideal shape based on a figure rating scale. They also reported on sleep, tobacco and alcohol use, food allergies, and current medically prescribed and non-medical (e.g., Noom, Weight Watchers, vegan/vegetarian, intermittent fasting) dieting practices. Functional status related to cooking and eating (e.g., shopping, meal preparation) was also assessed. These factors may be important in modifying individual eating behavior.

Health Status

Participants reported their history of chronic medical illnesses (e.g., cancer, thyroid disease, celiac disease), current or past radiation or chemotherapy treatment, bariatric surgery, current medication use, mental health history (e.g., current or past eating disorder, depression, anxiety), changes in chemosensory functioning, dental health status and access to dental care, history of falls within the past month, and hospitalizations within the past three months. Participants also rated their current overall health (5-point Likert scale, *poor* to *excellent*).

Eating Attitudes Test–26 (EAT-26)

The EAT-26 is a 26-item, 5-point Likert (*always* to *never*), self-report questionnaire assessing symptoms of EDs (Garner & Garfinkel, 1979). The EAT-26 has a maximum score of 104 (all 26 items endorsed as *always* [4]). The test yields three subscales: Dieting, Bulimia and Food Preoccupations, and Oral Control (Garner et al., 1982). The total and subscale scores were calculated by summing item ratings (Garner et al., 1982). Scores ≥ 20 have been employed to indicate necessity of further eating assessment in nonclinical populations (Dotti & Lazzari, 1998; Hayakawa et al., 2019; Koslowsky et al., 1992; Patton et al., 1990). Results from studies conducted with college student samples suggest the EAT-26 cutoff score of 20 has a specificity of .94 and sensitivity of .77 (Mintz & O'Halloran, 2000). A systematic review reported acceptable internal consistency (mean Cronbach's α for the total score = .86, mean Cronbach's α for the subscales = .56 to .80) and test-retest reliability (sample-weighted reliability coefficient for the total score = .87; Gleaves et al., 2014).

Eating Disorder Examination–Questionnaire (EDE-Q)

The EDE-Q is a 28-item self-report measure that focuses on the past 28 days and uses a 7-point rating scale (Fairburn, 2008). Twenty-two items measure symptom severity (rated from *no days* to *every day*), while six items assess the frequency of disrupted eating behaviors (e.g., number of times or how many days). Scores on the EDE-Q range from 0 to 6. In studies, the measure has yielded four subscales (Restraint, Eating Concern, Weight Concern, and Shape Concern) and a global score (Fairburn, 2008; Fairburn & Beglin, 1994). Subscale scores are obtained by summing item ratings and dividing by the total number of items in the subscale (Fairburn, 2008). To calculate the global score, the subscale scores are summed, and the total divided by four (i.e., the number of subscales). Higher scores indicate more symptoms and research has suggested a score ≥ 2.3 differentiates clinically significant symptoms in community samples (Fairburn & Beglin, 1994; Hilbert et al., 2012; Mond et al., 2004). Global and subscale means, standard deviations, and percentile ranks for community and clinical samples are available (Jennings & Phillips, 2017; Mond et al., 2006). Research in women under 40 years has indicated the EDE-Q has a specificity of .86 and sensitivity of .92 (Mond et al., 2004). A systematic review of the psychometrics properties of the EDE-Q indicated acceptable internal consistency across four subscales (Cronbach's α = .70 to .93) , and test-retest correlations ranging from .66 to .94 for the four subscales and from .51 to .92 for the behavioral items (Berg et al., 2012).

Orthorexia Nervosa Inventory (ONI)

The ONI (Oberle et al., 2020) is a relatively new 24-item measure using a 4-point Likert scale (*not at all true* [1] to *very true* [4]), yielding three subscales: Impairments, Behaviors, and Emotions. The measure has a maximum score of 96 (all 24 items endorsed as *very true* [4]). Relevant to the present study, this measure includes items assessing health provider concerns and physical health status (e.g., "Health professionals have expressed concern that my diet is too restrictive"; "Even though I have eaten much healthier over time, my physical health has actually declined"; p. 4), which are not included in the EDE-Q or the EAT-26. Research indicates this measure has good internal consistency (Cronbach's α = .88 to .90) and test-retest reliability over two weeks (Pearson's r = .86 to .87; Oberle et al., 2020).

Automated Self-Administered 24-Hour (ASA24) Dietary Assessment Tool

Dietary intake data for 24-hour recalls were collected and analyzed using the Automated Self-Administered 24-hour (ASA24) Dietary Assessment Tool, version 2020, developed by the National Cancer Institute, Bethesda, MD (Thompson et al., 2015). The ASA24 is a free, web-based research tool that allows participants to report what, when, where, how much, and with whom they consumed food (including beverages and supplements) over the past 24-hours, in addition to querying whether this was a typical day.

The ASA24 (Thompson et al., 2015) was chosen for dietary recall data collection because it uses the gold standard Automated Multiple-Pass Method (AMPM) methodology for representing an individual's food intake (Kirkpatrick et al., 2014; Kupis et al., 2019; Moshfegh et al., 2008). Evaluation of the self-administered, web-based ASA24 compared to the interviewer-administered AMPM indicated there were no statistically significant differences regarding accuracy of capturing food and drinks consumed or in total energy (i.e., calories) reported (Kirkpatrick et al., 2014). This research also indicated that overall differences in caloric intake between the ASA24 self-report and a meal consumed at the study site were not significant (average of 125 kcals more actually consumed than reported). For estimating caloric intake, previous research has indicated that a Pearson's r of $\geq$ .90 can be achieved with four to six days of 24-hour dietary recall data (Nelson et al., 1989). More recently, collecting three days of recall data has been demonstrated to provide the optimal approximation of energy intake compared to doubly-labelled water, with three days resulting in significantly different paired samples t tests than two days (improved) or more than three days (no additional improvement; Ma et al., 2009). Recalls obtained from 173 homebound older adults (mean age = 81 years) have indicated sufficient test-retest reliability (Pearson's $r = .59$) with three days of data (Sun et al., 2010). Additionally, a recent study with 1,077 older adults indicated that 91% of men and 86% of women completed at least three ASA24 recalls (Subar et al., 2020), suggesting it is a feasible method for collecting dietary data in this age group.

Estimated Energy Requirement (EER)

Comparison of ASA24 recall data to the individual's EER allowed for comparison with a reference standard employed in public health settings (National Institutes of Health, 2020; Trumbo et al., 2002; U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015). EERs were calculated using the equations from Trumbo et al. (2002) and the Institutes of Medicine (IOM; 2005), outlined in Table 4 (next page). These equations yield the estimated amount of energy (i.e., calories) needed to maintain an individual's current weight based on the physiological requirements associated with their age, sex, weight, height, and their estimated energy expenditure based on self-reported physical activity level (Gerrior et al., 2006; Panel on Macronutrients et al., 2005; Trumbo et al., 2002). Physical activity categories were assessed based on definitions from the IOM (Panel on Macronutrients et al., 2005) and a brief screener (International Physical Activity Questionnaire–Short form [IPAQ-SF]; see below). If the individual's ASA24 recall data indicated at least two days with caloric intake at or below 75% of the individual's EER, the case was classified as positive for restriction. This is consistent with professional guidelines regarding the identification of adult malnutrition, suggesting intake < 75% of the individual's EER over one week to several months---depending on chronic disease status---is a component of diagnosing moderate malnutrition in adults (White et al., 2012).

Table 4

Equations for Calculating EER by Gender Identity and Physical Activity Level (PAL)*

For those identifying as men:	
Equation	661.8 - (9.53 * [age]) + PAL * ((15.91*[weight(kg)]) + (539.6*[height(m)]))
Sedentary	661.8 - (9.53 * [age]) + 1 * ((15.91*[weight(kg)]) + (539.6*[height(m)]))
Low active	661.8 - (9.53 * [age]) + 1.12 * ((15.91*[weight(kg)]) + (539.6*[height(m)]))
Active	661.8 - (9.53 * [age]) + 1.27 * ((15.91*[weight(kg)]) + (539.6*[height(m)]))
Very active	661.8 - (9.53 * [age]) + 1.45 * ((15.91*[weight(kg)]) + (539.6*[height(m)]))
For those identifying as women:	
Equation	354.1 - (6.91 * [age]) + PAL * ((9.36*[weight(kg)]) + (726*[height(m)]))
Sedentary	354.1 - (6.91 * [age]) + 1 * ((9.36*[weight(kg)]) + (726*[height(m)]))
Low active	354.1 - (6.91 * [age]) + 1.12 * ((9.36*[weight(kg)]) + (726*[height(m)]))
Active	354.1 - (6.91 * [age]) + 1.27 * ((9.36*[weight(kg)]) + (726*[height(m)]))
Very active	354.1 - (6.91 * [age]) + 1.45 * ((9.36*[weight(kg)]) + (726*[height(m)]))

Note. Equations from "Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids" by P. Trumbo et al., 2002, *Journal of the American Dietetic Association*, *102*(11), p. 1629. Copyright 2002 by American Dietetic Association. Activity levels as defined in "Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids" by the IOM Panel on Macronutrients et al., 2005, *National Academies Press*, p. 158. Copyright 2005 by National Academy of Sciences.
*For those identifying as genderqueer, gender nonconforming, self-identified gender identity, or who chose not to identify their gender, the average of their EER based on the equation for men and the equation for women was used.

Self-Reported Physical Activity Level (PAL)

PAL calculations follow the IOM's (2005) guidelines for deriving the EER. To characterize participants' physical activity level, they were asked to indicate which description best characterizes their overall lifestyle:

- Sedentary = lifestyle that only includes the typical activities of daily living such as household chores and gardening,
- Low active = lifestyle includes the typical activities of daily living PLUS 30-60 minutes of moderate activity per day (e.g., walking 2 miles at a brisk or firm pace of 3-4 mph),
- Active = lifestyle includes the typical activities of daily living PLUS 60 to 100 minutes of moderate activity daily (e.g., walking 7+ miles at a brisk or firm pace of 3-4 mph),
- Very active = lifestyle includes the typical activities of daily living PLUS more than 60 minutes of moderate activity daily AND an additional 60 minutes of vigorous activity OR 120 minutes or more of moderate activity daily (e.g., walking 7+ miles at a brisk or firm pace AND running an hour per day OR walking 14+ miles at a brisk or firm pace).

Procedures

Recruitment and Data Collection

Interested individuals clicked on a link or scanned a QR code to access the REDCap informed consent document and surveys. After accessing REDCap and completing the informed consent, participants were asked to enter their email address and age (only those self-reporting their age as ≥ 40 years old were eligible to participate) before proceeding to the rest of the survey. REDCap was used to send participants a unique username and password for the ASA24 website. A message thanking participants for their responses appeared once the survey was completed. This message also stated that participants would receive an email with a link to the above ASA24 information within 24 hours.

REDCap automatically emailed a link to reminders for the second and third ASA24 recalls and sent two additional reminders if the third recall was not marked as completed (i.e., the participant did not click “Submit” in REDCap). Participants were instructed to complete their recall within 24 hours of receiving the email. Research has indicated that three nonconsecutive recalls is optimal for estimating usual intake, and that the reliability of dietary data entries decreases beyond this point (Basiotis et al., 1987; Ma et al., 2009; Thompson & Subar, 2017). Spacing the recalls four days apart helped to ensure that data from weekdays and weekends were collected, increasing the representativeness of the dietary data collected for each individual (Maisey et al., 1995; National Cancer Institute, n.d.).

The ASA24 online platform generates a detailed nutrition report after each entry, and participants had opportunities to compare their reported intake to USDA guidelines for each recall completed. Research has indicated that the ASA24 may be challenging for older adults or those with lower levels of education to complete independently (e.g., Kupis et al., 2019). To address this, participants could request assistance with completion of the ASA24 via an item in the REDCap survey. If that item was endorsed, study team members provided telephone and/or video call support for completing dietary recalls. In addition, study team members were available via email, text message, and voicemail to respond to participant questions.

Data Cleaning and Interrater Reliability

All data were screened and cleaned for missing values and outliers. REDCap data were screened and cleaned by the author (KHK). Because of forced responses within the survey, the EDE-Q, EAT-26, and ONI had no missing data among survey completers.

Underreporting of daily intake is a frequent limitation of the 24hr dietary recall method. To address this limitation and assist with identifying cases of restriction, ASA24 dietary recall data were screened by two research assistants to identify possible cases of underreporting. Consistent with documentation provided by the ASA24, participants reporting < 600 calories of intake over the past 24 hours underwent additional assessment to determine whether these values represented potentially dangerous energy restriction or if low ASA24 values resulted from another factor. First, the research assistants examined the ASA24 data file for breakoffs (i.e., the participant started the recall but quit prior to completion). Next, the REDCap data file was examined to determine whether current cancer treatment (e.g., currently undergoing chemotherapy or radiation therapy), recent bariatric surgery (i.e., < 1-year post-surgery), difficulty shopping or cooking independently, and/or lack of money to purchase food may have impacted the participant's ability to eat or prepare meals and resulted in low intake for reasons other than restriction. If the research assistants determined that health or financial limitations may have resulted in low caloric intake, the case was excluded. If review of the ASA24 and REDCap data file did not contain evidence to support excluding the case, the participant was retained in the analyses. In the present study, after both reviewers examined the data files, no participants reporting intake < 600 calories were excluded due to health (i.e., recent bariatric surgery or current cancer treatment), financial concerns, or functional limitations. Analysis of interrater reliability indicated high agreement between the two raters (Cohen's $\kappa = 1.0$, $p < .001$).

Results

Demographics

The CONSORT diagrams below detail participants' progress through the REDCap survey and ASA24 recall phases of the study (Figures 4 and 5, next pages).

Figure 4

CONSORT Diagram of REDCap Survey Completion

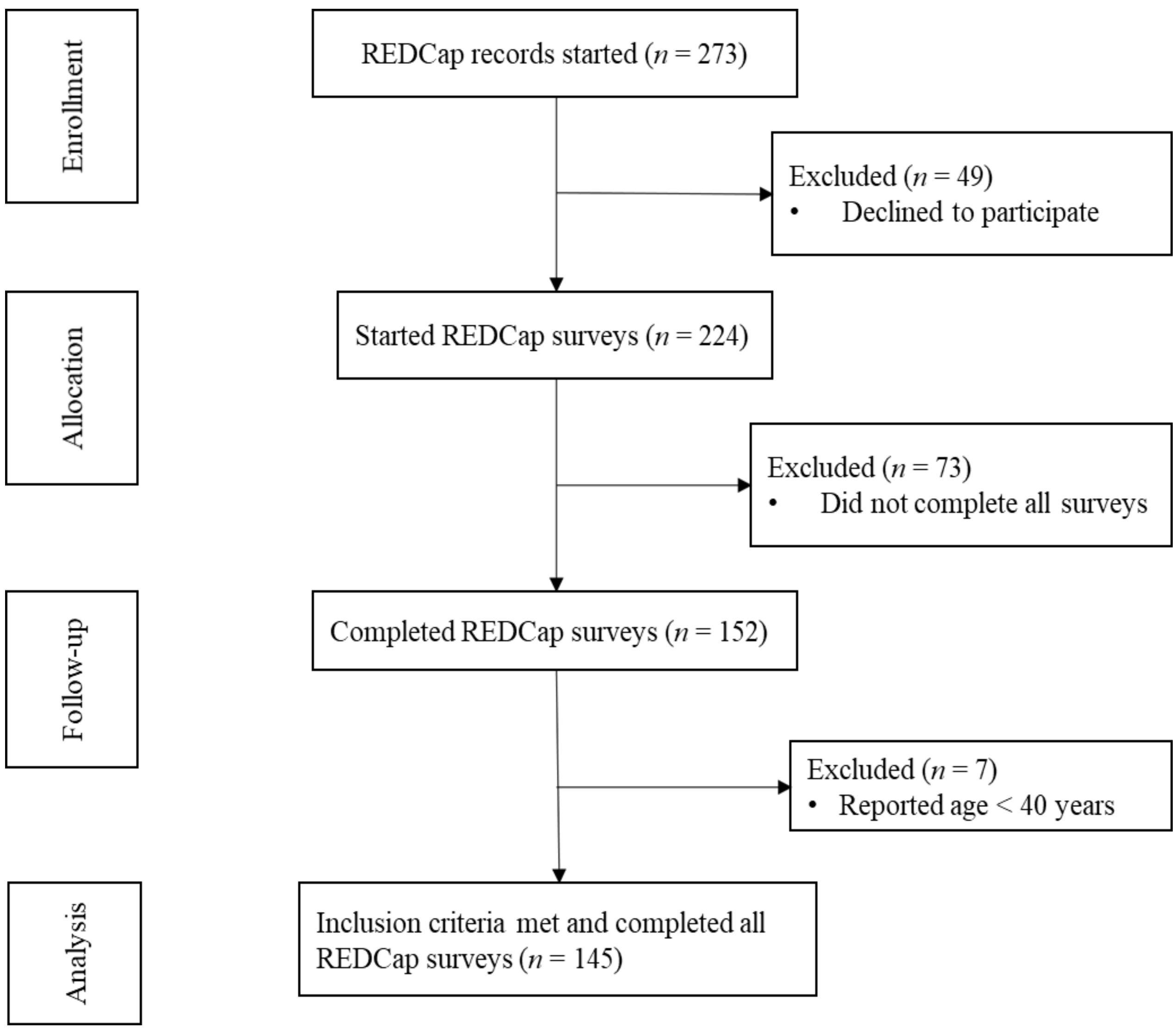
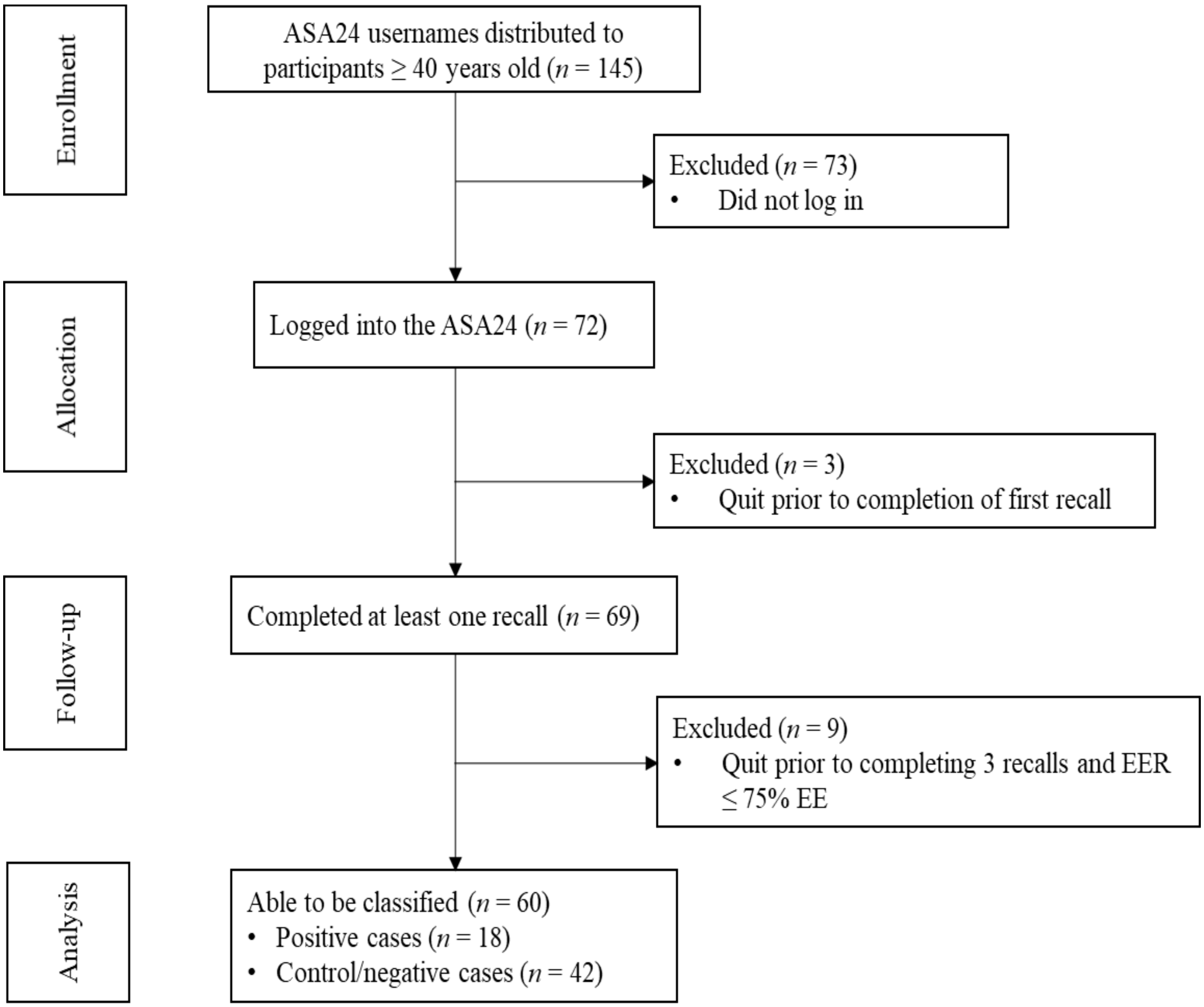


Figure 5

CONSORT Diagram of ASA24 Recall Completion



One hundred forty-five participants provided informed consent and completed all of the REDCap surveys. Of these survey completers, 60 participants were able to be classified as negative or positive cases of restriction based on the criteria defined above. Participants' demographic details and health factors can be found in Tables 5 and 6. Population pyramids demonstrating the distribution of health factors across positive and negative cases are depicted in Figures 6, 7, and 8 (pp. 39-41).

Table 5

Participant Demographics

Characteristic	All Survey Completers (*N* = 145)		Restriction Positive Cases (*N* = 18)		Restriction Negative Cases (*N* = 42)	
	N	%	*n*	%	*n*	%
Gender						
Cisgender women	108	74.5	10	55.6	35	83.3
Cisgender men	21	14.5	7	38.9	3	7.1
Not cisgender	5	3.4	0	0	1	2.4
Prefer not to say	11	7.6	1	5.6	3	7.1
Race/ethnicity						
Non-White	21	14.5	3	16.7	0	0
White	125	86.2	15	83.3	42	100.0
Prefer not to say	2	1.4	0	0	0	0
Work Status						
Currently working	80	55.2	10	55.6	29	70.0
Retired	41	28.3	4	22.2	10	23.8
Unemployed	19	13.1	4	22.2	3	7.1
Unemployed due to COVID	6	4.1	1	5.6	0	0.0
Prefer not to say	4	2.8	0	0	0	0
Financial status						
At least enough for necessities	130	89.7	17	94.4	38	90.5
Difficulty affording basics	7	4.8	0	0	2	4.8
Prefer not to say	8	5.5	1	5.6	2	4.8

Table 5 continued

Characteristic	All Survey Completers (*N* = 145)		Restriction Positive Cases (*N* = 18)		Restriction Negative Cases (*N* = 42)	
	N	%	*n*	%	*n*	%
Education level						
< 12 years	8	5.5	0	0	1	2.4
12 – 16 years	78	53.8	11	61.1	21	50.0
16+ years	55	37.9	6	33.3	20	47.6
Prefer not to say	4	2.8	1	5.6	0	0
Age						
40-49 years	52	35.9	7	38.9	13	31.0
50-59 years	35	24.1	5	27.8	13	31.0
60-69 years	40	27.6	5	27.8	13	31.0
70-79years	15	10.3	1	5.6	3	7.1
80-89 years	3	2.1	0	0	0	0
BMI						
Underweight (<18.5)	4	2.8	0	0	2	0.5
Normal weight (18.5-24.9)	58	40.0	3	16.7	26	54.2
Overweight (25-29.9)	41	28.3	7*	38.9	6	14.3
Obese (≥30)	41	28.3	8*	44.4	8	19.1
Household members						
Lives alone	25	17.2	3	16.7	4	9.5
Lives with others	119	82.1	15	83.3	37	88.1
Married – yes	91	62.8	13	72.2	31	73.8
Caregiver - yes	47	32.4	6	33.3	20	47.6

Note. Total percentage for race/ethnicity is > 100% as some participants endorsed multiple categories.

*p<.05

Table 6

Participant Health Factors

Health Factor	All Survey Completers (N = 145)		Restriction Positive Cases (n= 18)		Restriction Negative Cases (n = 42)	
	N	%	*n*	%	*n*	%
Overall health rating						
Excellent	19	13.9	2	11.1	10	23.3
Very good	48	33.1	5	27.8	13	31.0
Good	60	41.4	9	50.0	17	40.5
Fair	15	10.3	1	5.6	2	4.8
Poor	3	2.1	1	5.6	0	0
Prefer not to say	0	0	0	0	0	0
Physical health conditions						
None	28	19.3	5	27.8	8	19.0
1	33	22.8	1	5.6	13	31.0
2-3	42	29.0	4	22.2	11	26.2
4-5	20	13.8	4	22.2	6	14.3
6+	22	15.2	4	22.2	4	9.5
Any cancers	13	8.8	2	11.1	4	9.5
Diabetes	6	4.1	0	0	0	0
Behavioral health conditions						
None	52	35.9	6	33.3	16	38.1
1	54	37.2	7	38.9	15	35.7
2-3	32	22.1	5	27.8	8	19.0
4-5	4	2.8	0	0	2	4.8
6+	3	2.1	0	0	1	2.4

Table 6 continued

Health Factor	All Survey Completers (N = 145)		Restriction Positive Cases (n= 18)		Restriction Negative Cases (n = 42)	
	N	%	*n*	%	*n*	%
Medications - past month						
None	38	26.2	5	27.8	10	23.8
1	50	34.5	7	38.9	13	31.0
2-3	43	29.7	2	11.1	15	35.7
4-5	12	8.3	3	16.7	4	9.5
6+	2	1.4	1	5.6	0	0
Hours of sleep						
4 hours or less	4	2.8	1	5.6	1	2.4
5 to 8 hours	118	81.4	14	77.8	32	76.2
9 hours or more	12	8.3	1	5.6	5	11.9
Functional status related to eating						
Adequate time for meals	116	80.0	16	88.9	36	85.7
Adequate money for food	141	97.2	18	100.0	42	100.0
Able to shop independently	138	95.2	17	94.4	41	97.6
Able to cook independently	136	93.7	17	94.4	41	97.6
Dieting						
Prescribed	17	11.7	3*	16.7	1	2.4
Not prescribed	42	28.9	4	22.2	10	23.8

Table 6

Health Factor	All Survey Completers (N = 145)		Restriction Positive Cases (n= 18)		Restriction Negative Cases (n = 42)	
	N	%	n	%	n	%
Pandemic-related changes						
Eating changes - yes	89	61.4	11	61.1	30	71.4
Activity changes -yes	101	69.6	14	77.8	28	66.7
Alcohol use - yes	87	60.0	6	33.3	34***	81.0
Current tobacco use	13	8.9	0	0.0	4	9.5
Food allergies - yes	24	16.6	4	22.2	6	14.3
Lifetime eating disorder diagnosis	5	3.4	0	0	1	2.4

* $p < .05$; ***$p < .001$

More than four-fifths of the sample rated their health in the excellent to good range while only one-fifth did not endorse any health conditions, suggesting active management of chronic diseases occurred for four-fifths of the sample that is also reflected by the percentage of medication users. Two-thirds of the sample endorsed changes in activity and eating patterns due to the pandemic. Chi squared tests of independence comparing numbers of physical and behavioral health conditions and medications over the past month between positive and negative cases were not significant (χ^2 values ranged from 1.8 to 10.1, p = .19 to .93). Positive and negative cases of restriction also did not differ significantly regarding perceived current ($M_{positive}$ = 5.2, $SD_{positive}$ = 2.1; $M_{negative}$ = 4.5, $SD_{negative}$ = 1.5) or ideal body size ($M_{positive}$ = 3.7, $SD_{positive}$ = 1.6; $M_{negative}$ = 3.3, $SD_{negative}$ = 1.0), on the figure rating scale, $t(58) = -1.4$, $p = .18$ and $t(58) = -1.2$, $p = .24$, respectively. Restriction positive cases were significantly more likely to have BMIs in the overweight or obese categories compared to restriction negative cases ($\chi^2 = 16.53$, p =

.005) and were significantly more likely endorse being on a diet prescribed by their healthcare provider (χ^2 = 4.13, p = .042). Restriction negative cases were significantly more likely to endorse using alcohol (χ^2 = 12.86, p < .001) than restriction positive cases.

Attrition Analysis

Attrition analyses for the present study did not indicate significant demographic differences between participants who completed the REDCap surveys only (“survey only completers”; *N* = 85;) compared to those who completed the surveys and ASA24 recalls (“ASA24 completers”; *N* = 60; see Table 7).

Table 7

Demographic Comparison of Survey Only Completers and ASA24 Completers

	Survey Only Completers (*N* = 85)	ASA24 Completers (*N* = 60)	χ^2	*p*
Age				
40-49 yrs	32	20	2.31	.26
50-59 yrs	17	18		
60-69 yrs	22	18		
70-79 yrs	11	4		
80-89 yrs	3	0		
Gender				
Ciswomen	63	45	1.39	.71
Cismen	11	10		
Other gender identities	4	1		
Education				
< 12 yrs	7	1	3.99	.26
12-16 yrs	46	32		
16+ yrs	29	26		

Table 7 continued

	Survey Only Completers (N = 85)	ASA24 Completers (N = 60)	χ^2	p
Financial status				
At least enough for basic needs	75	55	0.57	.75
Not enough for basic needs	5	2		
Retired				
Yes	27	14	0.58	.75
No	12	7		
Physical health				
None	15	13	.46	.79
1 diagnosis	19	14		
2+ diagnoses	51	33		
Behavioral health				
None	30	22	0.03	.98
1 diagnosis	32	22		
2+ diagnoses	23	16		
Medications over the past month				
None	23	15	0.24	.89
1 diagnosis	30	20		
2+ diagnoses	32	25		
Sleep				
<5 hrs	2	2	0.71	.70
5-8 hrs	72	46		
9+ hrs	6	6		

Table 7 continued

	Survey Only Completers (*N* = 85)	ASA24 Completers (*N* = 60)	χ^2	*p*
Activity level				
Low	25	13	2.97	.23
Moderate	36	22		
High	24	25		
Diet – medically prescribed				
Yes	13	4	2.50	.11
No	72	56		
Diet – not medically prescribed				
Yes	28	14	1.58	.21
No	57	46		
Food allergies				
Yes	14	10	0.71	.70
No	70	50		
Alcohol use				
Yes	47	40	2.39	.30
No	37	20		
Pandemic-related eating changes				
Yes	48	41	2.57	.28
No	36	19		
Pandemic-related activity level changes				
Yes	59	42	0.01	.94
No	26	18		

Table 7 continued

		Survey Only Completers (*N* = 85)	ASA24 Completers (*N* = 60)	χ^2	*p*
Independence with IADLs					
	Yes	78	59	2.99	.22
	No	6	1		
Adequate money for food					
	Yes	81	60	2.90	.23
	No	3	0		
Adequate time for meals					
	Yes	64	52	2.84	.09
	No	21	8		
Able to shop independently					
	Yes	80	58	0.89	.64
	No	4	2		
Able to cook independently					
	Yes	78	58	1.68	.43
	No	6	2		

Survey-only completers did score statistically significantly higher than ASA24 completers on several subscales of the EAT-26, EDE-Q, and ONI (Table 8). However, these differences were not clinically significant based on comparison with each subscale's Reliable Change Index using Truax and Jacobson's method a formula (1991). In other words, the score difference observed between survey-only completers and ASA24 completers is not large enough to indicate that one group of scores falls into a different population than the other. Said another way, survey-only completers' higher scores do not indicate they represent a more symptomatic population than ASA24 completers. The differences observed are likely due to variation of scores within the same population.

Table 8

Results of Independent Samples t-Tests Comparing Survey Only Completers and ASA24 Completers

	Survey Only Completers (*N*= 85)		ASA24 Completers (*N* = 60)		*t* (143)	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
EAT-26							
Total score	9.28	10.0	6.97	6.71	1.56	.07	.26
Bulimia and food preoccupation	1.04	2.43	.50	1.54	1.51	.03*	.25
Oral control	2.08	2.93	1.90	2.15	.41	.62	.07
Dieting	6.16	5.97	4.57	4.56	1.75	.05*	.30
EDE-Q							
Global score	1.56	1.18	1.31	1.01	1.31	.17	.22
Restraint	1.69	1.25	1.30	1.61	1.79	.08	.30
Eating concern	.61	.88	.38	.68	1.73	.00*	.30
Shape concern	2.05	1.54	1.93	1.62	.46	.45	.08
Weight concern	1.87	1.41	1.68	1.31	.79	.53	.13
ONI							
Total score	35.25	9.28	31.87	5.99	2.48	.02*	.42
Impairments	12.19	4.29	10.65	1.39	2.68	<.00*	.45
Behaviors	15.94	4.96	14.97	4.61	1.26	.61	.21
Emotions	7.12	2.54	6.25	1.64	2.33	.01*	.40

*$p < .05$

EDE-Q, EAT-26, ONI

Descriptive statistics for the EDE-Q, EAT-26 and ONI are outlined in Table 9.

Table 9

EDE-Q, EAT-26, and ONI Descriptive Statistics

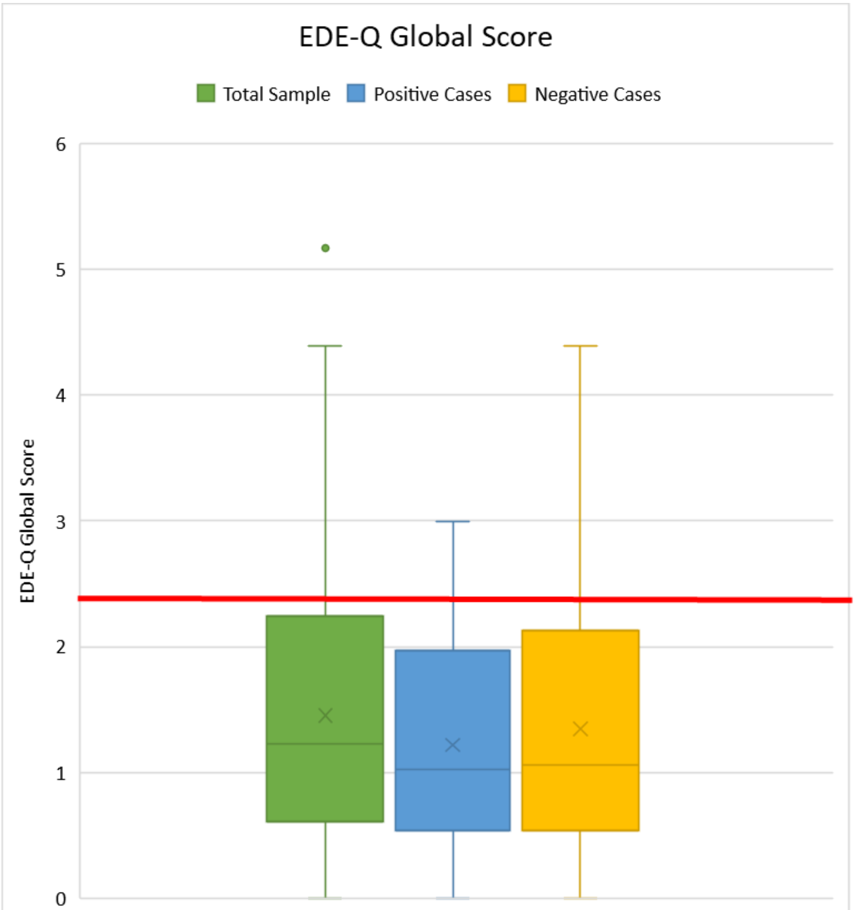
Measure	Total sample (*N* = 145)		Restriction Positive cases (*n* = 18)		Restriction Negative cases (*n* = 42)	
	Mean (*SD*)	Maximum	Mean (*SD*)	Maximum	Mean (*SD*)	Maximum
EDE-Q						
Global score	1.5 (1.1)	5.2	1.2 (0.9)	3	1.3 (1.1)	4.4
Restraint	1.5 (1.5)	6	1.3 (1.1)	3.4	1.2 (1.4)	4.2
Eating concern	0.5 (0.8)	4.2	0.2 (0.3)	1.2	0.4 (0.8)	4.2
Shape concern	2.0 (1.6)	6	1.8 (1.5)	4.4	2.0 (1.7)	6
Weight concern	1.8 (1.4)	6	1.5 (1.4)	4.8	1.7 (1.3)	4.8
EAT-26						
Total score	8.3 (8.9)	56	7.7 (7.5)	27	6.7 (6.4)	38
Bulimia and food preoccupation	0.8 (2.1)	15	0.8 (2.3)	9	0.4 (1.1)	6
Oral control	2.0 (2.6)	17	1.8 (2.4)	8	2.0 (2.1)	11
Dieting	5.5 (5.5)	28	5.1 (5.1)	19	4.4 (4.4)	21
ONI						
Total score	33.8 (8.2)	79	33 (6.5)	52	31.3 (5.8)	50
Impairments	11.5 (3.5)	37	10.3 (0.7)	12	10.8 (1.6)	17
Behaviors	15.5 (4.6)	30	16.3 (5.3)	30	14.4 (4.2)	30
Emotions	6.8 (2.2)	17	6.4 (1.8)	11	6.2 (1.6)	11

Box plots representing score distribution on each measure's total subscale scores for the total sample, restriction positive cases, and restriction negative cases are presented in Figures 6, 7, and 8. The red line in Figures 6 and 7 represents the current cutoff scores on the EDE-Q and

EAT-26. The red line in Figure 8 represents the recommended ONI cutoff score based on the results of the ROC analyses described below.

Figure 6

Box Plots of EDE-Q Global Subscale Scores



Note. Red line represents the current cutoff score (≥ 2.3)

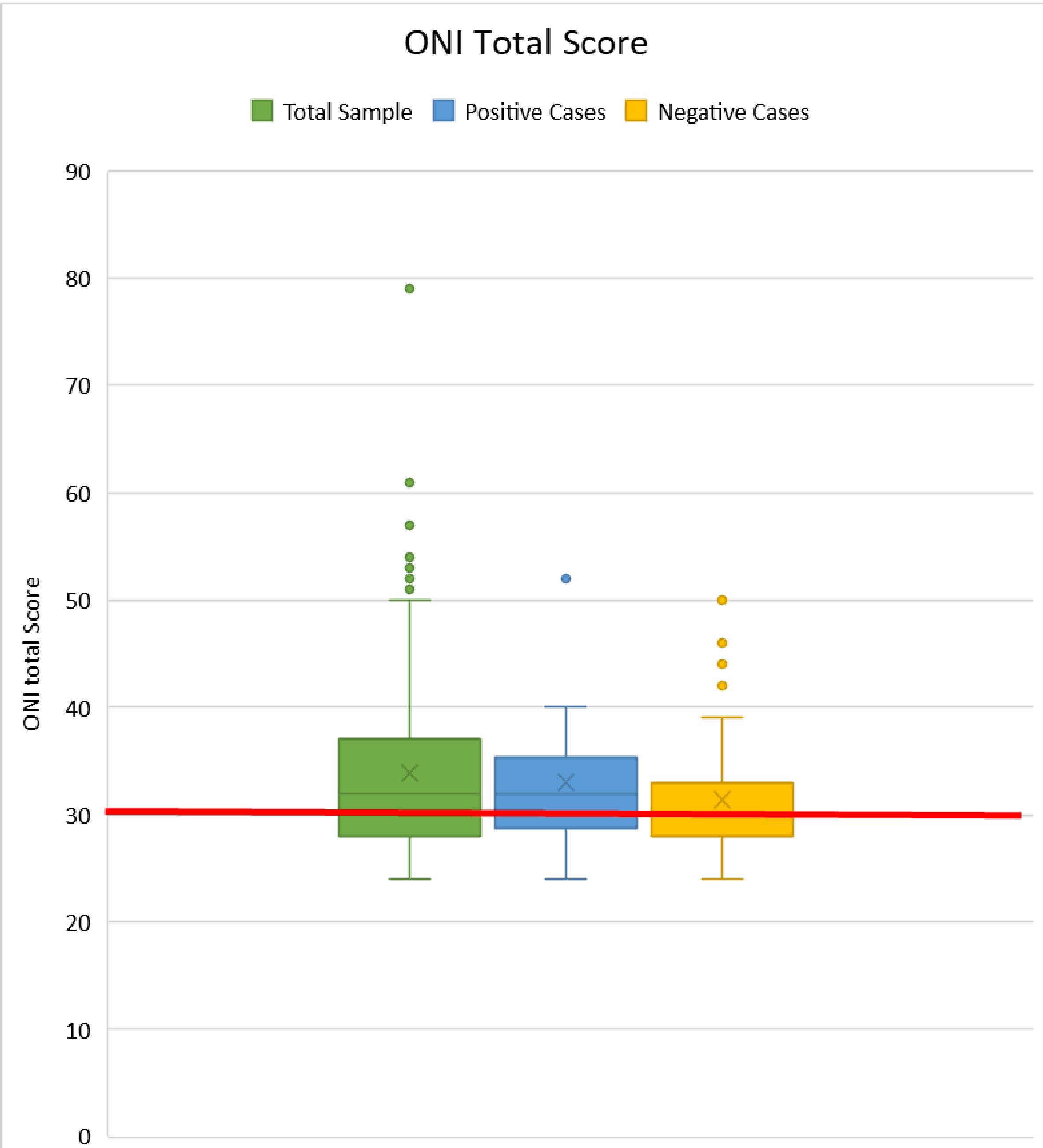
Figure 7

Box Plots of EAT-26 Total Scale Scores

Note. Red line represents the current cutoff score (≥ 20)

Figure 8

Box Plots of ONI Total Scale Scores



Note. Red line represents the cutoff score recommended by the ROC analyses below (≥ 30).

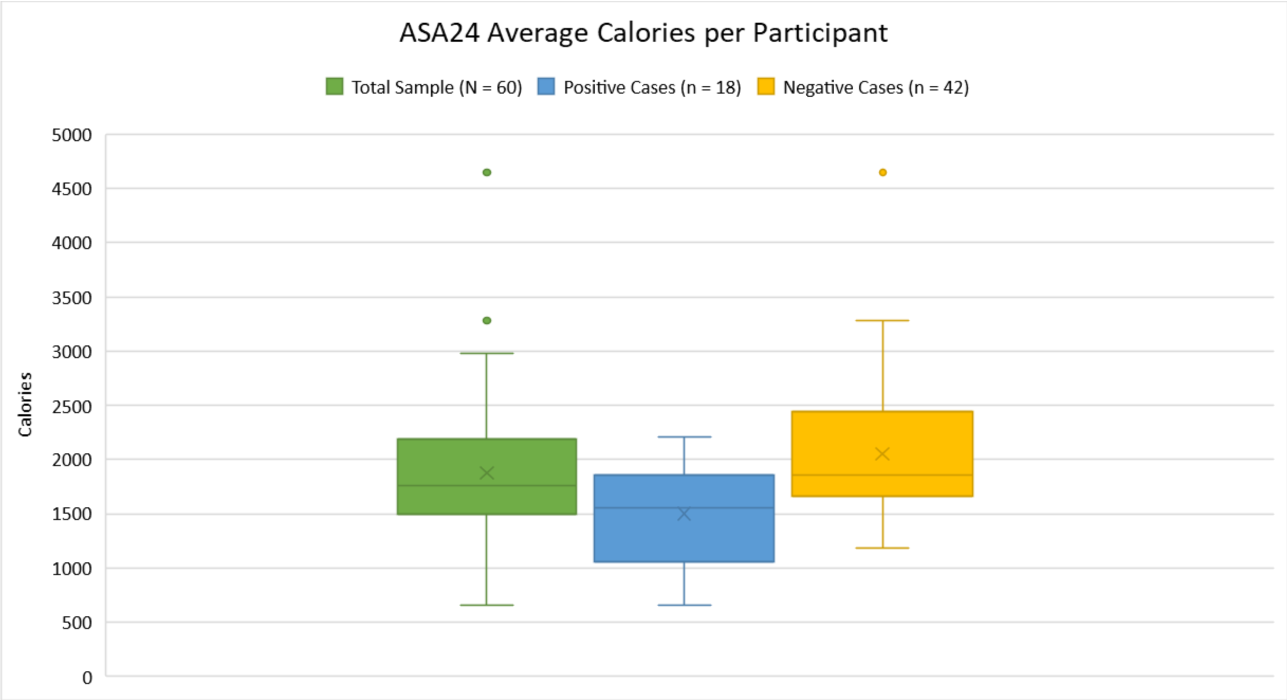
Notably, on average, positive cases of restriction tended to score higher on the ONI total scale than negative cases, though the difference was not statistically significant. On the EDE-Q and EAT-26 scores for positive and negative cases tended to be lower overall, and their means were closer to one another. Scores on the EDE-Q and EAT-26 also tended to be below the current cutoffs across all groups. Independent samples *t*-tests were not significant (*F* values ranged from 2.19 to .058, p = .81 to .14). This may be due to small sample size and few cases scoring above the cutoff score on the EAT-26 and EDE-Q.

ASA24 Dietary Recalls

Regarding dietary recalls, the average calories reported across all completed ASA24 recalls was 1,731.66 (*SD* = 737.02) for the total sample, 1,478.82 (*SD* = 673.30) for positive cases, and 2,024.59 (*SD* = 691.33) for negative cases. The distribution of the average number of calories reported per participant for each group is presented in Figure 9 (next page). For restriction positive cases, women (n = 10) reported an average of 1,476 calories and men (n = 7) reported an average of 1,583 calories. For restriction negative cases, women (n = 35) reported an average of 1,896 calories and men (n = 3) reported an average of 2,609 calories. Data collected through the CDC's National Health and Nutrition Examination Survey (NHANES) for the 2017 to 2018 data collection period indicated that the average daily caloric intake for men 40 years of age and older was 2,400-2,600 calories and 1,600-1,900 for women (CDC & NCHS, 2018), suggesting average intake reported for restriction negative cases was grossly representative of national data.

Figure 9

Box Plots of Average Calories Reported per Participant



Receiver Operating Characteristics (ROC)

The software program Rstudio, with easyROC package enabled (Goksuluk et al., 2016), was used to completed the ROC analyses. Data were screened and cleaned using SPSS version 27.0 (2020) through examination of frequency distributions and descriptive statistics. The primary criterion measure of energy restriction was self-reported energy intake via the ASA24 compared to the participant's individualized EER. EER was calculated using data obtained in REDCap and compared to the ASA24 data file. Participants with a sufficient number of completed ASA24 recalls were classified as positive cases of restriction (1) or negative cases (0). The overall screening accuracy of the EAT-26, EDE-Q, and ONI at classifying positive cases of restriction was quantified using non-parametric estimates of the AUC from ROC analyses. Optimal cutoff scores for each measure were also evaluated using the ROC curve.

Performance at Current Cutoff Scores: EAT-26 and EDE-Q

At the currently employed cutoff scores, Table 10 demonstrates the performance of the EDE-Q and EAT-26 at classifying participants who completed at least one ASA24 recall for classification.

Table 10

Classification of Eating Screener Performance at Current Cutoff Scores

	Truth criterion	
	ASA24 ≤ 75% of EER	ASA24 > 75% of EER
EDE-Q ≥ 2.3	3 (hits)	8 (false alarms)
EDE-Q < 2.3	15 (misses)	34 (correct rejections)
EAT-26 ≥ 20	1 (hits)	1 (false alarms)
EAT-26 < 20	17 (misses)	41 (correct rejections)

Note. ASA24 = Automated Self-Administered 24-hour Dietary Assessment Tool; EER = Estimated Energy Requirement; EDE-Q = Eating Disorders Examination–Questionnaire; EAT-26 = Eating Attitudes Test–26 items.

Summary statistics regarding each measure's performance can be found in Table 11. Notably, the EDE-Q and EAT-26 missed 83% and 97% of positive cases, respectively. This is a concern in a community screening setting, as missed detections result in the loss of opportunities for further assessment and access to appropriate intervention.

Table 11

Summary Statistics for the EDE-Q and EAT-26 at Current Cutoff Scores

Statistic	EDE-Q	EAT-26
Sensitivity	16.7%	5.6%
Specificity	83.3%	97.6%
Positive Predictive Value	27.3%	50.0%
Negative Predictive Value	70.0%	70.7%
Prevalence (observed)	30.0%	30.0%
Accuracy	63.3%	70.0%
Diagnostic Odds Ratio	0.88	2.41

Table 11 indicates that although specificity (i.e., correct rejections) of the EAT-26 and EDE-Q at the current cutoff scores of ≥ 20 and ≥ 2.3, respectively, falls within the acceptable range (i.e., over 70%), both measures demonstrated very low sensitivity (i.e., accuracy among restriction positive cases) and positive predictive value (i.e., percentage of cases scoring high on the measure who actually restrict their intake). Regarding replication of the pilot study using lifetime eating disorder diagnosis as the index criterion, research has suggested a minimum of 10 positive cases are needed for sound signal detection comparisons (Obuchowski et al., 2004) and only five participants endorsed a lifetime eating disorder diagnosis in the present study. Though it should be interpreted with caution, given few positive cases, for comparison purposes, a signal detection table applied to lifetime eating disorders as the index criterion can be found in the appendix.

Area Under the Curve: EAT-26, EDE-Q, and ONI

ROC curves for the EAT-26 total score, EDE-Q global score, and ONI global score can be found in Figures 10, 11, and 12. Notably, the curves for the EAT-26 total score and the EDE-Q global score are falling near the dotted line representing measure performance at the level of chance. The ROC curve for the ONI behaviors subscale is also included in Figure 13, as this subscale demonstrated the highest AUC of the three ONI subscales.

Figure 10

EAT-26 Total Score ROC Curve

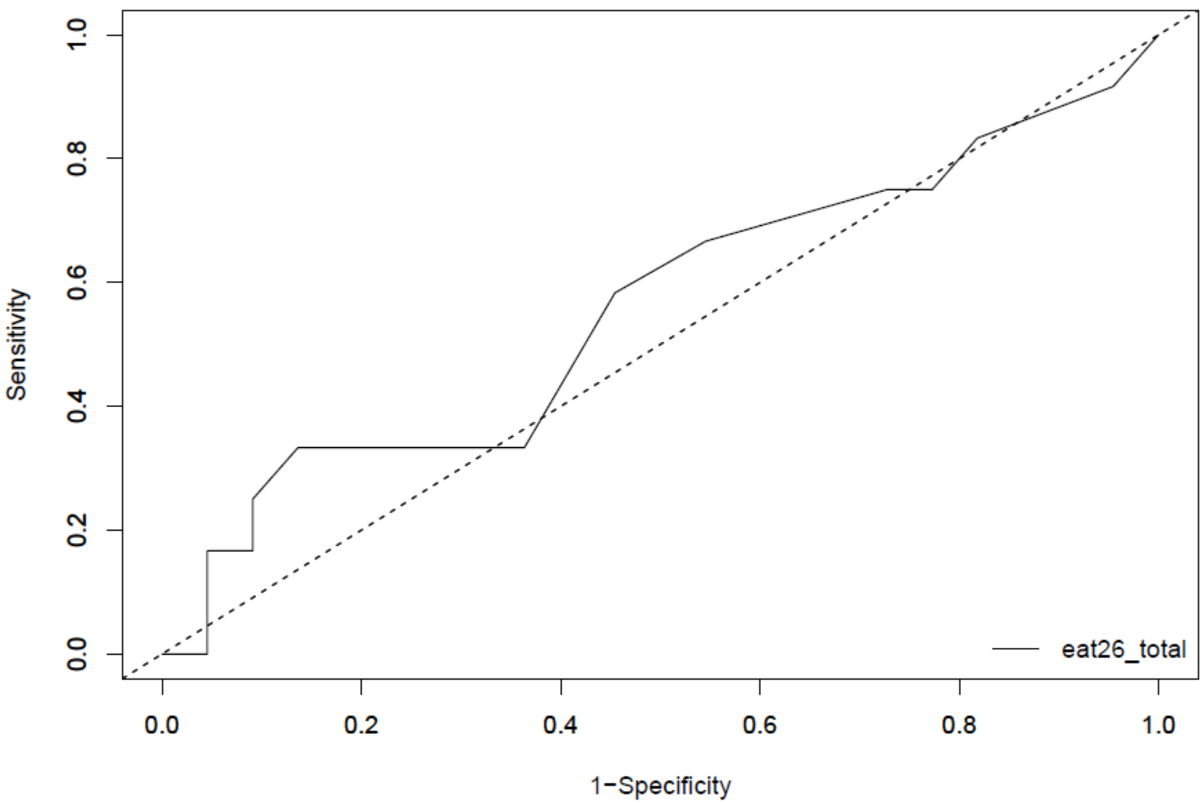


Figure 11

EDE-Q Global Score ROC Curve

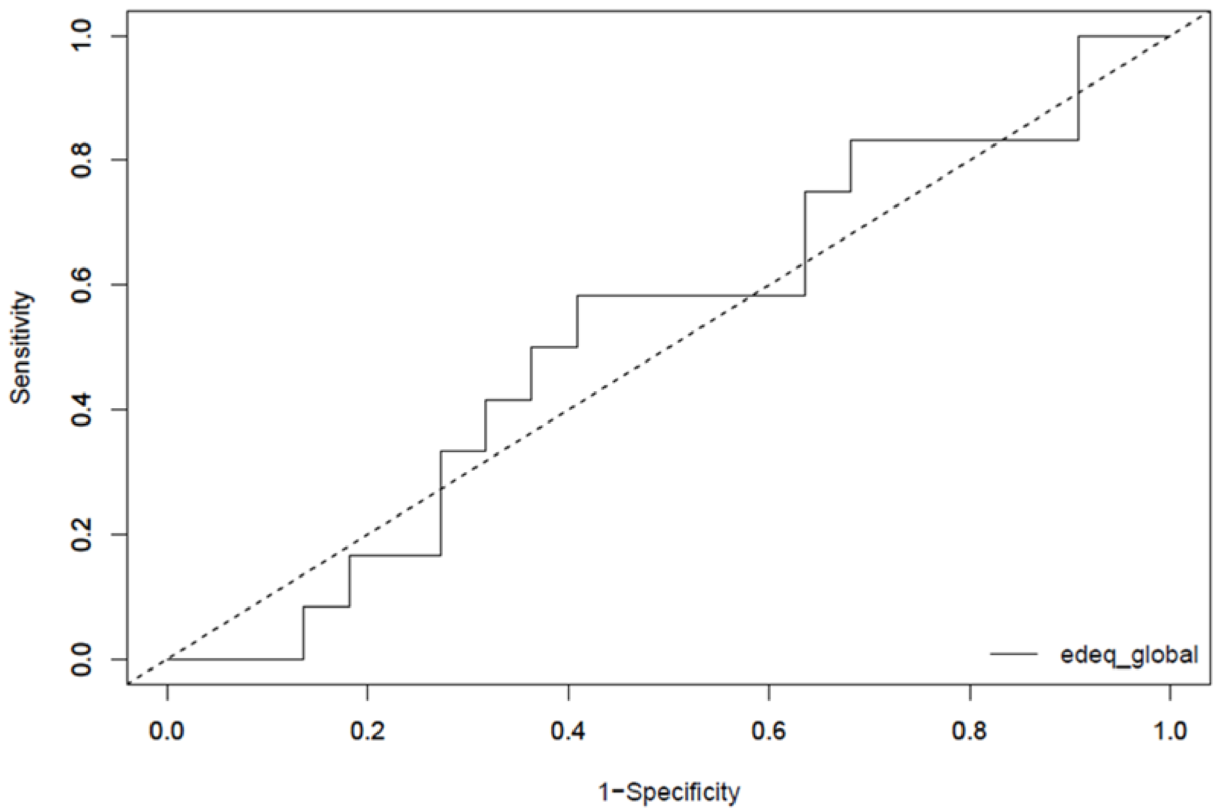


Figure 12

ONI Total Score ROC Curve

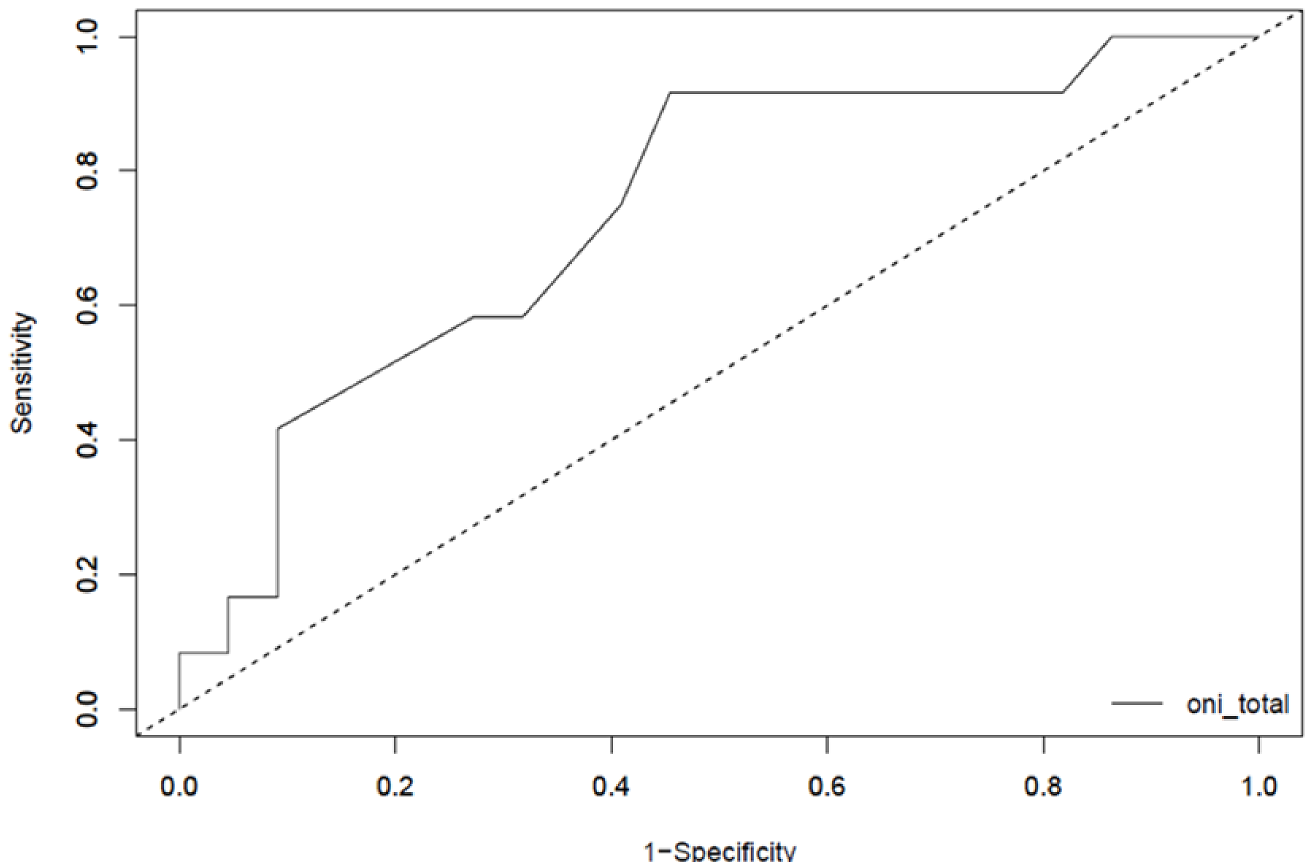
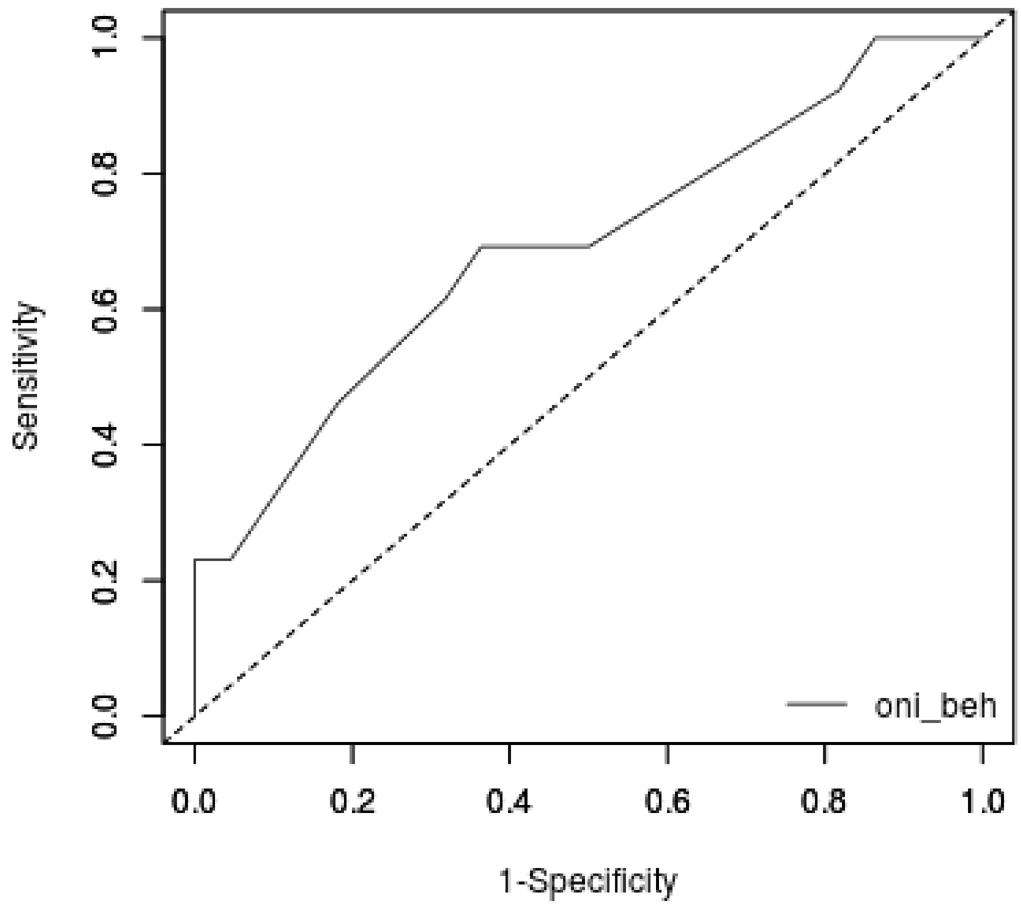


Figure 13

ONI Behaviors Subscale ROC Curve



AUC statistics for each eating screener, including total and subscale scores, can be found in Table 12. Sensitivity and specificity at the recommended cutoff score for each measure's total or global scale score are also included. Notably, the recommended cutoff score based on the current analysis for the EDE-Q and the EAT-26 is substantially lower than the typically used cutoff scores (e.g., those demonstrated in Figures 6 and 7 on pp. 39-40).

Table 12

Results of ROC Analyses

	Accuracy (AUC)	Optimal Cutoff	Sensitivity	Specificity
EDE-Q				
Global score	.52	.98	.59	.58
Restraint	.65			
Eating concern	.48			
Shape concern	.47			
Weight concern	.48			
EAT-26				
Total score	.56	11	.33	.86
Bulimia and food preoccupation	.52			
Oral control	.44			
Dieting	.58			
ONI				
Total	.74	30	.92	.55
Behaviors	.72			
Emotions	.66			
Impairment	.51			

Note. AUC = Area Under the Curve; EDE-Q = Eating Disorders Examination – Questionnaire; EAT-26 = Eating Attitudes Test – 26 items; ONI = Orthorexia Nervosa Inventory

The EDE-Q's AUC indicates a 52% probability that a randomly selected participant who restricts their intake will score higher on the EDE-Q than a participant who does not restrict their intake. The measure yielded a sensitivity of 59% (low range), specificity of 58% (low range), positive predictive value of 29.0% (below chance range), negative predictive value of 69.0% (low range), and diagnostic odds ratio of 0.91.

The EAT-26's AUC indicates a 56% probability that a randomly selected participant who restricts their intake will score higher on the EAT-26 than a participant who does not restrict their intake. These AUCs indicate the measures are performing at the level of chance. The measure yielded a sensitivity of 33% (below chance range), specificity of 55% (low range), positive predictive value of 46.2% (below chance range), negative predictive value of 74.5% (acceptable range), and diagnostic odds ratio of 2.5.

Results of the ROC for the ONI indicated an optimal cutoff score of 30 and the associated AUC suggests a 74% probability that a randomly selected participant who restricts their intake will score higher on the ONI than a participant who does not engage in restriction. This AUC falls within the acceptable range of screener performance. Of note, the behaviors subscale demonstrated the greatest accuracy at classifying participants of the three ONI subscales. In addition, the ONI total score yielded a sensitivity of 92% (high range), specificity of 55% (low range), positive predictive value of 52.4% (low range), negative predictive value of 92.3% (high range), and diagnostic odds ratio of 2.36.

Discussion

The EAT-26 and EDE-Q were developed with and have the preponderance of their evidence-base for use among adolescent girls and young adult women. Although these measures are used to detect disordered eating patterns across adulthood, using cutoff scores of ≥ 20 for the EAT-26 and ≥ 2.3 for the EDE-Q, the findings of the present study which sampled midlife and older adults indicated they operate at the level of chance (AUC = .56 and .52, respectively) for detecting potentially dangerous caloric restriction in this age group. The present study also indicated lower cutoff scores for the measures of ≥ 11 on the EAT-26 and ≥ 0.98 on the EDE-Q for optimal measure performance (though performance was within the chance range). The ONI, which focuses on health-related reasons for restriction of caloric intake, performed in the acceptable range (AUC = .74) for accurately identifying cases of energy restriction in the current sample. The present study also established an optimal recommended cutoff score of ≥ 30 on the ONI total scale for detecting energy restriction among this age group. When compared to participants who met or exceeded their daily energy requirements according to dietary recall data, participants who restricted their caloric intake tended to have a higher BMI based on self-reported height and weight, and they were more likely to endorse being on a medically prescribed diet. The combination of higher BMI and dieting prescribed by healthcare providers may have increased the salience of health-related reasons to restrict caloric intake for participants classified as restriction positive. However, contrary to the initial hypothesis, there were no significant differences in the number of self-reported medical conditions or number of current medications between individuals who restricted caloric intake and those who did not.

In contrast to the ONI's focus on health, the EAT-26 and EDE-Q emphasize shape and weight concerns without emphasizing health factors. These measures have performed well in other studies using samples of young adult women, with AUC's in the .70 to .90 range (Mintz & O'Halloran, 2000; Mond et al., 2004). The lower AUC found in the present study may be due to two distinct sets of rules for restriction of energy intake: shape/weight concerns versus health concerns. The former set of rules may be more prevalent among younger adults, while the latter may be more likely to govern eating behavior in midlife and older adulthood when both BMI and concerns about maintaining health tend to increase. Notably, research has indicated that greater risk of death is associated with lower (e.g., underweight) rather than higher (e.g., overweight or mild obesity categories) BMI categories suggesting that emphasizing weight loss to optimize health for patients with BMIs < 35 may be unnecessary and potentially detrimental compared to health risks associated with restriction and weight cycling (Berman, 2018). Regarding overall body image, literature has indicated that older adults' body image is more dependent on their perceived health and physical fitness than on thin beauty ideals targeting younger age groups (Towler et al., 2021). The EDE-Q and EAT-26 items' focus on shape/weight concerns unrelated to health may not adequately capture body-related concerns for adults 40+ years of age, particularly those that the healthcare system perceives as being at greater health risk due to their BMI, despite evidence that the metric is a poor indicator of overall health status (Berman, 2018; Nuttall, 2015). Additionally, the majority of participants in the present study endorsed changes in their eating and physical activity level due to the COVID-19 pandemic (Table 6). Given reports of COVID-19's relationship with chronic illness as well as BMI status (Haybar et al., 2020), in addition to medically prescribed restriction, health anxiety may have motivated participants to engage in lifestyle changes (including dietary restriction) aimed at lowering their risk of serious illness during the pandemic. Considering these findings, for settings serving populations of adults 40 years of age and older (e.g., primary care) using a measure that assesses health-related reasons for restriction, such as the ONI, may yield greater accuracy in detecting patients in need of behavioral health interventions to address potentially dangerous restrictive eating patterns.

Sociocultural shifts toward the importance of “healthy lifestyles” and away from “dieting” may also have contributed to participants in the present study endorsing health-related rules for restrictive eating patterns (Hanganu-Bresch, 2020). Diets designed to help individuals achieve thin body ideals were common in Western countries during the 1970s and 1980s, the era in which the EAT-26 and EDE-Q were developed (Hanganu-Bresch, 2020; Ross Arguedas, 2020). More recently, movements for body positivity and/or body acceptance have become increasingly common in the media, resulting in declining popularity of “weight loss diets” and the rise of “healthy lifestyles” for people of all ages and body sizes (Ross Arguedas, 2020). Nonetheless, it is possible that these lifestyles’ emphasis on maintaining health through specific eating patterns inadvertently encourages restriction or creates confusion regarding flexible eating versus rigid rules governing eating for health promotion (Gibson, 2021; Welsh, 2011). Patients may be particularly susceptible to confusion regarding how to implement healthy lifestyle habits as recent literature has indicated many do not follow up with their healthcare providers for further guidance (de Heer et al., 2019).

Patients, particularly those living in larger bodies, who do engage frequently with the healthcare system, whether regarding eating patterns or other health factors, are at risk of encountering weight-related bias (Flint, 2021). Increasing exposure to weight stigma within healthcare may be related to the greater accuracy of the ONI in the present study, particularly considering restriction positive cases were more likely to fall into higher BMI categories and endorse being on a diet prescribed by their healthcare provider, though they did not differ significantly from restriction negative cases regarding number of physical health conditions reported. Weight stigma is a common experience in medical settings (Tomiyama et al., 2018) and adults 40 years and older may experience greater weight stigma as their contact with the healthcare system increases---for reasons such as increased appointments for preventative screenings or for the treatment of chronic illnesses (de Heer et al., 2019; Mensinger et al., 2018). Literature has suggested that patients at higher BMIs are likely to be prescribed restrictive weight loss diets by their healthcare providers in an attempt to improve health, despite evidence suggesting that most weight loss attempts are not sustained and have limited benefit to long-term health (Berman, 2018; Tomiyama et al., 2018). Research has also suggested that such advice contributes to patient avoidance of preventative health screenings and primary care visits (Drury & Louis, 2002; Wee et al., 2008), thereby increasing these patients' risk of negative health outcomes. Notably, previous dieting and weight loss attempts are among the strongest risk factors for the development of a significantly disordered eating pattern (Puhl & Brownell, 2006; Stice, 2002; Stice et al., 2020). Items on the EAT-26 and EDE-Q may not represent these health-related reasons for restrictive eating as well as items on the ONI, resulting in decreased accuracy at detecting restriction in the present sample.

Limitations

The present study has several limitations that should inform interpretation of the results. First, the sample was homogeneous, limiting generalizability to non-White, lower socioeconomic status, and lower education individuals. Second, self-reported dietary intake data is vulnerable to under-reporting and may not accurately reflect a participant's true energy intake. We attempted to account for these limitations by using a dietary recall system that uses a gold standard method (AMPM) for dietary recall, collecting three days of intake data to establish a better indication of typical intake than a single recall, and by screening dietary recalls < 600 calories for reduced intake related to medical (e.g., current chemotherapy or recent bariatric surgery) or financial (e.g., unable to afford food) concerns. While estimates of inter-rater reliability indicated that raters agreed on case classification, under-reporting may still have occurred. Third, completion rates for the ASA24 were low. Attrition analyses did not indicate significant differences between survey only completers and ASA24 completers on demographic variables; however, differences were present on several eating measure subscales. Of note, these differences were not clinically significant and likely occurred due to variability in responding within the same population rather than across different populations (e.g., participants with disrupted eating patterns vs. those without). This study's small sample size may have limited power to detect an association between number of physical health conditions and/or medications use and classification as a positive or negative case. Additionally, the medications included in the present study focused on those related to changes in appetite and some medications impacting other eating-related processes were not included (e.g., insulin). Further, anxiety regarding current health status may have impacted restriction independent of participants' current number of health conditions. This study did not evaluate anxiety or worry related to health. The present study also did not ask follow-up questions regarding monitoring of medically prescribed diets, making it unclear whether participants were followed by their providers to monitor implementation of eating patterns or not. In addition, alcohol use rates differed significantly between positive and negative cases; however, the present study did not assess the impact of alcohol on total caloric consumption. It is possible that alcohol use among some negative cases contributed to their intake being greater than their EER, though consumption of energy from food (vs alcohol) may have been low. Finally, many participants endorsed changes in their eating and physical activity habits due to the COVID-19 pandemic and the present study did not include follow-up questions to evaluate the direction of those changes (i.e., increased or decreased). The impact of pandemic-related changes on eating and activity patterns is unclear in the present study and the results may be linked to behaviors that developed in this context.

Future Directions

In addition to addressing the above limitations, future studies should aim to replicate the results of the present study with a larger, more diverse sample. For researchers aiming to make recommendations regarding eating screening measures for public health, a sample reflecting national demographics is optimal. For clinicians aiming to decide which measure or cutoff score is best for their practice setting, replicating the present study with a sample that reflects their practice population will be beneficial to inform decision-making.

Further examination of the EAT-26, EDE-Q, and ONI at the subscale and item level may assist with the development of a novel measure to accurately identify energy restriction in adults 40 years of age and older, particularly those at higher BMIs who have been prescribed diets by their physician. Elucidation of the items that most accurately predict restrictive eating patterns may help in the development of a more efficient and accurate measure. This may be particularly helpful since all three measures may be too long for use as brief, public health screeners.

Conclusion

The EAT-26 and EDE-Q were developed to emphasize overvaluation of shape and weight thought to underlie disordered eating patterns among adolescent girls and young adult women. The results of the present study suggest they perform at the level of chance when attempting to identify cases of substantial energy restriction among adults aged 40 years and older. The ONI, containing items emphasizing health-related reasons for restriction, performed in the acceptable range, using the cutoff score of ≥ 30 indicated in the present study, for detecting participants who restricted their intake. Although initial hypotheses regarding increased number of health conditions contributing to restriction were not supported, the present study found that participants who restricted their caloric intake were more likely to have higher BMIs and endorse being on medically prescribed diets than those who did not restrict their intake. The EAT-26 and EDE-Q's decreased accuracy may be related to increased importance of health-related reasons for restriction (vs. overvaluation of shape and weight) in middle and late life, particularly for patients living in larger bodies who have been prescribed diets by their healthcare providers and may not have received adequate healthcare provider advice regarding how to do so to optimize health markers rather than with the goal of lowering BMI (de Heer, 2019). Given the increasing incidence of disrupted eating patterns among this age group, it is important that clinicians be aware that measures demonstrating accuracy in younger cohorts may not accurately identify cases of energy restriction in older populations. Thus, clinicians serving patients 40 years of age and older may wish to consider using a screening measure that encompasses health-related rules about eating, such as the ONI, as this may increase accurate detections of restriction among their patients.

References

Agarwal, E. (2017). Disease-related malnutrition in the twenty-first century: From best evidence to best practice. *Nutrition & Dietetics*, *74*(3), 213–216. https://doi.org/10.1111/1747-0080.12364

Basiotis, P. P., Welsh, S. O., Cronin, F. J., Kelsay, J. L., & Mertz, W. (1987). Number of days of food intake records required to estimate individual and group nutrient intakes with defined confidence. *The Journal of Nutrition*, *117*(9), 1638–1641. https://doi.org/10.1093/jn/117.9.1638

Berde, C., & Nurko, S. (2008). Opioid side effects—Mechanism-based therapy. *The New England Journal of Medicine; Boston*, *358*(22), 2400–2402. http://dx.doi.org/10.1056/NEJMe0801783

Berg, K. C., Peterson, C. B., Frazier, P., & Crow, S. J. (2012). Psychometric evaluation of the Eating Disorder Examination and Eating Disorder Examination-Questionnaire: A systematic review of the literature. *International Journal of Eating Disorders*, *45*(3), 428–438. https://doi.org/10.1002/eat.20931

Berman, M.I. (2018). *A clinician's guide to acceptance-based approaches for weight concerns*. Routledge.

Brown, C. D., & Davis, H. T. (2006). Receiver operating characteristics curves and related decision measures: A tutorial. *Chemometrics and Intelligent Laboratory Systems*, *80*(1), 24–38. https://doi.org/10.1016/j.chemolab.2005.05.004

Carl, L., & Johnson, P. (2008). Drugs and dysphagia. *Perspectives on Swallowing and Swallowing Disorders*, *17*(4), 143–148. https://doi.org/10.1044/sasd17.4.143

Cederholm, T., Jensen, G. L., Correia, M. I. T. D., Gonzalez, M. C., Fukushima, R., Higashiguchi, T., Baptista, G., Barazzoni, R., Blaauw, R., Coats, A., Crivelli, A., Evans,

D. C., Gramlich, L., Fuchs-Tarlovsky, V., Keller, H., Llido, L., Malone, A., Mogensen, K. M., Morley, J. E., … Yu, J. (2019). GLIM criteria for the diagnosis of malnutrition – A consensus report from the global clinical nutrition community. *Clinical Nutrition*, *38*(1), 1–9. https://doi.org/10.1016/j.clnu.2018.08.002

Centers for Disease Control and Prevention. (2009). *Percent of U.S. adults 55 and over with chronic conditions*. https://www.cdc.gov/nchs/health_policy/adult_chronic _conditions.htm.

Centers for Disease Control and Prevention & National Center for Health Statistics (2018). *National Health and Nutrition Examination Survey data*. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. https://wwwn.cdc.gov /nchs/nhanes/search/datapage.aspx?Component=Dietary&CycleBeginYear=2017

Dahlgren, C. L., & Wisting, L. (2016). Transitioning from DSM-IV to DSM-5: A systematic review of eating disorder prevalence assessment. *International Journal of Eating Disorders*, *49*(11), 975–997. https://doi.org/10.1002/eat.22596

de Heer, H., Kinslow, B., Lane, T., Tuckman, R., & Warren, M. (2019). Only 1 in 10 patients told to lose weight seek help from a health professional: A nationally representative sample. *American Journal of Health Promotion*, *33*(7), 1049–1052. https://doi.org/10.1177/0890117119839904

Dotti, A., & Lazzari, R. (1998). Validation and reliability of the Italian EAT-26. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, *3*(4), 188–194. https://doi.org/10.1007/BF03340009

Drury, C. & Louis, M. (2002). Exploring the association between body weight, stigma of obesity, and health care avoidance. *Journal of the American Academy of Nurse Practitioners*, *14*(12), 554–561. https://doi.org/10.1111/j.1745-7599.2002.tb00089.x

Elran-Barak, R., Fitzsimmons-Craft, E. E., Benyamini, Y., Crow, S. J., Peterson, C. B., Hill, L. L., Crosby, R. D., Mitchell, J. E., & Le Grange, D. (2015). Anorexia nervosa, bulimia nervosa, and binge eating disorder in midlife and beyond. *The Journal of Nervous and Mental Disease*, *203*(8), 583–590. https://doi.org/10.1097/NMD.0000000000000333

Elsner, R. J. F. (2002). Changes in eating behavior during the aging process. *Eating Behaviors*, *3*(1), 15–43. https://doi.org/10.1016/S1471-0153(01)00041-1

Fairburn, C. G. (2008). *Cognitive behavior therapy and eating disorders*. The Guilford Press.

Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire? *International Journal of Eating Disorders*, *16*(4), 363–370.

Fan, J., Upadhye, S., & Worster, A. (2006). Understanding receiver operating characteristic (ROC) curves. *Canadian Journal of Emergency Medicine*, *8*(01), 19–20. https://doi.org/10.1017/S1481803500013336

Farshchi, H., Rane, A., Love, A., & Kennedy, R. L. (2007). Diet and nutrition in polycystic ovary syndrome (PCOS): Pointers for nutritional management. *Journal of Obstetrics and Gynaecology*, *27*(8), 762–773. https://doi.org/10.1080/01443610701667338

Fischer, J. E., Bachmann, L. M., & Jaeschke, R. (2003). A readers' guide to the interpretation of diagnostic test properties: Clinical example of sepsis. *Intensive Care Medicine*, *29*(7), 1043–1051. https://doi.org/10.1007/s00134-003-1761-8

Flint, S. W. (2021). Time to end weight stigma in healthcare. *Clinical Medicine*, *34*, 100810. https://doi.org/10.1016/j.eclinm.2021.100810

Gallagher, L., & Naidoo, P. (2009). Prescription drugs and their effects on swallowing. *Dysphagia*, *24*(2), 159–166. https://doi.org/10.1007/s00455-008-9187-7

Garner, D., & Garfinkel, P. E. (1979). The Eating Attitudes Test: An index of the symptoms of anorexia nervosa. *Psychological Medicine*, *9*, 273–279.

Garner, D., Olmsted, M. P., Bohr, Y., & Garfinkel, P. E. (1982). The Eating Attitudes Test: Psychometric features and clinical correlates. *Psychological Medicine*, *12*, 871–878.

Gerrior, S., Juan, W., & Peter, B. (2006). An easy approach to calculating estimated energy requirements. *Preventing Chronic Disease*, *3*(4), 1-4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1784117/

Gibbs, E. L., Kass, A. E., Eichen, D. M., Fitzsimmons-Craft, E. E., Trockel, M., Wilfley, D. E., & Taylor, C. B. (2016). Attention-deficit/hyperactivity disorder–specific stimulant misuse, mood, anxiety, and stress in college-age women at high risk for or with eating disorders. *Journal of American College Health*, *64*(4), 300–308. https://doi.org/10.1080/07448481.2016.1138477

Gibson, G. (2021). Health(ism) at every size: The duties of the "good fatty." *Fat Studies*, 1–14. https://doi.org/10.1080/21604851.2021.1906526

Gleaves, D. H., Pearson, C. A., Ambwani, S., & Morey, L. C. (2014). Measuring eating disorder attitudes and behaviors: A reliability generalization study. *Journal of Eating Disorders*, *2*(1), 6. https://doi.org/10.1186/2050-2974-2-6

Goksuluk, D., Korkmaz, S., Zararsiz, G., & Karaagaoglo, A. (2016). EasyROC: An interactive web-tool for roc curve analysis using R language environment. *The R Journal*, *8*(2), 213–230.

Goodwin, R. D., Hoven, C. W., & Spitzer, R. L. (2003). Diabetes and eating disorders in primary care. *International Journal of Eating Disorders*, *33*(1), 85–91. https://doi.org/10.1002/eat.10106

Greaney, M. L., Cohen, S. A., Xu, F., Ward-Ritacco, C. L., & Riebe, D. (2020). Healthcare provider counselling for weight management behaviours among adults with overweight or obesity: A cross-sectional analysis of National Health and Nutrition Examination Survey, 2011-2018. *BMJ Open*, *10*(11), e039295. https://doi.org/10.1136/bmjopen-2020-039295

Haybar, H., Kazemnia, K., & Rahim, F. (2020). Underlying chronic disease and COVID-19 infection: A state-of-the-art review. *Jundishapur Journal of Chronic Disease Care*, *9*(2), 1-7. https://doi.org/10.5812/jjcdc.103452

Hanganu-Bresch, C. (2020). Orthorexia: Eating right in the context of healthism. *Medical Humanities*, *46*(3), 311–322. http://dx.doi.org/10.1136/medhum-2019-011681

Haque, N., Salma, U., Nurunnabi, T. R., Uddin, M. J., Jahangir, M. F. K., Islam, S. M. Z., & Kamruzzaman, M. (2011). Management of type 2 diabetes mellitus by lifestyle, diet and medicinal plants. *Pakistan Journal of Biological Sciences 14*(1), 13–24.

Hayakawa, N., Tanaka, S., Hirata, N., Ogino, S., & Ozaki, N. (2019). A battery of self-screening instruments and self-reported body frame could not detect eating disorders among college students. *BMC Research Notes*, *12*(1), 613. https://doi.org/10.1186/s13104-019-4672-7

Hilbert, A., de Zwaan, M., & Braehler, E. (2012). How frequent are eating disturbances in the population? Norms of the eating disorder examination-questionnaire. *PLoS ONE*, *7*(1), e29125. https://doi.org/10.1371/journal.pone.0029125

Himmerich, H., & Treasure, J. (2018). Psychopharmacological advances in eating disorders. *Expert Review of Clinical Pharmacology*, *11*(1), 95–108. https://doi.org/10.1080/17512433.2018.1383895

Jackson, S. E., Beeken, R. J., & Wardle, J. (2015). Obesity, perceived weight discrimination, and psychological well-being in older adults in England. *Obesity*, *23*(5), 1105–1111. https://doi.org/10.1002/oby.21052

Jenkins, P. E., & Price, T. (2018). Eating pathology in midlife women: Similar or different to younger counterparts? *International Journal of Eating Disorders*, *51*(1), 3–9. https://doi.org/10.1002/eat.22810

Jennings, K. M., & Phillips, K. E. (2017). Eating Disorder Examination–Questionnaire (EDE–Q): Norms for a clinical sample of males. *Archives of Psychiatric Nursing*, *31*(1), 73–76. https://doi.org/10.1016/j.apnu.2016.08.004

Johnson, C. S., & Bedford, J. (2004). Eating attitudes across age and gender groups: A Canadian study. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, *9*(1), 16–23. https://doi.org/10.1007/BF03325040

Kim, Y., Kim, G. M., Son, S., Song, M., Park, S., Chung, H. C., & Lee, S.-M. (2020). Changes in taste and food preferences in breast cancer patients receiving chemotherapy: A pilot study. *Supportive Care in Cancer*, *28*(3), 1265–1275. https://doi.org/10.1007/s00520-019-04924-9

Kirkpatrick, S. I., Subar, A. F., Douglass, D., Zimmerman, T. P., Thompson, F. E., Kahle, L. L., George, S. M., Dodd, K. W., & Potischman, N. (2014). Performance of the Automated Self-Administered 24-hour Recall relative to a measure of true intakes and to an interviewer-administered 24-h recall. *The American Journal of Clinical Nutrition*, *100*(1), 233–240. https://doi.org/10.3945/ajcn.114.083238

Koslowsky, M., Scheinberg, Z., Bleich, A., Mark, M., Apter, A., Danon, Y., & Solomon, Z. (1992). Factor structure and criterion validity of the short form of the eating attitudes test. *Journal of Personality Assessment*, *58*(1), 27–35.

Krautbauer, K. H., & Drossel, C. (2018a). Cancer-related eating problems. In A. Maragakis & W. T. O'Donohue (Eds.), *Principle-based stepped care and brief psychotherapy for integrated care settings* (pp. 89–97). Springer International Publishing. https://doi.org/10.1007/978-3-319-70539-2_9

Krautbauer, K. H., & Drossel, C. (2018b). *Eating and health in middle and older adulthood [Unpublished raw data]* [Data set]. Eastern Michigan University.

Krystock, A. (2014). Role of lifestyle and diet in the management of polycystic ovarian syndrome. In L. Pal (Ed.), *Polycystic ovary syndrome: Current and emerging concepts* (pp. 147–164). Springer. https://doi.org/10.1007/978-1-4614-8394-6_9

Kupis, J., Johnson, S., Hallihan, G., & Olstad, D. L. (2019). Assessing the usability of the Automated Self-Administered Dietary Assessment Tool (ASA24) among low-income adults. *Nutrients*, *11*(1), 132. https://doi.org/10.3390/nu11010132

Kurnia, D. A., Yulia, Waluyo, A., & Indrachayani, A. (2019). The lived experience of colorectal cancer patients with undernutrition in meeting their nutritional needs. *Enfermería Clínica*, *29*, 176–181. https://doi.org/10.1016/j.enfcli.2019.04.050

Laviano, A., Meguid, M. M., & Rossi-Fanelli, F. (2003). Cancer anorexia: Clinical implications, pathogenesis, and therapeutic strategies. *The Lancet Oncology*, *4*(11), 686–694. https://doi.org/10.1016/S1470-2045(03)01247-6

Lee, S., Kwok, K., Liau, C., & Leung, T. (2002). Screening Chinese patients with eating disorders using the Eating Attitudes Test in Hong Kong. *International Journal of Eating Disorders*, *32*(1), 91–97. https://doi.org/10.1002/eat.10064

Linardon, J., Fairburn, C. G., Fitzsimmons-Craft, E. E., Wilfley, D. E., & Brennan, L. (2017). The empirical status of the third-wave behaviour therapies for the treatment of eating disorders: A systematic review. *Clinical Psychology Review*, *58*, 125–140. https://doi.org/10.1016/j.cpr.2017.10.005

Ma, Y., Olendzki, B. C., Pagoto, S. L., Hurley, T. G., Magner, R. P., Ockene, I. S., Schneider, K. L., Merriam, P. A., & Hébert, J. R. (2009). Number of 24-hour diet recalls needed to estimate energy intake. *Annals of Epidemiology*, *19*(8), 553–559. https://doi.org/10.1016/j.annepidem.2009.04.010

Maisey, S., Loughridge, J., Southon, S., & Fulcher, R. (1995). Variation in food group and nutrient intake with day of the week in an elderly population. *British Journal of Nutrition*, *73*(3), 359–373. https://doi.org/10.1079/BJN19950039

Mangweth-Matzek, B., Kummer, K. K., & Pope, H. G. (2016). Eating disorder symptoms in middle-aged and older men: Eating disorder symptoms in middle aged men. *International Journal of Eating Disorders*, *49*(10), 953–957. https://doi.org/10.1002/eat.22550

Martin, C. B., & Ogden, C. L. (2019). *Prescription drug use in the United States, 2015–2016* [NCHS Data Brief]. Centers for Disease Control and Prevention.

Marvanova, M., & Gramith, K. (2018). Role of antidepressants in the treatment of adults with anorexia nervosa. *Mental Health Clinician*, *8*(3), 127–137. https://doi.org/10.9740/mhc.2018.05.127

Mattes, R. D., Arnold, C., & Boraas, M. (1987). Learned food aversions among cancer chemotherapy patients: Incidence, nature, and clinical implications. *Cancer*, *60*(10), 2576–2580. https://doi.org/10.1002/1097-0142(19871115)60:10<2576::AID-CNCR2820601038>3.0.CO;2-5

McFall, R. M., & Treat, T. A. (1999). Quantifying the information value of clinical assessments with signal detection theory. *Annual Review of Psychology*, *50*(1), 215–241. https://doi.org/10.1146/annurev.psych.50.1.215

McNicol, E., Horowicz-Mehler, N., Fisk, R. A., Bennett, K., Gialeli-Goudas, M., Chew, P. W., Lau, J., & Carr, D. (2003). Management of opioid side effects in cancer-related and chronic noncancer pain: A systematic review. *The Journal of Pain*, *4*(5), 231–256. https://doi.org/10.1016/S1526-5900(03)00556-X

Mensinger, J. L., Tylka, T. L., & Calamari, M. E. (2018). Mechanisms underlying weight status and healthcare avoidance in women: A study of weight stigma, body-related shame and guilt, and healthcare stress. *Body Image*, *25*, 139–147. https://doi.org/10.1016/j.bodyim.2018.03.001

Microsoft Excel. (2016). Microsoft Corporation. https://office.microsoft.com/excel

Midlarsky, E., & Nitzburg, G. (2008). Eating disorders in middle-aged women. *The Journal of General Psychology*, *135*(4), 393–408. https://doi.org/10.3200/GENP.135.4.393-408

Mintz, L. B., & O'Halloran, M. S. (2000). The Eating Attitudes Test: Validation with DSM-IV eating disorder criteria. *Journal of Personality Assessment*, *74*(3), 489–503. https://doi.org/10.1207/S15327752JPA7403_11

Mond, J. M., Hay, P. J., Rodgers, B., & Owen, C. (2006). Eating Disorder Examination Questionnaire (EDE-Q): Norms for young adult women. *Behaviour Research and Therapy*, *44*(1), 53–62. https://doi.org/10.1016/j.brat.2004.12.003

Mond, J. M., Hay, P. J., Rodgers, B., Owen, C., & Beumont, P. J. V. (2004). Validity of the Eating Disorder Examination Questionnaire (EDE-Q) in screening for eating disorders in community samples. *Behaviour Research and Therapy*, *42*(5), 551–567. https://doi.org/10.1016/S0005-7967(03)00161-X

Mond, J. M., Myers, T. C., Crosby, R. D., Hay, P. J., Rodgers, B., Morgan, J. F., Hubert Lacey, J., & Mitchell, J. E. (2008). Screening for eating disorders in primary care: EDE-Q versus SCOFF. *Behaviour Research and Therapy*, *46*(5), 612–622. https://doi.org/10.1016/j.brat.2008.02.003

Moshfegh, A. J., Rhodes, D. G., Baer, D. J., Murayi, T., Clemens, J. C., Rumpler, W. V., Paul, D. R., Sebastian, R. S., Kuczynski, K. J., Ingwersen, L. A., Staples, R. C., & Cleveland, L. E. (2008). The US Department of Agriculture Automated Multiple-Pass Method reduces bias in the collection of energy intakes. *The American Journal of Clinical Nutrition*, *88*(2), 324–332. https://doi.org/10.1093/ajcn/88.2.324

National Cancer Institute. (n.d.). *Learn more about day-of-week effect*. Dietary assessment primer. Retrieved July 3, 2020, from https://dietassessmentprimer.cancer.gov/learn/day.html

National Cancer Institute. (2018). *Cancer of Any Site—Cancer Stat Facts* [SEER Cancer Stat Facts: Cancer of Any Site]. National Cancer Institute. https://seer.cancer.gov/statfacts/html/all.html

National Institutes of Health. (2020). *Summary tables: Recommendations on potential approaches to dietary assessment for different research objectives requiring group-level estimates*. National Institues of Health. https://dietassessmentprimer.cancer.gov/approach/table.html

Nelson, M., Black, A., Morris, J. A., & Cole, T. J. (1989). Between and with-in subject variation in nutrient intake from infancy to old age: Estimating the number of days required to rank dietary intakes with desired precision. *The American Journal of Clinical Nutrition*, *50*, 155–167.

Nuttall, F. Q. (2015). Obesity, BMI, and health: A critical review. *Nutrition Today*, *50*(3), 117–128. https://doi.org/10.1097/NT.0000000000000092

Oberle, C. D., De Nadai, A. S., & Madrid, A. L. (2020). Orthorexia Nervosa Inventory (ONI): Development and validation of a new measure of orthorexic symptomatology. *Eating and Weight Disorders---Studies on Anorexia, Bulimia and Obesity, 26,* 609-622. https://doi.org/10.1007/s40519-020-00896-6

Orbitello, B., Ciano, R., Corsaro, M., Rocco, P. L., Taboga, C., Tonutti, L., Armellini, M., & Balestrieri, M. (2006). The EAT-26 as screening instrument for clinical nutrition unit attenders. *International Journal of Obesity; London*, *30*(6), 977–981. http://dx.doi.org/10.1038/sj.ijo.0803238

Obuchowski, N. A., Lieber, M. L., & Wians, F. H., Jr. (2004). ROC curves in clinical chemistry: Uses, misuses, and possible solutions. *Clinical Chemistry*, *50*(7), 1118–1125. https://doi.org/10.1373/clinchem.2004.031823

Panel on Macronutrients, Panel on the Definition of Dietary Fiber, Subcommittee on Upper Reference Levels of Nutrients, Subcommittee on Interpretation and Uses of Dietary

Reference Intakes, Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, & Institute of Medicine. (2005). *Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids*. National Academies Press. https://doi.org/10.17226/10490

Patton, G. C., Johnson-Sabine, E., Wood, K., Mann, A. H., & Wakeling, A. (1990). Abnormal eating attitudes in London schoolgirls---A prospective epidemiological study: Outcome at twelve month follow-up. *Psychological Medicine*, *20*(2), 383–394. https://doi.org/10.1017/S0033291700017700

Piotrowski, C. (2018). Assessment measures in research on eating disorders: Most prominent evaluation methods spanning the scholarly literature. *SIS Journal of Projective Psychology & Mental Health*, *25*(2), 120–127.

Pirlich, M., & Lochs, H. (2001). Nutrition in the elderly. *Best Practice & Research Clinical Gastroenterology*, *15*(6), 869–884. https://doi.org/10.1053/bega.2001.0246

Porreca, F., & Ossipov, M. H. (2009). Nausea and vomiting side effects with opioid analgesics during treatment of chronic pain: Mechanisms, implications, and management options. *Pain Medicine*, *10*(4), 654–662. https://doi.org/10.1111/j.1526-4637.2009.00583.x

Puhl, R. M., & Brownell, K. D. (2006). Confronting and coping with weight stigma: An investigation of overweight and obese adults. *Obesity*, *14*(10), 1802–1815. https://doi.org/10.1038/oby.2006.208

Quick, V. M., Byrd-Bredbenner, C., & Neumark-Sztainer, D. (2013). Chronic illness and disordered eating: A discussion of the literature. *Advances in Nutrition*, *4*(3), 277–286. https://doi.org/10.3945/an.112.003608

Raevuori, A., Lukkariniemi, L., Suokas, J. T., Gissler, M., Suvisaari, J. M., & Haukka, J. (2016). Increased use of antimicrobial medication in bulimia nervosa and binge-eating disorder prior to the eating disorder treatment. *International Journal of Eating Disorders*, *49*(6), 542–552. https://doi.org/10.1002/eat.22497

Riffenburgh, R. H. (2012). Receiver operating characteristic curves. In *Statistics in medicine* (3rd ed., pp. 211–214). Academic Press.

Rivas, T., Bersabé, R., Jiménez, M., & Berrocal, C. (2010). The Eating Attitudes Test (EAT-26): Reliability and validity in Spanish female samples. *The Spanish Journal of Psychology*, *13*(2), 1044–1056. https://doi.org/10.1017/S1138741600002687

Ross Arguedas, A. A. (2020). "Can naughty be healthy?": Healthism and its discontents in news coverage of orthorexia nervosa. *Social Science & Medicine*, *246*, 112784. https://doi.org/10.1016/j.socscimed.2020.112784

Skånland, S. S., & Cieślar-Pobuda, A. (2019). Off-label uses of drugs for depression. *European Journal of Pharmacology*, *865*, 172732. https://doi.org/10.1016/j.ejphar.2019.172732

Smith, F. M., Latchford, G. J., Hall, R. M., & Dickson, R. A. (2008). Do chronic medical conditions increase the risk of eating disorder? A cross-sectional investigation of eating pathology in adolescent females with scoliosis and diabetes. *Journal of Adolescent Health*, *42*(1), 58–63. https://doi.org/10.1016/j.jadohealth.2007.08.008

Smith, K. E., Mason, T. B., Murray, S. B., Griffiths, S., Leonard, R. C., Wetterneck, C. T., Smith, B. E. R., Farrell, N. R., Riemann, B. C., & Lavender, J. M. (2017). Male clinical norms and sex differences on the Eating Disorder Inventory (EDI) and Eating Disorder Examination Questionnaire (EDE-Q). *International Journal of Eating Disorders*, *50*(7), 769–775. https://doi.org/10.1002/eat.22716

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin*, *128*(5), 825–848. http://dx.doi.org/10.1037/0033-2909.128.5.825

Stice, E., Rohde, P., Shaw, H., & Desjardins, C. (2020). Weight suppression increases odds for future onset of anorexia nervosa, bulimia nervosa, and purging disorder, but not binge eating disorder. *The American Journal of Clinical Nutrition*, *112*(4), 941–947. https://doi.org/10.1093/ajcn/nqaa146

Strategic Training Initiative for the Prevention of Eating Disorders, & Academy for Eating Disorders. (2020). *Social and economic cost of eating disorders in the United States of America*. Deloitte Economics. https://www2.deloitte.com/au/en/pages/economics/ articles/social-economic-cost-eating-disorders-united-states.html

Streiner, D. L., & Cairney, J. (2007). What's under the ROC? An introduction to receiver operating characteristics curves. *The Canadian Journal of Psychiatry*, *52*(2), 121–128. https://doi.org/10.1177/070674370705200210

Striegel-Moore, R. H., Perrin, N., DeBar, L., Wilson, G. T., Rosselli, F., & Kraemer, H. C. (2009). Screening for binge eating disorders using the Patient Health Questionnaire in a community sample. *International Journal of Eating Disorders, 43*, (337-343). https://doi.org/10.1002/eat.20694

Subar, A. F., Potischman, N., Dodd, K. W., Thompson, F. E., Baer, D. J., Schoeller, D. A., Midthune, D., Kipnis, V., Kirkpatrick, S. I., Mittl, B., Zimmerman, T. P., Douglass, D., Bowles, H. R., & Park, Y. (2020). Performance and feasibility of recalls completed using the Automated Self-Administered 24-Hour Dietary Assessment Tool in relation to other self-report tools and biomarkers in the interactive diet and activity tracking in AARP

(IDATA) study. *Journal of the Academy of Nutrition and Dietetics*, *120*(11), 1805-1820. https://doi.org/10.1016/j.jand.2020.06.015

Sun, Y., Roth, D. L., Ritchie, C. S., Burgio, K. L., & Locher, J. L. (2010). Reliability and predictive validity of energy intake measures from the 24-hour dietary recalls of homebound older adults. *Journal of the American Dietetic Association*, *110*(5), 773–778. https://doi.org/10.1016/j.jada.2010.02.003

Swets, J. A. (1988). Measuring the accuracy of diagnostic systems. *Science*, *240*(4857), 1285.

Swets, J. A. (2014). *Signal detection theory and roc analysis in psychology and diagnostics: Collected papers*. Psychology Press.

Thomas, D. R. (2007). Loss of skeletal muscle mass in aging: Examining the relationship of starvation, sarcopenia and cachexia. *Clinical Nutrition*, *26*(4), 389–399. https://doi.org/10.1016/j.clnu.2007.03.008

Thompson, F. E., Dixit-Joshi, S., Potischman, N., Dodd, K. W., Kirkpatrick, S. I., Kushi, L. H., Alexander, G. L., Coleman, L. A., Zimmerman, T. P., Sundaram, M. E., Clancy, H. A., Groesbeck, M., Douglass, D., George, S. M., Schap, T. E., & Subar, A. F. (2015). Comparison of interviewer-administered and automated self-administered 24-hour dietary recalls in 3 diverse integrated health systems. *American Journal of Epidemiology*, *181*(12), 970–978. https://doi.org/10.1093/aje/kwu467

Thompson, F. E., & Subar, A. F. (2017). Dietary assessment methodology. In *Nutrition in the prevention and treatment of disease* (pp. 5–48). Elsevier. https://doi.org/10.1016/B978-0-12-802928-2.00001-1

Tomiyama, A. J., Carr, D., Granberg, E. M., Major, B., Robinson, E., Sutin, A. R., & Brewis, A. (2018). How and why weight stigma drives the obesity 'epidemic' and harms health. *BMC Medicine*, *16*, 1-6. http://dx.doi.org/10.1186/s12916-018-1116-5

Towler, L. B., Graham, C. A., Bishop, F. L., & Hinchliff, S. (2021). Older adults' embodied experiences of aging and their perceptions of societal stigmas toward sexuality in later life. *Social Science & Medicine*, *287*, 114355. https://doi.org/10.1016/j.socscimed.2021.114355

Towne, T. L., De Young, K. P., & Anderson, D. A. (2017). Trends in professionals' use of eating disorder assessment instruments. *Professional Psychology: Research and Practice*, *48*(4), 243–250. http://dx.doi.org/10.1037/pro0000067

Trumbo, P., Schlicker, S., Yates, A. A., & Poos, M. (2002). Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids. *Journal of the American Dietetic Association*, *102*(11), 1621–1630. https://doi.org/10.1016/S0002-8223(02)90346-9

U.S. Department of Health and Human Services, & U.S. Department of Agriculture. (2015). *2015-2020 dietary guidelines for Americans* (8th ed.). http://health.gov/dietaryguidelines/2015/guidelines/

Volkert, D., Beck, A. M., Cederholm, T., Cruz-Jentoft, A., Goisser, S., Hooper, L., Kiesswetter, E., Maggio, M., Raynaud-Simon, A., Sieber, C. C., Sobotka, L., van Asselt, D., Wirth, R., & Bischoff, S. C. (2019). ESPEN guideline on clinical nutrition and hydration in geriatrics. *Clinical Nutrition*, *38*(1), 10–47. https://doi.org/10.1016/j.clnu.2018.05.024

Wee, C. C., Davis, R. B., & Hamel, M. B. (2008). Comparing the SF-12 and SF-36 health status questionnaires in patients with and without obesity. *Health and Quality of Life Outcomes*, *6*(1), 11. https://doi.org/10.1186/1477-7525-6-11

Welsh, T. L. (2011). Healthism and the bodies of women: Pleasure and discipline in the war against obesity. *Journal of Feminist Scholarship, 1*(1), 33-48.

Westin, L. (2001). *Receiver operating characteristic (ROC): Evaluating discriminance effects among decision support systems*. Department of Computing Science, Umea University.

White, J. V., Guenter, P., Jensen, G., Malone, A., & Schofield, M. (2012). Consensus statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition: Characteristics recommended for the identification and documentation of adult malnutrition (undernutrition). *Journal of the Academy of Nutrition and Dietetics*, *112*(5), 730–738. https://doi.org/10.1016/j.jand.2012.03.012

Wilkins, T., Pepitone, C., Alex, B., & Schade, R. R. (2012). Diagnosis and management of IBS in adults. *American Family Physician*, *86*(5), 419–426.

Yang, Y. C., Walsh, C. E., Johnson, M. P., Belsky, D. W., Reason, M., Curran, P., Aiello, A. E., Chanti-Ketterl, M., & Harris, K. M. (2021). Life-course trajectories of body mass index from adolescence to old age: Racial and educational disparities. *Proceedings of the National Academy of Sciences*, *118*(17), e2020167118. https://doi.org/10.1073/pnas.2020167118

Youngstrom, E. A. (2014). A primer on receiver operating characteristic analysis and diagnostic efficiency statistics for pediatric psychology: We are ready to ROC. *Journal of Pediatric Psychology*, *39*(2), 204–221. https://doi.org/10.1093/jpepsy/jst062

Appendix: Repeat of Pilot Data Analyses

The analyses conducted with the pilot data have been repeated below (Tables 13 and 14), comparing performance of the EAT-26 and EDE-Q at current cutoff scores with lifetime eating disorder diagnosis as the index criterion. As noted above, the signal detection table should be compared with caution to the pilot data as fewer than 10 positive cases of lifetime eating disorder diagnoses were present in this study (Obuchowski et al., 2004).

Table 13

Signal Detection Table

	Truth criterion	
	Self-reported lifetime eating disorder diagnosis	No self-reported lifetime eating disorder diagnosis
1. EDE-Q ≥ 2.3	2 (hits)	31 (false alarms)
2. EDE-Q < 2.3	3 (misses)	109 (correct rejections)
3. EAT-26 ≥ 20	3 (hits)	9 (false alarms)
4. EAT-26 < 20	2 (misses)	131 (correct rejections)

Note. EDE-Q = Eating Disorders Examination–Questionnaire; EAT-26 = Eating Attitudes Test–26 items.

Table 14

Signal Detection Summary Statistics

Statistics	EDE-Q	EAT-26
Sensitivity	40.0%	60.0%
Specificity	77.9%	93.6%
Positive Predictive Value	6.1%	25.0%
Negative Predictive Value	97.3%	98.5%
Prevalence (observed)	3.4%	3.4%
Accuracy	76.6%	92.4%
Diagnostic Odds Ratio	2.3	21.8