Creating a Clinical Screening Questionnaire for Eating Behaviors Associated with Overweight and Obesity

Jessica L. J. Greenwood, MD, MSPH, Maureen A. Murtaugh, PhD, RD, Emily M. Omura, BS, Steven C. Alder, PhD, and Joseph B. Stanford, MD, MSPH

Objective: The objective of this study was to associate questions about specific eating behaviors with weight. Our ultimate goal was to create a clinical screening questionnaire for eating behaviors associated with overweight and obesity.

Methods: We developed a questionnaire based on eating behaviors associated with overweight and obesity. After pilot testing and revision, we administered the questionnaire to patients in 2 primary care clinics from the Utah Health Research Network. We analyzed the relationship between measured body mass index, demographic factors, and responses to screening questions about eating behaviors and physical activity.

Results: We collected 261 completed questionnaires with weight and height measurements. With regression analysis, questions about consumption of beverages with sugar added, fruits and vegetables, and full portions served at restaurants as well as questions about physical activity were associated with body mass index and being overweight and/or obese.

Conclusions: We suggest that future research about eating behaviors focus on the questions regarding typical consumption of beverages with sugar added, fruits and vegetables, and full portions served at restaurants to further develop a tool for clinical screening. (J Am Board Fam Med 2008;21:539–48.)

Being overweight or obese is epidemic in the United States. From 2001 to 2002 the prevalence of overweight or obesity among US adults was 65.7% and the prevalence of obesity was 30.6%.[1] The associations between being overweight, obesity, and many chronic diseases, including but not limited to hypertension, type 2 diabetes mellitus, gallbladder disease, coronary heart disease, and hypercholesterolemia, are well supported.[2] Effectively and efficiently managing and preventing overweight and obesity in the primary care setting is warranted.[3]

Weight is a product of energy balance: energy intake versus energy expenditure. This study focuses on specific eating behaviors that are known to affect energy intakes and that can lead to overweight or obesity. Restaurant and fast food consumption,[4–6] large portion size,[7–11] and beverages with sugar added[12,13] are positively associated with overweight and obesity. Conversely, low–energy-dense food, eg, fruits and vegetables,[14–19] and a healthy breakfast[20–23] are negatively associated with overweight and obesity. These specific behaviors may be amenable to clinic-based counseling to identify behaviors that put patients at high-risk for being overweight or obese.[24]

Traditionally, 24-hour diet recalls, food diaries, and food frequency questionnaires are used to assess dietary behavior. Many assessment tools have been created based on these traditional methods.[25] These tools, however, focus on a specific disease processes, ie, cardiovascular disease or hyperlipidemia,[25–28] or are created for use in a nonclinical setting.[29,30] For example, the MEDFICTS (meats, eggs, dairy, fried foods, fat in baked goods, convenience foods, fats added at the table, and snacks) questionnaire is valid for identifying adherence to

diets recommended for prevention and treatment of cardiovascular disease.[26] The Fat Intake Scale reliably identifies people on a cholesterol-lowering diet.[27] The Youth Weight, Activity, Variety, and Excess Screener is a valid questionnaire for use in the classroom setting.[29] These questionnaires, however, are not brief enough for use as clinical screening instruments. To our knowledge, no tool focuses on the clinical assessment of obesity risks in relation to the 5 eating behaviors described above: consumption of fast food/restaurant food, large portion sizes, consumption of beverages with sugar added, consumption of fruits and vegetables, and consumption of breakfast.

The purpose of this study was to create and evaluate a questionnaire that associates the responses to screening questions regarding these specific eating behaviors with overweight and obesity. Our ultimate goal is to develop a screening tool for use in primary care clinics that would help providers identify these potentially modifiable behaviors among patients.

Methods
We conducted this 2-part study from May through August 2007. Eligible patients were English-speaking adults, ages 21 to 65 years, who came to 2 university-based family medicine clinics from the Utah Health Research Network. We excluded pregnant women and those who had undergone bariatric or cardiac surgery or had a known eating disorder, kidney failure, or an uncontrolled thyroid disorder. Demographic information collected included age, gender/sex, race/ethnicity, and number of years completed in school.

Phase 1—Pilot Study
Based on a literature review and consultation with experts, we created 2 versions of a self-administered questionnaire to screen for the key eating behaviors mentioned above. We combined restaurant food and fast food consumption as one eating behavior. The 2 versions differed in format and length, but contained the same concepts. Version A asked questions about typical behavior over a day or a week. Version B asked questions regarding a 1-day or 1-week recall of behaviors, and typical behavior over a day or a week. We used quota sampling to ensure equivalent number of participants of the same sex and age range from each clinic. Patients completed both versions of the questionnaire in a random order predetermined by coin toss. They were subsequently interviewed regarding their opinion of the questions for ease of understanding, accuracy of response, and true representation of behavior. The responses to the interview were entered in Stata 9 software (StataCorp LP, College Station, TX) for descriptive analysis. We reviewed and categorized all the responses. Based on descriptive analysis we created the finalized questionnaire (Appendix 1).

Phase 2—Cross-Sectional Study
One of the 2 clinic sites was used for data collection each day of the study; the clinic site for the day was selected randomly by coin toss. Patients from each clinic completed the final version of the questionnaire. A medical assistant measured and recorded height and weight. We calculated body mass index (BMI) using the following equation: (height [inches] ÷ weight^2 [pounds]) $\times$ 703. We defined normal weight as BMI 18.5 to 24.4 kg/m^2, overweight as 24.5 to 29.4 kg/m^2, and obese as more than 29.5 kg/m^2. The patients from Clinic1 and Clinic 2 were very similar; therefore, we combined the data from each clinic for all analyses. To create a cumulative variable for consumption of beverages with sugar added, we combined the responses for the questions of nondiet soda and juice or punch consumption for 1-day recall and typical behavior, respectively. Similarly, we combined the responses for the questions about fruit and vegetable intake. We then categorized the combined responses for the fruit and vegetable intake questions to >3 times a day or ≤3 times daily. Using Stata 10 statistical software (StataCorp LP) we assessed univariate associations for related questions using Spearman's correlation. We also assessed multivariate linear and logistic regressions for the outcomes of BMI, testing for a 0.05 level of significance. We adjusted for demographic variables with the multivariate and logistic models and then expanded a logistic model to adjust for demographic factors, physical activity, and the other eating behaviors.

Results
Phase 1
We collected data about 48 patients: 22 men and 26 women, 24 of whom were from Clinic 1 and 24 of

whom were from Clinic 2. The average age of the patients was 42.6 years, with relatively equal distribution between decades of life. The majority (78.7%) reported their race/ethnicity as "white/Caucasian" (Table 1). When asked which type of question was easier to understand, 42% reported the 1-day or 1-week recall, 42% reported the typical recall, and 17% reported both question types were equally understandable. In response to the questions of whether the 1-day or 1-week recall were typical for the participant, 62% answered yes for the restaurant food/fast food consumption question, 76% answered yes for the large portion size question, 83% responded yes for questions about consumption of beverages with sugar added, 58% responded yes for fruit and vegetable intake questions, and 87% responded yes for the question about eating a healthy breakfast. Conversely, when questioned verbally, participants commented that reporting typical behaviors over a period of time was more representative of that behavior than reporting behaviors from the previous day. We considered both written and verbal responses during analysis. Finally, we created a concise final version of the questionnaire with both 1-day or 1-week *and* typical behavior questions.

The final version of the questionnaire included a total of 24 items: 14 questions about specific behaviors, 4 questions about demographics, and 6 questions about exclusion. The questions regarding consumption of restaurant food, beverage with sugar added, and fruits and vegetables used an 8-point anchored scale ranging from 0 to "more than 7." We used a 7-point scale for the question of portion size with responses ranging from "never" to "always." To quantify physical activity, we used an 8-point numbered scale from 0 to 7 called the "physical activity vital signs" as developed by Joy et al (manuscript submitted for publication). The questions of age and years of schooling were open-ended, but the participants were asked to circle a response for questions about gender/sex and race/ethnicity. The responses provided were "male" or "female" and "black/African-American," "white/Caucasian," "Latino/Hispanic," "Asian," "Pacific Islander," or "other," respectively.

Phase 2

Figure 1 depicts the process of patient recruitment. Two hundred fifty-four patients were enrolled as clinic patients and 7 additional eligible patients

Table 1. Demographic Characteristics and Body Mass Index

Characteristic	N (Prevalence [%])
Phase I* (48 participants)	
Female	26 (54)
Male	22 (46)
Age (years)†	
21–29	8 (17)
30–39	13 (27)
40–49	8 (17)
50–59	16 (33)
60–65	3 (6)
Clinic 1	24 (50
Clinic 2	24 (50)
Race/ethnicity	
White/Caucasian	37 (77)
Black	2 (4)
Asian	3 (6)
Latino/Hispanic	2 (4)
Other	3 (6)
Phase 2* (261 participants)	
Female	152 (58)
Male	109 (42)
Age (years)‡	
21–29	77 (30)
30–39	74 (28)
40–49	49 (19)
50–59	50 (19)
60–65	11 (4)
Clinic 1	137 (52)
Clinic 2	124 (48)
Race/ethnicity (n = 259)	
White/Caucasian	208 (80)
Black	5 (2)
Asian	12 (5)
Latino/Hispanic	12 (5)
Other	19 (63)
Years of schooling§	—
BMI category‖	
Underweight (<18.5)	7 (3)
Normal weight (18.5–24.49)	91 (35)
Overweight (24.5–29.49)	85 (33)
Obese (≥29.5)	78 (30)

*Combined data from clinic 1 and clinic 2.
†Mean age, 42.6 ± 12.1 years.
‡Mean age, 38.4 ± 11.7 years.
§Mean, 15.7 ± 3.4 years.
‖Body mass index (n = 261) calculated from height and weight measurements taken on the same day as the survey. All measurements were recorded in inches and pounds (BMI = [height² / weight] × 703). Mean BMI, 27.7 ± 7.2.
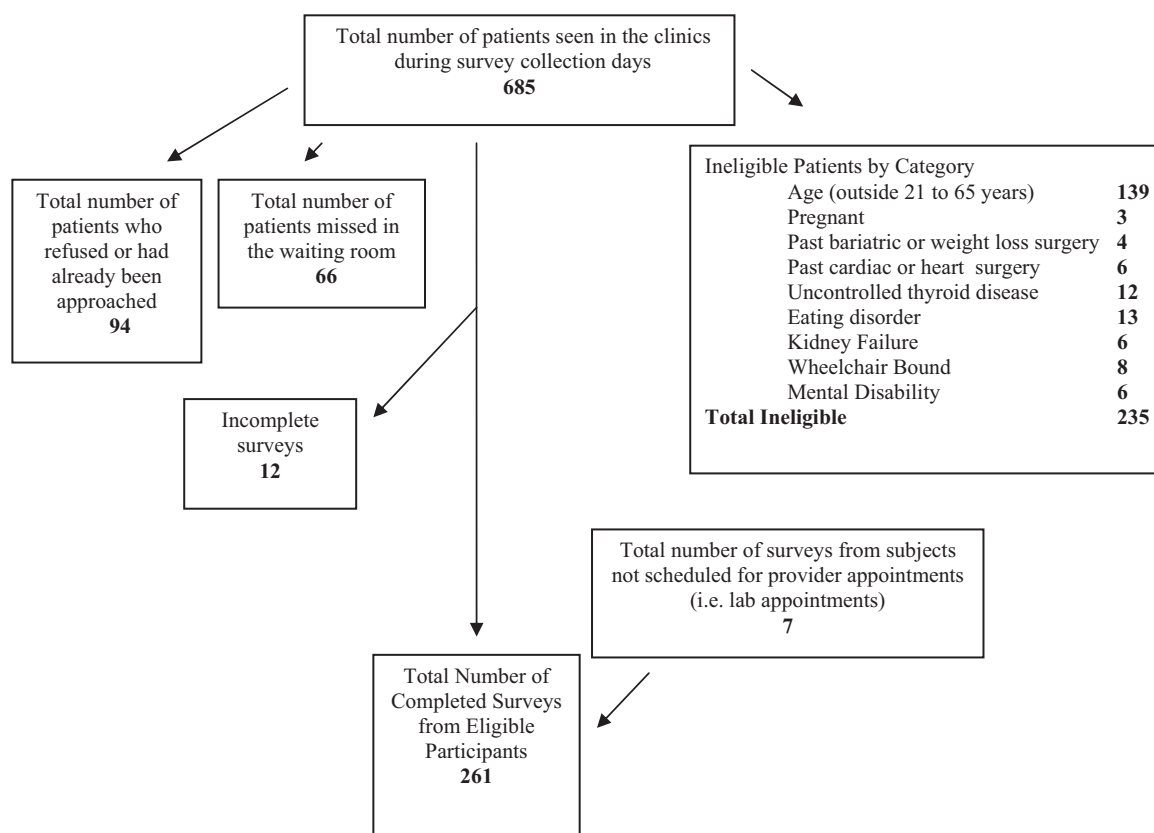
Figure 1. Survey distribution and patient eligibility.

who accompanied the clinic patients requested to take part in the study (71% participation rate). A total of 137 patients were from Clinic 1 and 124 patients were from Clinic 2. The gender/sex, age distribution, and race/ethnicity were similar for participants from each clinic. Furthermore, the mean BMI at each clinic was equal at 28 kg/m² (SD, 7.22; range, 16.68–68.65). Table 1 describes the characteristics of the combined sample. Table 2 represents the summary statistics for the responses

to each question from the finalized version of the questionnaire.

Using multivariate linear regression adjusting for age, gender/sex, race/ethnicity, and years of education, we found that associated with every additional beverage with sugar added typically consumed each day there was a 0.61 increase in BMI ($P = .006$), whereas there was no significant association with beverages with sugar added consumed the day before. We found that physical

Table 2. Summary of Responses by Question Type

Question	One-Day/Week Recall[†]	Typical Recall[†]
Restaurant and fast food	0.49 times yesterday, .74 (0–5)	2.44 times per week, 1.95 (0–8)
Beverage with sugar added	1.54 times yesterday, 1.78 (0–8)	1.97 times per day, 2.13 (0–11)
Fruits and vegetables	3.36 times yesterday, 2.41 (1–12)	3.91 times per day, 2.20 (1–13)
Breakfast	NA	4.76 times per week, 2.43 (0–7)
Full portion size	NA	2.97*, 1.76 (0–6)
Physical activity	3.01 times last week, 2.05 (0–7)	3.12 times per week, 1.91 (0–7)

*For the question regarding consumption of full portion-size meal, the value zero corresponds to "never" wheras the value 7 corresponds to "always." Otherwise, all numeric values correspond to the frequency of behavior for the given time period.
[†]Data shown as mean, SD (range).

Table 3. Change in Body Mass Index Associated with Reported Eating and Physical Activity Behaviors*

Question	One-Day or One-Week Recall (Coefficient of Change [CI])	Typical Recall (Coefficient of Change [CI])
Restaurant and fast food	1.05 (−0.20–2.30)	0.33 (−0.16–0.81)
Beverage with sugar added	−0.29 (−0.23–0.81)	0.61 (0.17–1.04)
Fruits and vegetables†	−0.27 (−2.12–1.58)	−0.39 (−2.21–1.42)
Breakfast	—	−0.24 (−0.63–0.15)
Full portion size	—	0.44 (−0.07–0.95)
Physical activity	−0.19 (−0.57–0.20)	−0.91 (−1.39 to −0.44)

*Based on multivariate linear regression analysis of body mass index, adjusted for age, gender/sex, race/ethnicity, and years of schooling.
†Represents change in body mass index with eating fruits and/or vegetables more than 3 times a day.

activity was associated with a protective effect. A 0.91-unit reduction in BMI was associated with every 1-day increase in moderate physical activity ($P < .001$). Table 3 depicts these associations between behavior and BMI categorized by response to 1-day recall and typical recall, respectively.

Using logistic regression to adjust for the same demographic factors, we found that the odds of being obese were significantly increased for consuming a full portion-sized meal (odds ratio, 1.35; $P = .006$) when compared with never consuming full portions. Furthermore, the odds of being obese decreased for those who reported engaging in moderate-intensity physical activity (odds ratio, 0.72; $P = .001$) (see Table 4).

Spearman's correlation determined that the questions of 1-day recall versus typical behavior were substantially collinear for beverages with sugar added (r = 0.71); fruit and vegetable consumption (r = 0.76); and physical activity (r = 0.78). However, the questions regarding restaurant food consumption specified 2 time periods: yesterday versus typical week. Thus, the 2 questions for the consumption of restaurant food were substantially independent (r = 0.42). These results in-

Table 4. Odds of Overweight and Obesity Associated with Reported Eating Behaviors and Physical Activity*

Screening Questions	Overweight†	Obese†
Restaurant and fast food		
1-day recall	0.75 (0.47–1.20)	1.35 (0.85–2.15)
Typical recall	1.05 (0.87–1.25)	1.00 (0.84–1.19)
Beverage with sugar added		
1-day recall	0.89 (1.74–1.07)	1.04 (0.87–1.25)
Typical recall	0.86 (0.74–1.01)	1.13 (0.97–1.31)
Fruits and vegetables‡		
1-day recall	0.55 (0.28–1.08)	1.60 (0.83–3.10)
Typical recall	0.54 (0.28–1.03)	1.48 (0.78–2.81)
Breakfast		
Typical recall	1.06 (0.92–1.21)	0.92 (0.82–1.03)
Full portion size		
Typical recall	0.81 (0.66–1.00)	1.34 (1.09–1.67)
Physical activity		
1-day recall	1.13 (0.95-1.32)	0.85 (0.72–1.00)
Typical recall	1.30 (1.08–1.57)	0.71 (0.59–0.87)

*Based on logistic regression of overweight and obesity with each eating behavior adjusted for age, gender/sex, race/ethnicity, and years of schooling. Each individual cell represents a distinct model for the logistic regression of overweight or obese, respectively, with a specific question.
†Data shown as odds ratio (CI).
‡Represents odds associated with eating fruits and/or vegetables more than 3 times a day.

Table 5. Odds of Overweight and Obesity with Mutual Adjustment for Reported Eating Behaviors and Physical Activity*

Screening Questions	Overweight[†]	Obese[†]
Restaurant and fast food		
1-day recall	0.67 (0.35–1.28)	1.50 (0.80–2.83)
Typical recall	1.11 (0.88–1.41)	0.98 (0.77–1.24)
Beverage with sugar added		
Typical recall	0.91 (0.74–1.12)	1.03 (0.84–1.27)
Fruits and vegetables[‡]		
Typical recall	0.39 (0.18–0.83)	2.28 (1.05–4.97)
Breakfast		
Typical recall	1.07 (0.91–1.26)	0.92 (0.78–1.09)
Full portion size		
Typical recall	0.78 (0.62–0.99)	1.47 (1.15–1.89)
Physical activity		
Typical recall	1.34 (1.10–1.65)	0.69 (0.56–0.85)

*Based on logistic regression of Overweight and Obesity with behaviors adjusted for age, gender/sex, race/ethnicity, schooling, physical activity and other eating behaviors. Each column represents a logistic regression model of Overweight or Obese, respectively, with all questions included.
[†]Data shown as odds ratio (CI).
[‡]Represents odds associated with eating fruits and/or vegetables more than 3 times a day.

formed the logistic regression models as described below.

As seen in Table 5, we constructed logistic regression models to include the screening questions for all target eating behaviors, physical activity, and demographic factors to predict the odds of overweight and obesity. Based on our findings from the Spearman's correlation, we included the questions of typical behaviors and both the 1-day and typical behavior for the restaurant/fast food questions. When adjusting for demographic factors, physical activity, and the other eating behaviors, the odds of being obese were 1.47 times higher for every unit increase in reported frequency of eating a full portion-sized meal compared with never eating a restaurant or fast food meal in its entirety ($P = .002$). Furthermore the odds of obesity decreased 0.69 times with each day of moderate intensity physical activity for 30 minutes or more in a typical week ($P = .001$). Finally, the odds of being overweight were 0.39 times lower for those who ate fruits and/or vegetables more than 3 times a day compared with eating these foods 3 times or fewer ($P = .015$).

Discussion

To our knowledge, this is the first study that addresses screening for several common eating be-

haviors simultaneously for their association with BMI, overweight, and obesity in a primary care setting. We found that our study population preferred to respond to questions of both 1-day or 1-week recall and typical behavior over a given period of time. For all questions except the consumption of restaurant and fast food, the responses to the 1-day/1-week and typical behavior were highly correlated, but the typical questions were more highly associated with weight outcomes. While adjusting for demographic factors, consumption of beverages with sugar added was positively associated with BMI, and consuming full portion sizes served was positively associated with obesity. Physical activity had a negative association with BMI and obesity. When adjusting for demographic factors and all behaviors, consumption of more than 3 servings of fruits and/or vegetables a day had a negative association with overweight.

This study focused on screening for behaviors related to the energy intake aspect of energy balance. The questionnaire included questions about physical activity primarily to adjust for this behavior. However, we found that physical activity had a protective effect against obesity, as would be expected. The recent Cochrane Analysis by Shaw et al[31] indicated that exercise alone decreases weight 0.5 to 4.0 kg and BMI 0.3 to 0.7 kg/m^2 compared

with weight and BMI changes of -0.1 to 0.7 kg and 0.3 to 0.4 kg/m^2, respectively, with no exercise.

The American College of Sports Medicine, US Department of Agriculture (USDA), and the Institute of Medicine (IOM) provide reasonably consistent guidelines with regard to energy expenditure. The American College of Sports Medicine and the USDA recommend at least 30 minutes of moderate physical activity 4 times a week,[32,33] whereas the IOM recommends 1 hour of moderate physical activity daily for cardiovascular health.[33] Similar simple guidelines would assist providers with counseling patients on eating behaviors. The IOM and USDA have given quantitative guidelines for food servings and macronutrient intake.[34] However, assessing caloric intake can be difficult to conceptualize and effectively communicate. A qualitative tool focused on particular behaviors known to be harmful or beneficial for maintaining healthy weight might be a more effective strategy in clinical settings. We suggest our questions regarding typical consumption of beverages with sugar added, full portions of restaurant meals, and fruits and vegetables might provide the framework for a screening tool focused on potentially modifiable behaviors.

Energy density is a measure of energy content per weight of food.[35] Foods with low energy density tend to have a high water and fiber content, such as fruits and vegetables, whereby high energy-dense foods tend to have a high fat content.[36] For the reference 2000 calorie diet, the US Department of Agriculture recommends at least four and one-half cups, or nine servings, of fruits and vegetables daily for health maintenance.[32] Our study found that the reported consumption of fruits and/or vegetables more than 3 times a day is associated with a reduced risk of overweight, which is consistent with previous research. In one study, Rolls et al found that middle aged women who ate 1.9 servings of fruits daily had a 25% lower risk of obesity (OR 0.75, $P < .001$) compared with women who ate fewer servings. Similarly, women who ate 2.8 servings of vegetables had a significantly lower risk of weight gain (OR 0.84, $P < .0001$) compared with those who eat fewer servings.[19] Furthermore, Ledikwe et al found that, compared with those eating high dense foods, those who consumed low energy-dense foods can decrease total energy intake by 432 kcal per day in men and 278 kcal per day in women.[17]

Our findings for consumption of beverages with sugar added are consistent with previous research on this behavior. Raben et al[12] found that adding ~2 g of sugar-added beverages per kilogram of body weight was associated with significant increases in energy intake (1.5 mJ/day), body weight (1.6 kg), and fat mass (1.3 kg) in adults over a 10-week period ($P < .5$). Similarly, Berkey et al[13] found that over a 1-year period, adolescent boys who drank 1 or 2 beverages with sugar added a day significantly increased their BMI by 0.10 ($P = .02$) and 0.14 ($P = .01$), respectively; adolescent girls who drank 2 or more beverages with sugar added a day significantly increase their BMI by 0.10 ($P = .046$).

Compared with other studies, we did not find significant associations for the frequency of restaurant or fast food consumption with BMI, overweight, and/or obesity. However, other investigators have found significantly positive associations between the frequency of the consumption of restaurant or fast food and increases in body weight.[4,5]

Recent findings from Duffey et al[6] suggested different associations with restaurant food consumption based on whether or not it was a fast food restaurant. BMI increased 0.13 units over 7 years with every time per week fast food consumption increased ($P = .003$). This increase in BMI was sustained at 10 years ($P = .001$). Conversely, longitudinal increases in restaurant food consumption (other than fast food) resulted in minimal decreases in BMI ($P = .756$ at 7 years; $P = .676$ at 10 years).[6] Our question combined restaurant and fast food consumption. We cannot assess the association of fast food restaurants and other restaurants separately. The lack of an association in our study may be related to combining these 2 types of food consumption into a single question.

Portion size consumed is closely related to the frequency of restaurant food consumption because the largest food portions in the United States come from restaurants and fast food establishments.[7] However, the studies of portion size are distinct from those of frequency. Several studies have shown increases in energy intake with increasing portions sizes of a meal.[8–11] Increases in energy intake, without a corresponding increase in energy expenditure, result in weight gain. Similarly, recent findings by Pedersen et al[37] indicate significant weight loss in diabetic patients using portion control instruments compared with those who did not

use these instruments (mean + SD, 1.8% + 3.9% vs 0.1% + 3.0%, respectively; $P = .01$). We found the odds of obesity greater in those who ate restaurant or fast food meals in thier entirety compared with those who never eat the meal in its entirety.

The overall prevalence of overweight or obesity in our study population was similar to that of the US population: 30% and 63% vs 31% and 66%, respectively. However, several limitations inhibit the inferences that can be made from this study. Our study had a relatively small sample size and patients were solely recruited from university-based family medicine clinics. We collected data for this study during the summer months of 2007 so we could not account for seasonal variations of eating patterns. Furthermore, the ethnic/racial diversity of our sample was limited and did not match that of the general US population. This study did not include people who did not speak or read English. The administration method made this study subject to recall bias and the setting may have introduced other subject biases because we used a self-administered questionnaire that was collected in a clinic environment. Finally, we used a completely novel questionnaire for this study. Previously validated questions, such as those mentioned above, were not used to keep the length and formatting as uniform and concise as possible, which is consistent with our goal of developing a brief questionnaire suitable for use as a clinical screening instrument.

We consider this to be a promising pilot investigation. Our results indicate that questions focusing on typical behavior are more likely to be relevant for identifying at-risk behavior than questions of 1-day or 1-week recall. Further research is warranted to more thoroughly evaluate the best way to screen for these behaviors and the relationship between these behaviors and weight. Future research should include a larger sample size with greater ethnic/racial diversity, inclusion of non–English-speaking patients, and, perhaps, separation of fast food consumption from other restaurant food consumption. Previous research on larger portion-size meals has focused on energy intake, not weight. Research specific to portion size and weight might improve understanding of this relationship. After refining our questions for efficiency, work to validate the questions in relation to more detailed assessments of behavior will be warranted. In addition,

it will be valuable to assess these behaviors in a prospective fashion for changes in weight over time and to assess the effects of clinical interventions targeted for these behaviors.

Our ultimate goal is to create and validate an effective screening tool to identify key eating behaviors that may assist primary care and public health providers in managing patients' excessive weight. We envision a concise 3- to 5-item tool feasible for use during a 15-minute clinic visit. This tool will take an estimated 3 to 5 minutes for patients to answer and 1 minute or less for providers to review. With the emergence of electronic medical records, the questionnaire can be programmed in with nursing notes or vital signs. The nurse or medical assistant can ask and record the responses while rooming a patient, or the provider can do the same as they encounter the patient. Alternatively, the questionnaire can be administered in paper form and patients can respond as they wait for the provider in the reception area or examination room. With this questionnaire, providers could identify patients who may need behavior modification counseling to prevent or manage overweight and/or obesity. We give special thanks to the Utah Health Research Network for their support in this endeavor.

References

1. Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM. Prevalence of overweight and obesity among US children, adolescents, and adults, 1999–2002. JAMA 2004;291:2847–50.

2. Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity. JAMA 1999;282:1523–9.

3. Nawaz H, Katz DL. American College of Preventive Medicine Practice Policy statement. Weight management counseling of overweight adults. Am J Prev Med 2001;21:73–8.

4. Bowman SA, Vinyard BT. Fast food consumption of US adults: impact on energy and nutrient intakes and overweight status. J Am Coll Nutr 2004;23:163–8.

5. Pereira MA, Kartashov AI, Ebbeling CB, et al. Fast-food habits, weight gain, and insulin resistance (the CARDIA study): 15-year prospective analysis. Lancet 2005;365:36–42.

6. Duffey KJ, Gordon-Larsen P, Jacobs DR Jr, Williams OD, Popkin BM. Differential associations of fast food and restaurant food consumption with 3-y change in body mass index: the Coronary Artery

Risk Development in Young Adults Study. Am J Clin Nutr 2007;85:201–8.

7. Nielsen SJ, Popkin BM. Patterns and trends in food portion sizes, 1977–1998. JAMA 2003;289:450–3.

8. Levitsky DA, Youn T. The more food young adults are served, the more they overeat. J Nutr 2004;134:2546–9.

9. Rolls BJ, Morris EL, Roe LS. Portion size of food affects energy intake in normal-weight and over-weight men and women. Am J Clin Nutr 2002;76:1207–13.

10. Diliberti N, Bordi PL, Conklin MT, Roe LS, Rolls BJ. Increased portion size leads to increased energy intake in a restaurant meal. Obes Res 2004;12:562–8.

11. Rolls BJ, Roe LS, Meengs JS. Larger portion sizes lead to a sustained increase in energy intake over 2 days. J Am Diet Assoc 2006;106:543–9.

12. Raben A, Vasilaras TH, Moller AC, Astrup A. Sucrose compared with artificial sweeteners: different effects on ad libitum food intake and body weight after 10 wk of supplementation in overweight subjects. Am J Clin Nutr 2002;76:721–9.

13. Berkey CS, Rockett HR, Field AE, Gillman MW, Colditz GA. Sugar-added beverages and adolescent weight change. Obes Res 2004;12:778–88.

14. Bell EA, Rolls BJ. Energy density of foods affects energy intake across multiple levels of fat content in lean and obese women. Am J Clin Nutr 2001;73:1010–8.

15. Rolls BJ, Roe LS, Meengs JS. Reductions in portion size and energy density of foods are additive and lead to sustained decreases in energy intake. Am J Clin Nutr 2006;83:11–7.

16. Stubbs RJ, Ritz P, Coward WA, Prentice AM. Covert manipulation of the ratio of dietary fat to carbohydrate and energy density: effect on food intake and energy balance in free-living men eating ad libitum. Am J Clin Nutr 1995;62:330–7.

17. Ledikwe JH, Blanck HM, Khan LK, et al. Dietary energy density determined by eight calculation methods in a nationally representative United States population. J Nutr 2005;135:273–8.

18. He K, Hu FB, Colditz GA, Manson JE, Willett WC, Liu S. Changes in intake of fruits and vegetables in relation to risk of obesity and weight gain among middle-aged women. Int J Obes Relat Metab Disord 2004;28:1569–74.

19. Rolls BJ, Roe LS, Meengs JS. Salad and satiety: energy density and portion size of a first-course salad affect energy intake at lunch. J Am Diet Assoc 2004;104:1570–6.

20. Ma Y, Bertone ER, Stanek EJ 3rd, et al. Association between eating patterns and obesity in a free-living US adult population. Am J Epidemiol 2003;158:85–92.

21. Keski-Rahkonen A, Kaprio J, Rissanen A, Virkkunen M, Rose RJ. Breakfast skipping and health-compro-mising behaviors in adolescents and adults. Eur J Clin Nutr 2003;57:842–53.

22. Schlundt DG, Hill JO, Sbrocco T, Pope-Cordle J, Sharp T. The role of breakfast in the treatment of obesity: a randomized clinical trial. Am J Clin Nutr 1992;55:645–51.

23. Ortega RM, Redondo MR, Lopez-Sobaler AM, et al. Associations between obesity, breakfast-time food habits and intake of energy and nutrients in a group of elderly Madrid residents. J Am Coll Nutr 1996;15:65–72.

24. Greenwood JL, Standford JB. Preventing or improving obesity by addressing specific eating patterns. J Am Board Fam Med 2008;21:135–40.

25. Peters JR, Quiter ES, Brekke ML, et al. The Eating Pattern Assessment Tool: a simple instrument for assessing dietary fat and cholesterol intake. J Am Diet Assoc 1994;94:1008–13.

26. Kris-Etherton P, Eissenstat B, Jaax S, et al. Validation for MEDFICTS, a dietary assessment instrument for evaluating adherence to total and saturated fat recommendations of the National Cholesterol Education Program Step 1 and Step 2 diets. J Am Diet Assoc 2001;101:81–6.

27. Retzlaff BM, Dowdy AA, Walden CE, Bovbjerg VE, Knopp RH. The Northwest Lipid Research Clinic Fat Intake Scale: validation and utility. Am J Public Health 1997;87:181–5.

28. Connor SL, Gustafson JR, Sexton G, Becker N, Artaud-Wild S, Connor WE. The Diet Habit Survey: a new method of dietary assessment that relates to plasma cholesterol changes. J Am Diet Assoc 1992;92:41–7.

29. Isasi CR, Soroudi N, Wylie-Rosett J. Youth WAVE Screener: addressing weight-related behaviors with school-age children. Diabetes Educ 2006;32:415–22.

30. Smith KW, Hoelscher DM, Lytle LA, et al. Reliability and validity of the child and adolescent trial for cardiovascular health (CATCH) food checklist: a self-report instrument to measure fat and sodium intake by middle school students. J Am Diet Assoc 2001;101:635–47.

31. Shaw K, Gennat H, O'Rourke P, Del Mar C. Exercise for overweight or obesity. Cochrane Database Syst Rev 2006;(4):CD003817.

32. US Department of Agriculture. Dietary Guidelines for Americans 2005. Washington, DC: US Department of Health and Human Services; 2005.

33. How much exercise is enough: responding to the IOM report on dietary guidelines. Sports Med Bulletin 2002;37:5.

34. Institutes of Medicine. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids. Washington, DC: National Academic Press; 2002.

35. Rennie KL, Johnson L, Jebb SA. Behavioral determinants of obesity. Best Pract Res Clin Endocrinol Metab 2005;19:343–58.

36. Rolls BJ, Drewnowski A, Ledikwe JH. Changing the energy density of the diet as a strategy for weight management. J Am Diet Assoc 2005;105(5 Suppl 1):S98–103.

37. Pedersen SD, Kang J, Kline GA. Portion control plate for weight loss in obese patients with type 2 diabetes mellitus: a controlled clinical trial. Arch Intern Med 2007;167:1277–83.

Appendix: Final Questionnaire

Type of Question	Questions	Possible Answers
Restaurant and fast food		
1-day recall	How many times did you eat restaurant or fast food yesterday (for example, Chili's, McDonalds, Burger King, etc)?	0 1 2 3 4 5 6 7 >7
Typical recall	How many times do you typically eat restaurant or fast food in one week (for example, Chili's, McDonalds, Burger King, etc)?	0 1 2 3 4 5 6 7 >7
Beverage with sugar added		
1-day recall	How many times did you drink juice yesterday (for example, orange juice, apple juice, Sunny Delight)?	0 1 2 3 4 5 6 7 >7
	How many cans of non-diet soda pop did you drink yesterday (for example, Coke, Pepsi, Sprite)?	
Typical recall	How many times do you typically drink juice in one day (for example, orange juice, apple juice, Sunny Delight)?	0 1 2 3 4 5 6 7 >7
	How many cans of non-diet soda pop do you typically drink in one day (for example, Coke, Pepsi, Sprite)?	
Fruits and vegetables		
1-day recall	How many times did you eat vegetables yesterday (for example, broccoli, spinach, greens, salad, etc)?	0 1 2 3 4 5 6 7 >7
	How many times did you eat fruit yesterday (for example, an apple, an orange, a hand full of grapes, etc)?	
Typical recall	How many times do you typically eat vegetables in one day (for example, broccoli, spinach, greens, salad, etc)?	0 1 2 3 4 5 6 7 >7
	How many times do you typically eat fruit in one day (for example, an apple, an orange, a hand full of grapes, etc)?	
Breakfast		
Typical recall	How many times do you typically eat breakfast in 1 week (7 days)?	0 1 2 3 4 5 6 7 >7
Portion size		
Typical recall	When eating restaurant food, do you eat all of the food served to you at one time?	Never Rarely Occasionally Sometimes Often Usually Always
Physical activity		
1-week recall	How many days during the *past week* have you performed physical activity where your heart beats faster and you are breathing harder than normal for 30 minutes or more (in three 10-minute bouts or one 30-minute bout)?	0 1 2 3 4 5 6 7 >7
Typical recall	How many days in a *typical week* have you performed activity such as this (see above)?	0 1 2 3 4 5 6 7 >7