

Household food expenditure patterns: a cluster analysis

Using data from the Consumer Expenditure Survey, researchers are studying household food expenditure patterns and are learning about the many ways people differ in what and where they eat

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The 2001 report titled “The Surgeon General’s Call to Action to Prevent and Decrease Overweight and Obesity” identified overweight and obesity as major public health problems, costing U.S. society as much as \$117 billion a year and posing as great a threat of death as poverty, smoking, or problem drinking.¹ As a first step in screening for overweight and obesity, “Body Mass Index” (BMI) is calculated using a person’s weight and height, and this number is viewed as being a reliable indicator of body fat for most people.²

The percentage of the U.S. population defined as obese (a BMI greater than 30) or overweight (a BMI greater than 25) has been rising in the past decade. Data from the 1999–2002 National Health and Nutrition Examination Survey (NHANES) show that 65 percent of U.S. adults ages 20–74 were overweight or obese. This is a substantial increase from the 56 percent estimated from the 1988–1994 NHANES and the 47 percent estimated from the 1976–1980 NHANES.³

The statistics presented for children are equally grim. The percentage of children defined as overweight (a BMI-for-age at or above the 95th percentile of the CDC Growth Charts) has also been increasing. Among children and teens ages 6–19, 16 percent (more than 9 million) are overweight according to the 1999–2000 NHANES data, triple the percentage reported in 1980.⁴

While numerous suggestions have been offered as possible solutions to the problem, an energy balance approach to the causes of overweight and obesity recognizes the equi-

librium of food consumption and energy expenditure as being of key importance in maintaining a healthy body weight. This approach suggests that obesity and overweight are caused by eating too much, exercising too little, or some combination of the two. This article examines the input component of this balance by investigating household food expenditure patterns. The literature linking food consumption and obesity can be classified into three categories: (1) type of food intake, (2) amount of energy intake, and (3) location of food intake (where one eats). Published research has identified associations between obesity and a high level of consumption of artificial sweeteners, meat and meat products, high-fructose corn syrup, and soda. Obesity has also been found to be correlated with a low level of consumption of milk, dairy products, bread, and other cereal-based goods.⁵ The amount of energy intake is found to be positively associated with BMI in controlled laboratory studies, although this association is found to be weak or nonexistent in population-based studies, possibly due to measurement issues.⁶ The research has consistently shown that the frequency of eating food away from home is positively associated with obesity and percent of body fat.⁷ Eating out more frequently is associated with a diet high in energy density, such as fat, and low in essential micronutrients and fiber, such as vegetables.⁸ Food away from home, especially fast-food consumption, is linked to an increased intake of energy.⁹

Research on patterns of both food expenditures or food consumption has shown an up-

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ward trend in the consumption of refined carbohydrates and fats from the mid 1980s to the late 1990s.¹⁰ Using U.S. Department of Agriculture Economic Research Services' loss-adjusted annual per capita food supply series, researchers also have found that the average daily calorie consumption in the United States in 2000 was 12 percent, or roughly 300 calories, above the 1985 level. In addition, researchers have observed a trend toward consuming more food away from home, both in terms of the frequency and number of people eating out¹¹ and in terms of the percentage of total calories consumed as food away from home.¹² These trends in type of food intake, calories consumed, and location of food intake are consistent with the observed increases in rates of obesity.

Analyses of food intake patterns can provide insight regarding the possible causes of obesity. There are several approaches that can be used to study household food intake. At one end of the spectrum, studying specific foods in detail to best determine the types of foods people are eating is an option. Such an approach, however, is likely to yield hundreds, if not thousands of food categories, with the overall picture lost amid such detailed analyses. At the other end of the spectrum, it is possible to argue that total caloric intake is the sole critical issue. Some evidence has shown, however, that holding calorie intake constant, different types of food may have different impacts on weight gain, possibly due to differences in the glycemic index.¹³ For this article, a middle-ground approach was initiated, starting from detailed food categories and using cluster analysis to identify major types of household food expenditure patterns; the approach was further developed by investigating which sociodemographic factors may be associated with the probability of households having a particular food expenditure pattern.

Ultimately, it is the overall pattern of food intake, rather than the intake of one or two particular food items, that determines energy intake and thus affects BMI. In most cases, the first step of behavior change is at the point of purchase, followed by the point of consumption. Therefore, identifying expenditure patterns can increase understanding as to which sociodemographic groups are more likely to have food expenditure patterns that put them at a higher risk of obesity. In turn, such an analysis may be useful for consumers, educators, and policymakers in their efforts to fight the obesity problem.

Data

Data used for studying household food expenditure patterns are from the Diary Survey component of the Con-

sumer Expenditure Survey, an ongoing survey conducted by the U.S. Bureau of Labor Statistics (BLS) that provides a continuous flow of information related to the buying habits of American consumers.¹⁴ The Diary Survey component is completed by the sample consumer units (or households) for two consecutive 1-week periods. Data from it are useful for this article because this component contains consumer information on small, frequently purchased items such as food, beverages, food consumed away from home, gasoline, housekeeping supplies, non-prescription drugs and medical supplies, and personal care products and services. Participants are asked to maintain expense records, or diaries, of all purchases made each day for the period surveyed, and information on the consumer unit's characteristics and earnings of the household members is collected as well. The Diary Survey sample is a national probability sample of households designed to represent the total noninstitutional civilian population of the United States. For this article, the 2001 and 2002 Diary Surveys were used.¹⁵ The sample size was 10,967 households with diary data collected in either 2001 or 2002. Because income is an important variable for our research, households were eliminated that were categorized as *incomplete income reporters*; nevertheless, we find it noteworthy that even *complete* reporters do not necessarily provide a full accounting of all sources of income.¹⁶

Cluster analysis: methodology and measurement. Cluster analysis is a multivariate technique used to group households based on similarities in their budget allocation patterns through maximizing within-group similarities and between-group differences.¹⁷ The identification of clusters is empirically based instead of guided by theory. For this article, the similarity measurement used is the Euclidian distance, and the centroid method of measuring similarity is employed because this method is more robust to outliers than most other hierarchical methods.¹⁸ The outcome of this cluster analysis is several clusters of households, with each cluster displaying a distinct food expenditure pattern.

BLS aggregates subcategories of food at home into 18 standard categories: cereals, bakery products, beef, pork, other meat, poultry, seafood, eggs, milk products, other dairy products, fresh fruit, fresh vegetables, processed fruits, processed vegetables, sweets, nonalcoholic beverages, oils, and other miscellaneous foods. This standard aggregation is used in this study. For food away from home, BLS does not have a standard aggregation method; therefore, three categories were created: (1) food away from home at fast-food establishments, (2) food away

from home at full-service establishments, and (3) food away from home at work. While BLS does not consider alcoholic beverages to be food, they are included in this study because alcoholic beverages involve calorie intake and are thus related to obesity. In total, then, there are 22 food expenditure categories used in this article, including 18 food-at-home categories, 3 food-away-from-home categories, and 1 alcoholic-beverages category. Details of which foods are included in each category are provided in the appendix.

Results of the cluster analysis. Eight expenditure patterns are identified from the cluster analysis. Because the cluster analysis technique assigns more weight to large budget-share items, the variances of large budget-share categories, such as fast food away from home and full-service food away from home are better explained than small budget-share categories, such as eggs and oils. This characteristic is not a severe drawback for analyzing a household's budget allocations, however, because large budget-share items figure more prominently in the household decisionmaking process.

The budget share means are presented for the entire sample and for each of the eight clusters. These means are averages of the budget shares for our sample households. The mean budget shares for each cluster indicate that every cluster represented a distinct budget pattern. The clusters are named according to their dominant budget share or shares as follows: (1) balanced, (2) full-service-dominated, (3) fast-food-dominated, (4) meat-eater, (5) miscellaneous-food-dominated, (6) alcohol-dominated, (7) beverages-dominated, and (8) food-at-work-dominated. (See table 1.)

Demographic profiles for the entire sample and for each cluster are presented. A household representative is designated for each consumer unit. For single-person households, the household representative is the reference person; for married-couple households, the household representative is the spouse who is employed. If both spouses are, or neither spouse is, employed, then the spouse with the highest education level is designated as the household representative. The demographic variables include the household representative's sociodemographic characteristics (age, race or ethnicity, education, and employment status), the household's characteristics (family composition, number of earners, and income-to-needs ratio), and characteristics of the community in which the household resides (region and Primary Sampling Unit (PSU) size). The household's income-to-needs ratio is defined as the household's after-tax income divided by the

poverty threshold for the given household size in 2002.¹⁹ Therefore, if a household has an income-to-needs ratio of 1.0, then its income is exactly equal to the poverty threshold for the household's size. (See table 2.)

Cluster 1: Balanced. Of the sample households, 29.1 percent belong to the balanced cluster. Compared with households in other clusters, these households allocate more of their food budget to 7 out of the 22 categories. The seven categories are cereal, bakery goods, seafood, dairy products other than milk, fresh fruits, processed fruits, and sweets. Households in this cluster also allocate more of their budget to all other food-at-home categories than the sample average. Higher-than-average proportions of older households, married-couple households, and households living in the urban Northeast belong to the cluster, as do much-lower-than-average proportions of households headed by single men. The percentage of full-time employment and the average income-to-needs ratio are both slightly lower than the sample averages. The percentage of household members older than 64 years in this cluster is the highest among all clusters, suggesting that members of these households may have more time to prepare meals at home. (See table 2.)

Cluster 2: Full-service-dominated. Of the sample households, 20.3 percent belong to the full-service food-away-from-home cluster. On average, households having this expenditure pattern allocate 42.2 percent of their total food budget to full-service food away from home, much higher than the sample mean of 13.0 percent. Understandably, households in the cluster spend less than the sample average on all other food categories. However, whatever amount they do spend on food at home is fairly balanced across food categories. Higher-than-average proportions of white households, college-educated households, and households living in PSU's that number more than 4 million people belong to the cluster. Households in this group are economically better off than households in other groups, as evidenced by the group's relatively high mean income-to-needs ratio. (See table 2.)

Cluster 3: Fast-food-dominated. Of the sample households, 18.4 percent belong to the fast-food-dominated cluster. Households in this cluster spend, on average, half of their food budget on fast food. However, their budget share for full-service food away from home is approximately half of the sample average. Higher-than-average proportions of younger households and households headed by single men belong to the cluster. Also, the cluster

Table 1. Eight clusters of food expenditure patterns

[Percent of food budget]

Food category	Entire sample	Balanced	Full service	Fast food	Meateater	Miscellaneous foods	Alcohol	Beverage	Work
Cereal	3.14	4.46	1.96	2.06	4.44	3.48	1.73	3.51	1.67
Bakery products	6.09	8.94	3.9	4.17	6.04	7.05	3.87	8.62	3.37
Beef	4.42	3.74	2.68	2.53	15.4	3.41	3	2.98	1.64
Pork	3.3	3.85	1.78	1.88	8.93	2.38	2.16	3.17	1.58
Other meats	1.99	2.74	1.12	1.29	3.01	2.35	1.22	2.66	0.87
Poultry	2.84	3.57	1.59	1.56	6.92	2.36	1.65	2.72	1.16
Seafood	1.98	3.12	1.27	0.9	3.03	1.65	1.32	1.53	1.16
Eggs	0.79	0.97	0.46	0.55	1.46	0.74	0.5	1.26	0.35
Milk products	3.16	4.12	1.92	2.49	4.24	3.27	1.97	5.36	1.84
Other dairy	3.88	5.66	2.47	2.41	3.88	5.3	2.95	4.3	1.79
Fresh fruits	3.43	5.39	2.48	2.01	3.91	3.26	1.76	3.34	1.75
Fresh vegetables	3.41	5.04	2.26	1.73	5.2	3.21	2.41	3.28	1.52
Processed fruits	2.36	3.49	1.63	1.59	2.56	2.78	1.38	2.13	1.28
Processed vegetables	1.64	2.31	0.98	0.93	2.42	1.99	1.2	1.84	0.46
Sweets	2.31	3.37	1.48	1.71	1.98	3.01	1.23	3.18	1.42
Nonalcoholic beverages	5.3	5.38	3.26	4.28	4.87	5.52	4.43	25.63	2.88
Oils	1.68	2.38	1	0.99	2.42	2.01	0.98	2.28	0.58
Miscellaneous foods	9.06	10.11	5.38	5.74	6.08	26.97	6.06	9.58	3.59
Fast food	18.28	10.68	13.43	49.98	7.83	11.31	12.81	8.29	10.81
Full-service food	13	6.32	42.2	6.45	2.17	4.42	9.01	2.14	4.67
Food at work	2.37	1.83	1.4	1.73	0.98	1.32	1.4	0.84	53.35
Alcoholic beverages	5.56	2.56	5.37	3.03	2.25	2.23	36.97	1.35	2.24
Sample size	10,967	3,192	2,231	2,017	1,181	1,030	786	360	170
Proportion		0.29	0.2	0.18	0.11	0.09	0.07	0.03	0.02

NOTE: The numbers in the table are budget shares. For example, the first number, 3.14, means that, for the whole sample, 3.14 percent of the food budget is spent on cereal. Numbers were computed by the authors from the Diary Survey component of the 2001 and 2002 Consumer Expenditure Survey.

has the highest percentage of full-time employment, 64.3 percent, compared with the sample average of 53.3 percent. In addition, the average number of earners, 1.51, is the highest, compared with the sample average of 1.37. The income-to-needs ratio for this cluster is slightly lower than the sample average, indicating less economic well-being. (See table 2.)

Cluster 4: Meat-eater. Of the sample households, 10.8 percent belong to the meat-eater cluster. This cluster of households allocates a substantial portion of its food budget to beef (15.4 percent, compared with the sample average of 4.4 percent), pork (8.9 percent, compared with the sample average of 3.3 percent), other meats (3.0 percent compared with the sample average of 2.0 percent), and poultry (6.9 percent, compared with the sample average of 2.8 percent). Households in the cluster also allocate more of their budget to eggs, milk products, fresh and frozen vegetables, and oils, compared with the sample average. Higher-than-sample-average proportions of older households, black households, Hispanic households, and households living in the urban South belong to this cluster. The group has the lowest income-to-needs ratio and the lowest percentage of full-time employment, 43.9 percent, compared with the sample average of 53.3 percent. (See table 2.)

Cluster 5: Miscellaneous-food-dominated. Miscellaneous foods include soup, frozen food, potato chips and other snacks, nuts, seasonings and condiments, other prepared food, and vitamin supplements. (See appendix.) Of the sample of households, 9.4 percent belong to this cluster. On average, these households allocate 27.0 percent of their budget to miscellaneous foods, much higher than the sample average of 9.1 percent. While they allocate close to the sample mean to the majority of the other food categories, they spend less on all three food-away-from-home items: full service, fast food, and food at work. They also spend less on alcohol. It appears that this household group substitutes store-bought prepared foods (such as frozen meals) for food away from home. Higher-than-average proportions of younger households, white households, households headed by single women, households living in the urban Midwest, and households living in less populated areas belong to this cluster. (See table 2.)

Cluster 6: Alcohol-dominated. Of all the households in the sample, 7.2 percent belong to this cluster. On average, the cluster spends approximately 37.0 percent of its household food budget on alcoholic beverages, compared

with the overall sample mean of 5.6 percent. The budget shares for these households on other food categories are all less than the sample means. Higher proportions of younger households, white households, college-educated households, households headed by single men, urban households, and households living in medium-sized areas (0.33–1.19 million) belong to this cluster. Households in the cluster have a high income-to-needs ratio, 4.04, second only to the full-service cluster. (See table 2.)

Cluster 7: Beverage-dominated. Of all households in the sample, 3.3 percent belong to this cluster. Households in the cluster allocate 25.6 percent of their food budget to nonalcoholic beverages, which include carbonated drinks, coffee, tea, and fruit-flavored drinks. These households also spend the highest cluster average for milk products. By contrast, they allocate much less than average on food-away-from-home categories. Higher proportions of older households, households with a high school education or less, households headed by single women, rural households, and households living in small areas belong to this cluster. These households also have the second-lowest income-to-needs ratio (second only to the meat-eaters cluster). (See table 2.)

Cluster 8: Food-at-work-dominated. This is the smallest cluster in the sample, with only 1.6 percent of households. Households in the cluster allocate more than half of their food budgets, 53.4 percent, to food at work. The allocations of their food budget to all other food categories are typically less than the sample averages. The cluster consists of higher-than-average proportions of those under 25 years; those between 45 and 54 years; blacks and another group not listed, including those who answered “don’t know”; those living in the urban Northeast and the Midwest; and those living in medium-sized areas (0.33–1.19 million). Households in this cluster have the second highest proportion of full-time employment (second only to the full-service cluster), and a slightly higher income-to-needs ratio than the overall sample mean. (See table 2.)

Findings. Overall, two food-at-home clusters have been identified: the balanced cluster and the meat-eater cluster. The balanced cluster seems to have a food expenditure pattern that is consistent with nutritional recommendations, which advise eating a variety of foods and avoiding foods that have a relatively high fat content, such as meat. The meat-eater cluster, in contrast, may place too high an emphasis on meat intake and thus fat intake. The other six clusters are clearly dominated by one type of food.

Table 2. Demographic profiles by cluster

Variables	Entire sample	Balanced	Full service	Fast food	Meat-eater	Miscellaneous foods	Alcohol	Beverage	Work
Age (percent):									
Less than 25 years	8.5	4.6	6.3	15.3	6.1	10.0	13.7	5.5	17.6
25–34 years	18.8	15.9	17.2	24.6	16.8	22.5	21.1	13.0	15.6
35–44 years	22.7	24.1	20.4	26.0	20.9	19.7	21.8	23.4	23.6
45–54 years	19.5	19.6	21.0	17.4	19.9	18.3	19.8	20.8	23.4
55–64 years	12.2	13.4	14.1	8.0	14.7	10.3	10.3	17.2	7.6
65 years and older	18.3	22.4	21.0	8.7	21.6	19.3	13.2	20.1	12.2
Race/Ethnicity (percent):									
White	74.3	74.2	83.9	69.9	54.8	79.9	82.8	76.6	62.2
Black	11.9	11.2	5.6	15.1	23.2	9.3	8.0	11.1	22.8
Hispanic	9.8	10.0	6.2	10.9	17.7	8.3	6.6	8.8	9.3
Other	4.1	4.6	4.2	4.2	4.3	2.6	2.6	3.4	5.7
Education (percent):									
Less than high school	14.6	15.6	7.2	13.5	29.2	15.1	10.0	22.6	7.5
High school graduate	58.0	57.0	53.2	63.0	57.1	58.3	58.6	64.0	66.3
College or more	27.4	27.5	39.6	23.5	13.7	26.6	31.4	13.5	26.2
Full-time employment (percent)	53.3	46.8	56.6	64.3	43.9	50.2	61.8	46.7	63.2
Gender/family type (percent):									
Married couple	51.2	57.6	55.9	45.0	52.2	48.0	37.9	43.5	35.2
Headed by single woman	29.5	30.9	22.9	30.2	35.4	33.0	22.9	37.8	30.3
Headed by single man	19.3	11.4	21.2	24.8	12.4	19.0	39.2	18.7	34.5
Other nonfamilies	13.5	12.4	11.2	15.8	16.7	12.3	15.9	14.6	6.3
Family composition:									
Number of people less than 2 years	.1	.1	.0	.1	.1	.1	.0	.0	.0
Number of people 2–5 years	.2	.2	.1	.2	.2	.2	.1	.1	.1
Number of people 6–12 years	.3	.4	.2	.3	.3	.3	.1	.2	.2
Number of people 13–17 years	.2	.2	.1	.2	.3	.2	.1	.2	.4
Number of people 18–64 years	1.5	1.6	1.5	1.6	1.6	1.5	1.4	1.4	1.4
Number of people 65 years and older	.3	.4	.4	.1	.4	.3	.2	.3	.2
Number of earners	1.37	1.36	1.36	1.51	1.31	1.30	1.36	1.12	1.33
Income-to-needs ratio	3.62	3.24	5.17	3.40	2.53	3.17	4.04	2.72	3.66
Region (percent):									
Urban Northeast	16.6	19.2	18.2	12.6	15.0	12.9	18.7	14.1	22.0
Urban Midwest	19.4	18.1	19.7	21.0	13.6	22.6	22.6	16.4	30.9
Urban South	30.8	28.2	31.8	33.4	37.4	29.9	27.6	23.9	27.4
Urban West	20.1	19.7	19.3	21.2	18.0	21.8	21.9	22.7	13.4
Rural	13.2	14.8	10.9	11.8	16.0	12.8	9.3	22.9	6.3

See footnote at end of table.

Table 2. Continued—Demographic profiles by cluster

Variables	Entire sample	Balanced	Full service	Fast food	Meat-eater	Miscellaneous foods	Alcohol	Beverage	Work
PSU size (percent)									
More than 4 million	24.4	25.5	29.2	22.2	22.5	18.0	23.4	22.6	24.1
1.2–4 million	21.2	19.4	21.9	21.4	20.5	24.0	24.8	18.1	20.2
0.33–1.19 million	17.3	17.3	16.3	18.1	19.4	16.1	18.2	11.1	25.1
125–329.1 thousand	11.9	12.1	10.4	11.9	10.2	16.4	11.9	13.8	8.7
Fewer than 125 thousand	25.2	25.7	22.1	26.3	27.3	25.5	21.7	34.4	21.9
Sample size	10,967	3,192	2,231	2,017	1,181	1,030	786	360	170
Proportion (percent)	100.0	29.1	20.3	18.4	10.8	9.4	7.2	3.3	1.6

NOTE: Numbers were computed by the authors from the Diary Survey component of the 2001 and 2002 Consumer Expenditure Survey.

Three of the six are food-away-from-home-dominated: full service, fast food, and food at work. In the miscellaneous-food-dominated cluster, households use a significant amount of store-bought prepared food (such as frozen meals). The last two are beverage groups, with one focusing on alcoholic beverages, and the other spending a considerable portion of its food budget on nonalcoholic beverages. If these two beverage groups are eliminated, and the cluster analysis is rerun with the first six groups, households in these clusters generally move toward the balanced cluster.

Past research suggests that the frequency of eating food away from home, especially fast-food consumption, is positively associated with obesity and body fat.²⁰ In addition, consuming higher levels of artificial sweetener, meat and meat products, high-fructose corn syrup, and soda are all associated with obesity.²¹ As such, membership in the full-service, fast-food, meat-eater, miscellaneous, and beverage clusters is likely to be positively associated with a high BMI, whereas membership in the balanced cluster is likely to be negatively associated with a high BMI. The relationships between BMI and the alcohol and food-at-work clusters are less clear.

Multivariate analysis

The next step in the study involved investigating the determinants of the identified food expenditure patterns. Neoclassical demand theory suggests that households attempt to maximize their consumption choices subject to preferences and resource constraints. Sociodemographic factors affect a household's preferences for food expenditure choices. Prices, income, and time constraints all affect a household's decision as to how best to spend its food

dollars. Mathematically, food demand (D) is a function of food prices (P), income (M), time constraint (t), and preferences (PR):

$$D = f(P, M, t, PR). \quad (1)$$

A standard set of preference shifters are used in this study. These variables include (1) the household representative's sociodemographic characteristics, (2) the household's characteristics, and (3) characteristics of the community in which the household resides. The household representative's measured sociodemographic characteristics include age (less than 25, 25–34, 35–44, 45–54, 55–64, 65 and older); education (less than high school, high school, some college, college or postgraduate); race or ethnicity (non-Hispanic whites; non-Hispanic blacks; Hispanics; and another group not listed, including “don't know”); and full-time employment status. Household characteristics include family type (married couple, headed by single woman, headed by single man, and other families); family composition (number of family members younger than age 2, and those aged 2–5, 6–12, 13–17, 18–64, and 65 and older); and number of wage earners in the family. Community characteristics include region (urban Northeast, urban Midwest, urban South, urban West, rural) and population size of the metropolitan area (PSU) (greater than 4 million, from 1.2 to 4 million, from 0.33 to 1.19 million, from 125 to 329.9 thousand, and fewer than 125 thousand).

The Diary Survey component of the Consumer Expenditure Survey does not gather price information; therefore, variation in prices cannot be directly measured. In spite of that, the location variables just presented may capture price differences across different regions. Income effects are captured by including the household's income-to-needs ratio, which measures income adjusted for

household size. Time constraints are approximated by the employment status of the household representative and the number of wage earners in the family.

Although the neoclassical consumer demand model guides the multivariate analysis presented, no rigorous attempt is made to model the household's decisions regarding food-purchase choices. Rather, an attempt is made to determine socioeconomic factors that are associated with particular household food expenditure patterns. In that sense, the multivariate analysis is exploratory in nature. As such, no explicit hypotheses are formed. However, it is expected that households in which the household representative works full time and households with more earners are more likely to be in the food-away-from-home clusters, especially the fast-food-dominated cluster, because the purchase of food away from home reduces food preparation time. It is also expected that households with higher income-to-needs ratios are more likely to be in the full-service food-away-from-home cluster because full-service restaurants are typically income elastic goods. Because of traditional gender roles, households headed by single men may be less likely than other types of households to be in clusters that require significant amounts of at-home food preparation, such as the balanced and the meat-eater clusters.

Because cluster membership is a categorical variable, an unordered multinomial logit analysis is used. Following Maddala (1983), the multinomial logit model is specified as

$$\log\left(\frac{P_i}{P_m}\right) = \beta_i'x, \quad i = 1, 2, \dots, m-1, \quad (2)$$

where P_i is the probability that a certain observation falls into the i th cluster, x is the set of preference and constraints variables, and β is the corresponding set of regression coefficients. Note that the x vector includes P , M , t , and PR . A total of $(m-1)$ binary logit equations are fit simultaneously, and the sum of the m predicated probabilities is restricted to 1. The dependent variables of the multinomial logit analysis are the log-odds ratios of being in cluster i versus in cluster m . A household's probability of inclusion in cluster i is computed with the formula

$$P_j = \frac{e^{\beta_j'x}}{1 + \sum_{j=1}^{m-1} e^{\beta_j'x}} \quad j = 1, 2, \dots, m-1, \quad (3)$$

and the household's probability of inclusion in cluster m is calculated with

$$P_m = \frac{1}{1 + \sum_{j=1}^{m-1} e^{\beta_j'x}}. \quad (4)$$

The household's marginal probability of inclusion in cluster i for variable x_i is computed as

$$\frac{\partial P_j}{\partial x_i} = \beta_{ji} P_j - P_m P_j \sum_{j=1}^{m-1} \beta_{ji} e^{\beta_j'x} \quad j = 1, 2, \dots, m-1. \quad (5)$$

The household's marginal probability of inclusion in cluster m for variable x_i is

$$\frac{\partial P_m}{\partial x_i} = - \sum_{j=1}^{m-1} \frac{\partial P_j}{\partial x_i} \quad (6)$$

Results of the multivariate analysis

Table 3 shows the results of the multinomial logit analysis. For ease of interpretation, the marginal effects for each observation in the sample are computed, along with the means of these marginal effects. The McFadden pseudo- R^2 of the model is 0.18. Other than the dummy variable indicating a PSU size smaller than 125,000, all independent variables are at least jointly statistically significant at the 95-percent confidence level.

Age. The probability of being in the full-service-dominated cluster increases with age, while the probability of being in the fast-food-dominated cluster and the food-at-work cluster decreases with age, all else being equal. In addition, those who are age 34 years and younger are more likely to be in the miscellaneous-food-dominated group or the alcohol-dominated group, compared with those who are age 65 and older. The effect of age is the largest for the fast-food cluster, with those younger than age 25 being 24.6 percent more likely to be in this cluster, compared with those who are age 65 and older. There are two explanations for this age trend: the first is a life-cycle explanation, in that for life-cycle-stage reasons, younger households are more likely than older households to eat in fast-food establishments. As people grow older, their tastes may change and they may move to other clusters. The second is a cohort explanation, in that there are fundamental differences in the younger households compared with the older households, which posits that the younger households may prefer fast-food consumption even as they grow older, compared with the older groups. Given

Table 3. Average marginal probability of cluster inclusion and P-value

Variables	Balanced	Full service	Fast food	Meat eater	Miscellaneous foods	Alcohol	Beverage	Work	P-value
Age (65 and older):									
Less than 25	-15.6	-3.1	23.2	-5.5	-5.1	5.0	-0.9	2.0	<.0001
25-34	-13.4	-.9	17.0	-3.7	-3.0	3.6	.5	-.2	<.0001
35-44	-10.4	-.6	13.1	-2.6	-3.5	2.6	1.7	-.2	<.0001
45-54	-6.3	-.8	5.9	-.3	-2.3	2.4	1.5	.0	.0375
55-64	-3.5	-.1	2.2	1.7	-2.6	.5	2.1	-.4	.2158
Race/ethnicity (white):									
Black	-3.7	-7.2	2.8	12.8	-3.7	-2.4	-.8	2.1	<.0001
Hispanic	-2.5	-3.5	-.4	11.9	-3.2	-1.5	-1.1	.4	<.0001
Other	2.9	-2.9	1.1	3.6	-2.6	-2.8	-.6	1.4	.0002
Education (high school):									
Less than high school	-2.5	-5.1	.8	7.0	-.3	-.7	1.3	-.5	<.0001
College or more	1.7	4.9	-3.1	-2.4	-.2	.4	-1.0	-.2	<.0001
Full-time employed	-2.6	1.2	2.7	.0	-.8	-.8	.2	.2	.0803
Gender/family type (married couple):									
Headed by single woman	-1.4	-3.8	2.3	.3	2.7	-1.3	.0	1.2	.0006
Headed by single man	-8.9	-3.0	4.0	-2.5	.8	7.2	-.8	3.3	<.0001
Other nonfamilies	2.0	-.1	-.8	1.0	-2.2	.5	.7	-1.2	.0008
Family composition:									
Number of people less than 2 years	.6	-4.6	-4.5	1.8	10.9	-2.7	-1.1	-.3	<.0001
Number of people 2-5 years	4.5	-3.6	-.5	.2	1.2	-1.3	-.1	-.4	<.0001
Number of people 6-12 years	4.7	-2.8	-.5	1.2	-.2	-1.6	-.7	-.1	<.0001
Number of people 13-17 years	3.7	-2.6	-2.5	1.4	.0	-1.5	.2	1.2	<.0001
Number of people 18-64 years	1.7	-.5	-2.4	1.9	.3	-1.7	.1	.6	.0009
Number of people 65 years and older	.7	2.6	-1.9	1.8	-1.8	-1.3	-.1	.0	.1015
Number of earners	-.7	-.9	3.3	-1.2	-.4	1.1	-.9	-.3	<.0001
Income-to-needs ratio	-.6	1.4	-.1	-.7	-.1	.2	-.2	.1	<.0001
Region (Urban Northeast):									
Urban Midwest	-4.7	-.8	4.5	-1.7	3.1	-.3	.0	.0	.0003
Urban South	-5.7	2.3	3.9	.5	1.5	-1.5	-.1	-.8	<.0001
Urban West	-3.7	-2.1	4.1	-1.1	2.8	-.3	1.1	-.7	<.0001
Rural	-1.3	-3.0	.7	3.0	.9	-1.6	2.1	-.8	.0216

Table 3. Continued—Average marginal probability of cluster inclusion and P-value

Variables	Balanced	Full service	Fast food	Meat-eater	Miscellaneous foods	Alcohol	Beverage	Work	P-Value
PSU size (more than 4 million)									
1.2–4 million	–2.1	–3.0	–.3	.9	3.4	1.4	–.4	.1	.0018
0.33–1.19 million	–.1	–4.9	1.6	1.6	.7	.8	–1.1	1.3	<.0001
125–329.1 thousand	.5	–4.5	–.4	–.3	4.5	.5	–.1	–.2	.0026
Fewer than 125 thousand	–2.3	–2.1	1.8	–.4	2.1	.1	.1	.6	.1486

NOTE: For dummy variables, the category listed by the variable title is the reference group. For example, the number –15.6 in row 3, column 2, should be interpreted as follows: Compared with those households with a reference person 65 and older, those with a

reference person less than 25 are 15.6 percent less likely to be in the balanced cluster. Numbers were computed by the authors using the Diary Survey component of the 2001 and 2002 Consumer Expenditure Survey.

the research evidence suggesting that high levels of fast-food consumption are linked to overweight and obesity, the cohort explanation paints a rather bleak forecast of future obesity trends. Further study is needed to decompose these two effects.

Race/ethnicity. All else being equal, compared with non-Hispanic whites, minority groups are more likely, on average, to be in the meat-eater cluster, with black households 13.3 percent more likely and Hispanic households 12.7 percent more likely, on average, holding other things equal. Blacks and Hispanics are less likely to be in the full-service, miscellaneous, and alcohol clusters, compared with whites. In addition, black households are more likely to be in the fast-food and food-at-work clusters, compared with white households. These ethnic differences raise concern for black and Hispanic Americans because large amounts of fast-food consumption and meat consumption both have been linked to high BMI.²² Research presented in the literature has shown that black and Hispanic Americans have higher BMI levels than do non-Hispanic white Americans.²³ Although this might be attributable to ethnic- and race-specific genetic effects, food preferences among these groups also might be an explanation.

Education. Households headed by a college-educated person are less likely to be in the fast-food, meat-eater, and beverage clusters, compared with those headed by an individual with only a high school diploma or one who has less formal education, all else being equal. By contrast, households headed by a person with less than a high school education are 7.4 percent more likely to be in the meat-eater cluster and 1.2 percent more likely to be in

the beverage cluster, compared with households headed by a high school graduate. This would seem to imply that a college education may have an effect on how people decide on a type of diet that is commonly identified as “healthful.”

Gender/family type. Households headed by single persons are less likely to be in the balanced cluster compared with married-couple households, and the difference is larger for households headed by single men compared with those headed by single women (13.3 percent less, as opposed to 4.8 percent less), holding other factors constant. Households headed by single men are more likely to be in the alcohol cluster (13.2 percent more likely), the fast-food cluster (3.3 percent more likely), and the food-at-work cluster (2.6 percent more likely). The difference between households headed by single women and married-couple households is smaller. Households headed by single women are more likely to be in the beverage cluster (1.3 percent more likely) and the food-at-work cluster (1.0 percent more likely) and less likely to be in the meat-eater cluster (1.8 percent less likely), compared with married-couple households. One explanation for this gender and family composition difference is that, generally, women have more food-preparation skills than do men. As such, households with an adult female present are more likely to have more balanced food expenditure patterns.

Location. Households residing in the urban Northeast and in rural areas are more likely to be in the balanced cluster, compared with households residing in the urban Midwest, the South, and the West, all else being equal. In turn, households in the urban West, the South, and the

Midwest are more likely to be in the fast-food (3.7 percent to 4.5 percent more likely) and miscellaneous-food clusters (1.4 percent to 3.0 percent more likely). For urban areas, population size is positively related to membership in the full-service cluster, probably an indication of both access issues and location-specific lifestyle differences.

Work hours and income/needs ratio. Households in which the average adult market-work hours number more than 35 hours per week are more likely to be in the full-service and fast-food clusters (1.1 percent and 4.6 percent more likely, respectively), compared with otherwise similar households working less than 35 hours per week per adult, all else being equal. This is consistent with the notion that consumption of food away from home, especially fast food, is positively correlated with adult market-work hours. Similarly, the higher the income-to-needs ratio, the more likely the household belongs to one of these two clusters, but this income effect is larger for the full-service cluster than for the fast-food cluster. A higher income-to-needs ratio is also positively associated with the probability of being in the alcohol and food-at-work clusters, but negatively associated with the probability of being in the meat-eater cluster.

Thus, age, ethnicity, education, gender/family type, location, and population size all affect household food expenditure patterns. If we subscribe to the idea that a more balanced diet is good for one's health, then it is younger, black or Hispanic, less educated households headed by a single person that appear less likely to have a healthy, balanced food expenditure pattern. In addition, households with higher average adult market-work hours and households with higher needs-adjusted incomes are less likely to have a balanced pattern. Households living in the urban Midwest, the South, the West, in rural areas, and households living in either very large metropolitan areas or in very small areas also are less likely to have balanced food expenditure patterns.

Conclusions and implications

Energy intake changes start with changing point-of-purchase decisions. This article has identified eight constellations of food expenditures that are either more or less likely to be associated with healthy eating habits. While the nutrition literature does not arrive at complete agreement as to which eating patterns are the most healthful, it is generally agreed that a balanced, diversified pattern of food consumption is beneficial to energy balance. The findings presented in this article show that only 29 percent

of all households in this nationally representative survey fall into the balanced-purchasing cluster that is likely to be the most healthful. In sharp contrast, 40 percent of the households in this survey typically spend between 40 to 50 percent of their food budgets on meals eaten away from home (including those eaten at work). The generally poorer nutritional content and higher caloric content of these types of meals increases the likelihood that such eating habits might be contributing to the growing energy balance problem in the population of the United States.

To help offer a solution, educational efforts might focus on teaching people about the nutritional benefits that could be gained from eating more home-prepared meals and focus as well on strategies for keeping energy intake in balance when eating out (for example, two people splitting a meal that is purchased away from home). It is likely that many households do not even realize that by eating out, they are increasing both their caloric intake (for example, through higher portion sizes) and their intake of fat, while reducing their intake of essential micronutrients and fiber, such as vegetables.²⁴ Providing additional educational resources, as they relate to the nutritional implications of eating food away from home, may be a good first step towards helping people make positive changes in their energy intake.

Higher work hours and higher needs-adjusted incomes are associated with an increased likelihood of being in one of the food-away-from-home groups. These associations are particularly important given the upward trends in women's labor force participation rates and real median household income throughout the past 20 years.²⁵ With less time available to prepare meals and more real disposable income, households appear to be choosing to spend more of their food dollars on high-calorie meals consumed away from home. Although education programs targeted at focused groups (for example, nutrition and cooking programs targeted at both male and female high school students) might have some impact, the trend toward spending a sizable share of the household food budget on meals eaten away from home is likely to continue. With fully 40 percent of the households falling into one of the food-away-from-home clusters, it is imperative that researchers attempt to ascertain the food-away-from-home expenditures to arrive at a better understanding of the factors that may be influencing purchase choices among this sizable, and likely growing, part of the population.

Younger households are much more likely to be in the fast-food-dominated cluster, and less likely to be in the balanced cluster. Given the cross-sectional nature of this analysis, it cannot be ascertained whether this is a life-

cycle effect or a cohort effect. In either case, but especially in the case of a cohort effect, educational efforts regarding healthy eating choices should be focused on younger age groups. In addition, households headed by single men are much less likely to be in the balanced cluster and much more likely to be in the alcohol cluster, compared with married households. Because of traditional gender roles, men are more likely to lack the skills necessary to prepare nutritious meals at home. Given that the percentage of households headed by single men has been increasing in the United States, it is important that cooking and nutrition education reach this segment of the male population.²⁶ Indeed, this might be an argument for making nutrition and cooking classes a requirement for high school graduates, both male and female, so that all high school graduates can be equipped with a basic knowledge of nutrition and of which foods contribute to healthy eating.

In addition, the data indicate that blacks and Hispanics are much more likely to have a meat-eater pattern, compared with whites. The literature also shows that blacks and Hispanics are more likely to be overweight.²⁷ Although there might be race/ethnic-specific genetic effects, it is possible that their food preferences have some effect as well. Although race- or ethnic-specific genetic effects are difficult to modify, members of black and Hispanic communities might benefit from education about decreasing meat consumption and increasing consumption of whole

grains, vegetables, and so forth. Further research is needed to ascertain if ethnicity interacts with other covariates to explain differences in these groups' eating patterns.

Household food expenditures, of course, do not correlate precisely with food intake. Although food expenditures and food consumption are likely to be highly correlated, not all food purchased will be consumed, and different individuals in a household may consume very different amounts of certain foods purchased by the household. Nevertheless, the identification of household food expenditure patterns provides useful information in understanding the food intake choices of households.

IN SUM, BASED ON THE FINDINGS presented in this article, it is suggested that educational efforts targeting young people in general, males of all age groups, and minorities might be beneficial. These efforts could focus on teaching cooking skills, increasing understanding of the nutritional impact of eating food away from home (particularly its role in obesity), and increasing awareness of the impact of meat consumption on obesity. Because these groups make up approximately 40 percent of the sample studied in this article, further research is needed to "unpack" food-away-from-home expenditures to gain a better understanding of the factors that influence food-purchasing choices among this sizable, and likely growing, segment of the U.S. population. □

NOTES

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²⁶ *Ibid.*

²⁷ *AOA Fact Sheets: Obesity in Minority Population.*

APPENDIX: Food expenditure categories

Food category	Description
Cereal	(1) flour, (2) prepared flour mixes, (3) cereal, (4) rice, (5) pasta, cornmeal, and other cereal products
Bakery products	(1) white bread, (2) bread other than white, (3) fresh biscuits, rolls, muffins, (4) cakes and cupcakes, fresh and other, excluding frozen; (5) cookies, excluding refrigerated dough, (6) crackers, excluding crumbs, (7) bread and cracker products, (8) doughnuts, sweet rolls, coffeecakes, fresh and other, excluding frozen, (9) frozen refrigerated and canned bakery products, such as biscuits, rolls, muffins, cakes, cupcakes, doughnuts, pies, tarts, turnovers, and miscellaneous products, including dough and batter, (10) pies, tarts, turnovers, fresh and other, excluding frozen
Beef	(1) ground beef, excluding canned, (2) chuck roast, excluding canned, (3) round roast, excluding canned, (4) other beef roast, excluding canned, (5) round steak, excluding canned, (6) sirloin steak, excluding canned, (7) other steak, excluding canned, (8) other beef, excluding canned
Pork	(1) bacon, (2) pork chops, (3) ham, excluding canned, (4) other pork, excluding canned, (5) pork sausage, excluding canned, (6) canned ham
Other meats	(1) frankfurters, excluding canned, (2) bologna, liverwurst, salami, excluding canned, (3) other lunchmeat, (4) lamb and organ meats, excluding canned, (5) mutton, goat, game
Poultry	(1) fresh and frozen whole chicken, (2) fresh or frozen chicken parts, (3) other poultry
Seafood	(1) canned fish, seafood and shellfish, (2) fresh fish and shellfish, (3) frozen fish and shellfish
Eggs	(1) eggs
Milk products	(1) fresh milk all types, (2) cream
Other dairy	(1) butter, (2) cheese, (3) ice cream and related products, including frozen yogurt, (4) other dairy products, including powdered milk, and fresh, canned and nonfrozen yogurt
Fresh fruits	(1) apples, (2) bananas, (3) oranges, (4) other fresh fruits, (5) citrus fruits, excluding oranges
Fresh vegetables	(1) potatoes, (2) lettuce, (3) tomatoes, (4) other fresh vegetables
Processed fruits	(1) frozen orange juice, (2) frozen fruits, (3) frozen fruit juices, (4) fresh fruit juices, (5) canned/bottled fruit juices, (6) canned fruits, (7) dried fruits
Processed vegetables	(1) frozen vegetables, (2) canned beans, (3) canned corn, (4) miscellaneous canned vegetables, not collected in a separate UCC, (5) other processed dried vegetables, such as squash, not collected in a separate UCC, (6) dried peas, (7) dried beans, (8) dried carrots, onions, leafy greens, and cabbage, (9) frozen vegetable juices, (10) fresh/canned vegetable juices
Sweets	(1) candy and chewing gum, (2) sugar, (3) artificial sweeteners, (4) jams, jellies, preserves, and other sweets
Nonalcoholic beverages	(1) cola drinks, (2) other carbonated drinks, (3) coffee, roasted, (4) coffee, instant or freeze dried, (5) noncarbonated fruit flavored drinks, including lemonade—nonfrozen, (6) tea, (7) other noncarbonated beverages and ice, excluding coffee and tea, (8) nonalcoholic beer
Oils	(1) margarine, (2) fats and oils, (3) salad dressings, (4) nondairy cream substitutes, (5) peanut butter
Miscellaneous foods	(1) soup, (2) frozen meals, (3) frozen prepared food other than meals, (4) potato chips and other snacks, (5) nuts, (6) salt, other seasonings and spices, (7) olives, pickles, relishes, (8) sauces and gravies, (9) other condiments, (10) prepared salads, (11) prepared desserts, (12) baby food, (13) miscellaneous prepared foods including items such as canned meats not included in previous categories, fresh and canned ethnic foods, fresh and canned pizza, (14) vitamin supplements
Fast food (*)	(1) lunch at fast food, (2) lunch at vending machine, (3) dinner at fast food, (4) dinner at vending machine, (5) snacks at fast food, (6) snacks at vending machine, (7) breakfast at fast food, (8) breakfast at vending machine, (9) catered affair at fast food, (10) catered affair at vending machine, (11) board at fast food, (12) board at vending machine
Full-service food (*)	(1) lunch at full service, (2) dinner at full service, (3) snacks at full service, (4) breakfast at full service, (5) catered affair at full service, (6) board at full service
Food at work (*)	(1) lunch at employer, (2) lunch at board, (3) lunch at catered affairs, (4) dinner at employer, (5) dinner at board, (6) dinner at catered affairs, (7) snacks at employer, (8) snacks at board, (9) snacks at catered affairs, (10) breakfast at employer, (11) breakfast at board, (12) breakfast at catered affairs, (13) board at employer, (14) board, (15) board at catered affairs, (16) catered affairs at employer, (17) catered affairs at board, (18) catered affairs
Alcoholic beverages (*)	(1) beer and ale at home, (2) whiskey at home, (3) wine at home, (4) other alcoholic beverages at home, (5) beer at fast food, (6) beer at full service, (7) beer at vending machine, (8) beer at employer, (9) beer at board, (10) beer at catered affairs, (11) wine at fast food, (12) wine at full service, (13) wine at vending machine, (14) wine at employer, (15) wine at board, (16) wine at catered affairs, (17) alcoholic beverage excluding beer/wine fast food, (18) alcoholic beverage excluding beer/wine full service, (19) alcoholic beverage excluding beer/wine vending machine, (20) alcoholic beverage excluding beer/wine at employer, (21) alcoholic beverage excluding beer/wine at board, (22) alcoholic beverage excluding beer/wine catered affairs
Note: An asterisk (*) indicates a category developed by the authors for this study. All others are standard categories of BLS.	