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Household acquisition of healthy food away from home

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Abstract

Purpose – The purpose of this paper is to analyze households' acquisition of healthy food away from home (FAFH) from restaurants. Specifically, determinants of households' decision to purchase healthy FAFH, the share of households' FAFH expenditures allocated to healthy FAFH and the share of households' FAFH calories obtained from healthy items are identified.
Design/methodology/approach – Using data from the National Household Food Acquisition and Purchase Survey, the UK Food Standards Agency's Nutrient Profiling Model is used to classify the healthfulness of households' FAFH purchases. A double-hurdle model is estimated to identify determinants of households' decision to purchase healthy FAFH and the share of their FAFH expenditures and calories allocated to healthy items.
Findings – Households' acquisition of healthy FAFH varies with income, food assistance, FAFH purchase frequency, dieting, restaurant type, household composition, region and season. There is little difference in the impact of these factors on healthy FAFH expenditure shares vs calorie shares, suggesting that healthy FAFH expenditures proxy the contribution of healthy FAFH to a households' diet.
Practical implications – Results suggest that increased availability of healthy FAFH may need to be supplemented by targeted advertising and promotions, revisions to nutrition education programs, improved nutrition information transparency and value pricing in order to improve the dietary quality of households' FAFH acquisitions.
Originality/value – This study is the first to analyze household acquisition of healthy FAFH.

Keywords Calories, Healthy, Double-hurdle, Expenditures, Food away from home

Paper type Research paper

Introduction

Over the course of three generations, US dining habits have undergone a major transformation, with Americans cooking at home less and dining out more. From 1954 to 2014, the share of food dollars Americans allocated to food away from home (FAFH) increased from 25 to 50 percent (USDA-ERS, 2016a). Defined as meals and snacks obtained from restaurants, schools and other foodservice establishments, FAFH expenditures exceeded $730 billion in 2014 and now comprise over 30 percent of American's caloric intake (USDA-ERS, 2016a; Lin and Guthrie, 2012; Stewart *et al.*, 2005).

The increasing role of FAFH in Americans' diets motivated early studies on FAFH expenditures. Redman (1980), Kinsey (1983) and Yen (1993) focus on understanding the link between FAFH expenditures and demographic factors, placing particular emphasis on the effect of women entering the workforce. In the late 1980s, the literature shifted to analyzing determinants of expenditures by FAFH type. McCracken and Brandt (1987) and

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Byrne *et al.* (1998) analyze FAFH expenditures by retailer type, distinguishing between quick-service and full-service restaurants, while Hiemstra and Kim (1995) and Jensen and Yen (1996) analyze FAFH expenditures by meal type, considering breakfast, lunch, dinner and snacks.

Subsequent to these studies, FAFH has faced increasing scrutiny from the media, nutritionists and government. The nutrition literature finds that FAFH consumption is associated with greater intake of calories, fat, cholesterol and sodium and lower intake of nutrients (Lin and Guthrie, 2012; Jeffery *et al.*, 2006). Furthermore, nutritionists find that FAFH consumption is linked to an increased risk for obesity (Kim *et al.*, 2014). Mainstream media helped increase public awareness of FAFH's poor nutritional quality through books and documentaries such as *Fast Food Nation: The Dark Side of the All-American Meal* and *Super Size Me* (Bauer *et al.*, 2012). Responding to scientific findings and public criticism, the 2010 Patient Protection and Affordable Care Act mandated that all food vendors with more than 20 locations display calorie counts on their menus by 2018 (Bleich *et al.*, 2015).

With negative publicity adversely affecting industry sales, some FAFH retailers responded by improving the nutritional quality of their menu offerings (Jeffery *et al.*, 2006; Binkley, 2006). Improvements made by restaurants include the addition of healthy menu lines, healthier children's meals, healthy indicator labels, fortified menu items and the discontinuation of "super-sized" portions (Bleich *et al.*, 2015; Bauer *et al.*, 2012; Harris *et al.*, 2010).

Criticism of the nutritional quality of FAFH has renewed interest in the determinants of FAFH expenditures in the literature. Stewart *et al.* (2005) explore the effect of preferences for a healthy diet and nutritional knowledge on FAFH demand, while Binkley (2006) considers how nutritional concerns and attitudes affect FAFH expenditures. Liu *et al.* (2013a, b) analyze determinants of FAFH expenditures by retailer, meal and household type to obtain a renewed understanding of the FAFH market. Furthermore, Richards and Mancino (2013) obtain FAFH price elasticities to inform FAFH tax policies aimed at curbing obesity.

While rising nutritional concerns have motivated researchers to reexamine FAFH, no study has considered households' acquisition of healthy FAFH. Thus, despite FAFH retailers' extensive efforts to improve the nutritional quality of their menu items, little is known about the factors affecting consumers' decision to purchase healthy items or the share of their FAFH expenditures allocated to healthy items. Determining which demographic and socio-economic factors impact healthy FAFH acquisition can help inform food and nutrition policy, as well as FAFH retailers' marketing and product development.

The objective of this study is to analyze households' acquisition of healthy FAFH from restaurants. Specifically, this study analyzes determinants of: households' decision to purchase healthy FAFH when dining away from home, the share of households' FAFH expenditures allocated to healthy items and the share of households' FAFH calories obtained from healthy items. Given the focus on healthy FAFH, the analysis of households' FAFH expenditures is complemented with an analysis of their calorie obtainment from FAFH. This joint analysis allows for the determination of whether variation in households' healthy FAFH expenditure shares across demographic and socio-economic factors corresponds with variation in the contribution of healthy FAFH to their diets.

Data

Analysis of healthy FAFH utilizes data from the National Household Food Acquisition and Purchase Survey (FoodAPS). Sponsored by the US Department of Agriculture's (USDA) Economic Research Service and Food and Nutrition Service, FoodAPS is a nationally representative data set of household food purchases and acquisitions. Administered between April 2012 and January 2013, FoodAPS consists of one-week food diaries for 4,826 participating households, which document all food at home and FAFH acquisitions. Entry and exit surveys were also administered to obtain demographic and socio-economic data for each household.

Within the FoodAPS data set, FAFH is defined as meals and snacks that are prepared outside of the home. This includes food items from full-service restaurants (i.e. those with a waiter), quick-service restaurants (i.e. fast food) and schools, as well as prepared food items from supermarkets, grocery stores and convenience stores. This analysis focuses specifically on healthy FAFH acquisitions from full-service and quick-service restaurants, as these retailer types comprise over 75 percent of FAFH expenditures and have been actively improving the nutritional quality of their menu offerings (USDA-ERS, 2016b).

Of the 4,826 FoodAPS households, 3,756 purchased or obtained FAFH from restaurants during the survey period[1]. Given this study's analysis of the share of FAFH expenditures and calories allocated to healthy items, households who do not purchase or obtain FAFH from sit-down or quick-service restaurants are excluded from the sample. The 3,756 remaining households purchase or obtain a total of 52,018 FAFH items from restaurants. Of these FAFH items, 233 are removed from the sample due to missing nutrient data. This results in a final sample of 3,756 households, purchasing 51,785 FAFH items from restaurants.

FoodAPS is ideal for analyzing healthy FAFH in that it includes nutritional data. USDA researchers used the Food and Nutrient Database for Dietary Studies (FNDDS) to append nutrient data to each FAFH item purchased (USDA-ERS, 2016c). In coding the nutritional content, each FAFH item was first categorized as either being purchased at a top-chain restaurant or a non-top-chain restaurant. For FAFH purchased from top-chain restaurants, which represent ~50 percent of this study's sample, FNDDS codes for the specific food item were used to match nutrient content. For FAFH items purchased from non-top-chain restaurants, nutritional content was coded by matching the item to the most similar FNDDS code. With over 9,000 codes, the FNDDS distinguishes FAFH items across categories and by within category characteristics, such as if the item is reduced fat, whole-grain and the cooking method used. USDA researchers went through extensive measures to accurately match each food item purchased from a non-top-chain restaurant to the appropriate FNDDS code; however, their ability to do so was dependent on the completeness of each FAFH items description in the households' food diary and the food codes available in FNDDS. Thus, it is important to note that the actual nutritional content of food items from non-top-chain restaurants may vary slightly from their coded nutritional content in FoodAPS.

Using these nutritional data, the UK Food Standards Agency's nutrient profiling model is calculated to evaluate the healthfulness of each FAFH item in FoodAPS (Food Standards Agency, 2011). Developed in 2005 to regulate the advertisement of unhealthy foods to children, the nutrient profiling model is a validated approach for categorizing healthy foods for adults and children (Arambepola *et al.*, 2008). Previously used to classify healthy FAFH items by Dunford *et al.* (2010), the model identifies healthier food items using a point scoring system ranging from −15 to 40, with lower values indicating healthier items (Food Standards Agency 2011). Under the scoring system, "A Points" are allocated based on the energy, saturated fat, total sugar and sodium content of each item. Between 0 and 10 "A Points" can be awarded for each nutrient, with increasing values indicating increasing levels of the nutrient. Similarly, "C Points" are allocated based on each item's fruit, vegetable, nut, fiber and protein content. Between 0 and 5 "C Points" can be awarded for each nutrient or food component, with increasing scores again indicating increasing levels of the nutrient or food component. Total "A (C) Points" are calculated by summing the "A (C) Points" for each individual nutrient and food component. An overall score is then calculated by subtracting the "C Points" from the "A Points". Foods scoring less than 4 points and drinks scoring less than 1 point are classified as healthy options (Food Standards Agency 2011). For a more detailed overview of the nutrient profiling model scoring system, see Food Standards Agency (2011).

Applying the nutrient profiling model to FoodAPS results in the classification of 22,736 FAFH items as healthy. Examples of common healthy FAFH items are presented in Table I. Common healthy FAFH items at restaurants predominantly include lean protein entrees, vegetable entrees and side dishes and low-calorie beverages. Notably, fresh fruit and low-fat dairy products are not among the top 25 most commonly purchased healthy FAFH items.

Methodology

The censored dependent variable problem

A common empirical issue when analyzing household purchase and acquisition data is the presence of a large number of households that do not acquire the good(s) of interest. This problem is known as the censored dependent variable problem (Wooldridge, 2010). Two types of models are commonly used to correct for this issue: tobit models and double-hurdle models. Tobit models imply that zero expenditure or calorie shares are the result of a corner solution, i.e. households choose not to purchase or obtain healthy FAFH given economic factors. Double-hurdle models are less restrictive in that they model a two-step decision process. In the first step, or the participation decision, a household dining away from home decides whether to purchase or obtain healthy FAFH. In the second step, or the share decision, the household decides the share of its FAFH expenditures or calories to allocate to healthy FAFH. This approach allows for zero expenditure and calorie shares to be the result of both economic factors and non-economic factors.

In addition to being censored below at 0, healthy FAFH expenditure and calorie shares also have an upper bound of 100. Intuitively, this upper bound represents households who only purchase or obtain calories from FAFH items that are healthy, i.e. their healthy FAFH expenditure and calorie shares equal 100 percent. To control for potential bias, an upper limit of 100 is placed on both the tobit model and the share decision of the double-hurdle model.

Vuong's test for non-nested models is used to determine whether the tobit or Cragg's double-hurdle model best fits the FoodAPS data. For both expenditure and calorie shares, the Vuong test statistics of 13.47 and 9.20 are significant at the 1 percent level and thus strongly reject the null hypothesis that the two models fit the data equally well, in favor of the double-hurdle model.

Cragg's double-hurdle model

Cragg's double-hurdle model is estimated twice in this analysis, once to analyze the share of FAFH expenditures households allocate to healthy items and second to analyze the share of FAFH calories households obtain from healthy items. Analysis of both expenditure and calories shares is conducted given that variation in healthy FAFH expenditures shares does not necessarily imply variation in the contribution of healthy FAFH to households' diets. Healthy FAFH expenditure shares may differ from calorie shares for several reasons, including the purchase of zero calorie food items, obtaining free food items and differences

Baked fries/potatoes	Grilled/baked fish	Steak
Baked potato chips	Grilled/baked chicken	Stir-fry and soy mixtures
Beef/pork/fish sandwiches	Grilled chicken salad	Tacos
Chicken nuggets or strips	Lettuce salads	Unsweetened tea
Chicken/turkey sandwiches	Mashed potatoes	Vegetable mixed dishes
Citrus juice	Meat mixed dishes	Vegetable sides
Coffee	Rice/chow mein	Water
Diet soft drinks	Soup	Yeast breads
Dumplings and sushi		

Note: $n = 22{,}736$

Table I. Top 25 healthy food away from home items purchase in FoodAPS

in the relative price of healthy FAFH purchases among particular demographic and socio-economic groups. Thus, analysis of both expenditure and calorie shares allows for the determination of whether variation in healthy FAFH expenditure shares across demographic and socio-economic factors corresponds with variation in the contribution of healthy FAFH to households' diets.

For both expenditure and calorie shares, Cragg's double-hurdle model with a lower bound of 0 and an upper bound of 100 is defined as follows:

$$y_i = \begin{cases} 0 & \text{if } y_i^* \leqslant 0 \\ y_i^* & \text{if } 0 < y_i^* < 100 \\ 100 & \text{if } y_i^* \geqslant 100 \end{cases} \quad (1)$$

where:

$$s_i = \boldsymbol{z_i}\alpha + u_i \quad (2)$$

$$y_i^* = \boldsymbol{x_i}\beta + \varepsilon_i \quad (3)$$

In the expenditure model, y_i is the observed share of FAFH expenditures households allocate to healthy items, y_i^* is the latent healthy FAFH expenditure share and s_i is a binary indicator of healthy FAFH purchase. In the calorie model, y_i is the observed share of FAFH calories households obtain from healthy items, y_i^* is the latent healthy FAFH calorie share and s_i is a binary indicator for obtaining calories from healthy FAFH. For both models, $\boldsymbol{z_i}$ is a vector of explanatory variables for the participation decision, $\boldsymbol{x_i}$ is a vector of explanatory variables for the expenditure and calorie share decisions, and u_i and ε_i are error terms.

Estimation of the double-hurdle model is broken into two steps. First, Equation (2) is estimated via a probit regression to model the purchase and/or obtainment decision. In the second step, Equation (3) is estimated using a truncated regression with a lower bound of 0 and an upper bound of 100 to model the share decision. The first stage's inverse mills ratio is included in the second stage to correct for potential sample selection bias. Following Burke (2009), average partial effects (APEs) of participation, $((\partial P(y > 0|\boldsymbol{z}))/(\partial z_j))$, and conditional expenditure and calorie shares, $((\partial E(y|0 < y \leqslant 100, \boldsymbol{x}))/(\partial x_j))$, are calculated holding other variables at their means. The APE of participation represents the effect of a change in an explanatory variable, z_j, on the probability that the average household dining away from home purchases or obtains healthy FAFH. Conditional expenditure (calorie) shares represent the effect of an explanatory variable, x_j, on the average household's expected healthy FAFH expenditure (calorie) shares, y, given that $0 < y \leqslant 100$.

Description of variables

Table II provides definitions and descriptive statistics for the variables used in the estimation of the double-hurdle model. Dependent variables include the share of households' FAFH expenditures allocated to healthy FAFH and the share of FAFH calories households' obtained from healthy items. Of the 3,756 households purchasing FAFH, healthy FAFH expenditure and calorie shares are greater than 0 for 87 and 75 percent of households, respectively. Descriptive statistics further indicate that 37 and 32 percent of households' FAFH expenditures and calories are allocated to healthy items.

Explanatory variables are grouped into four categories: income, food characteristics, health preferences and household characteristics. The income category consists of two indicator variables: SNAP households and low-income households not participating in SNAP. Relative to non-low-income households, both SNAP and low-income, non-SNAP

Variable	Definition	Unit	Base	Mean
Dependent variables				
HFAFH Exp Share	Share of food away from home expenditures allocated to healthy items	%	–	36.79
HFAFH Cal Share	Share of food away from home calories from healthy items	%	–	32.24
Income				
SNAP	Household verified as having at least one member receiving SNAP benefits	DV	Non low-income	0.27
Low-Inc/Non-SNAP	Household has income below the poverty threshold and does not receive SNAP	DV	Non low-income	0.12
Food characteristics				
FAFH QSR Exp Share	Share of food away from home expenditures from quick-service restaurants	%	–	64.71
FAFH QSR Cal Share	Share of food away from home calories from quick-service restaurants	%	–	67.19
FAFH Visits	Number of food away from home acquisition events	#	–	9.61
Health preferences				
Dieting	Any member in the household is dieting	DV	Not dieting	0.32
Nutrition Education	In last two months, household head participated in a nutrition education event	DV	No education	0.06
Healthy Time	Household head is too busy to prepare healthy meals	DV	Has time	0.22
Household characteristics				
Kids	Number of children in the household	#	–	0.96
Seniors	Number of seniors in the household	#	–	0.37
Single	Household head has never been married	DV	Married	0.27
Separate	Household head is separated or divorced	DV	Married	0.23
College	Household head has a bachelor's degree or more	DV	No college	0.23
African-American	Household head is African-American	DV	Caucasian	0.15
Asian	Household head is Asian	DV	Caucasian	0.04
Hispanic	Household head is Hispanic	DV	Caucasian	0.20
Rural	Household is located in a rural census tract	DV	Urban	0.26
Midwest	Household is located in the Midwest	DV	Northeast	0.25
South	Household is located in the South	DV	Northeast	0.37
West	Household is located in the West	DV	Northeast	0.22
Fall	Household completed food diary in the fall	DV	Summer	0.31
Winter	Household completed food diary in the winter	DV	Summer	0.02
Spring	Household completed food diary in the spring	DV	Summer	0.22
TFP Price	Average cost of the Thrifty Food Plan at retailers located in the household's primary sampling unit and adjacent counties (calculated for a family of 4)	$	–	283.62

Notes: $n = 3{,}756$. DV, discrete variable

Table II. Variable definition and descriptive statistics

households are expected to have lower healthy FAFH purchase rates, expenditure shares and calorie shares given Hiza *et al.*'s (2013) finding that low-income households have lower healthy eating index (HEI) scores. Nguyen *et al.* (2014) further find that SNAP households have lower HEI scores than low-income, non-SNAP households. Thus, SNAP households are expected to have lower healthy FAFH acquisition rates, expenditure shares and calorie shares than low-income, non-SNAP households.

Food characteristics also likely affect households' acquisition of healthy FAFH. In order to account for potential differences in the availability of healthy items by restaurant type, FAFH expenditure (calorie) shares at quick-service restaurants are included. Creel *et al.* (2008)

and Binkley (2008) find that quick-service restaurants tend to have less healthy options than full-service restaurants. Thus, increasing quick-service expenditure (calorie) shares are expected to be inversely related to healthy FAFH acquisition. Given Mancino *et al.*'s (2009) finding that increased FAFH consumption lowers diet quality, the number of FAFH visits is also expected to have an inverse association with healthy FAFH acquisition.

Three variables representing households' health preferences are considered: nutrition education, dieting and healthy time. While Stewart *et al.* (2005) find that nutritional knowledge is inversely related to overall FAFH acquisition, nutrition education is expected to have a positive association with healthy FAFH acquisition. Similarly, households indicating that a member is dieting are expected to be more likely to purchase and allocate a greater share of their FAFH expenditures and calories to healthy items. However, prior research by Todd *et al.* (2010) finds that the nutritional quality of FAFH purchases made by dieters is lower than that of non-dieters. Binkley (2006) and McCracken and Brandt (1987) further find that the importance households place on convenience is positively associated with acquiring FAFH. Similarly, time constraints in healthy meal preparation, i.e. healthy time, are expected to have a positive impact on healthy FAFH acquisition.

The literature further suggests that household characteristics will impact healthy FAFH acquisition. Hiza *et al.* (2013) and Ervin (2011) find that dietary quality increases with education, suggesting that households with college-educated heads will have greater healthy FAFH acquisitions than those without a college-educated head. Findings by Hiza *et al.* (2013) and Ervin (2011) also suggest that healthy FAFH acquisition will vary by race, with Hispanics and Asians having higher HEI scores than Caucasians. In contrast, rural households are expected to have lower healthy FAFH purchase rates, expenditure shares and calorie shares, with Sharkey *et al.* (2011) and Morton and Blanchard (2007) finding that rural households have lower dietary quality. Household composition likely affects healthy FAFH acquisition, with Hiza *et al.* (2013) finding that children and seniors have higher HEI scores than young and middle-aged adults. Following Todd (2014), the potential effect of marital status is accounted for through the inclusion of single and separated binary indicator variables. Seasonal indicators, regional indicators and the market price of the Thrifty Food Plan are also included to account for potential seasonal and regional differences in food prices.

Double-hurdle model estimates

Cragg's double-hurdle model estimates are presented in Table III. The models explain a significant amount of the variation in households' healthy FAFH expenditure and calorie shares, with numerous significant coefficients and Wald χ^2 test statistics being significant at the 1 percent level. The inverse mills ratio is not significant in the share decision of either model, indicating sample selection bias is not present. Furthermore, Pearson correlation coefficients indicate no presence of a multicollinearity problem. In order to facilitate interpretation of the double-hurdle model estimates, APEs of participation and conditional healthy FAFH expenditure and calorie shares are calculated and included in Table III.

Income

Relative to non-low-income households, SNAP households and low-income, non-SNAP households are both 3 and 2 percent less likely to purchase and obtain calories from healthy FAFH, respectively. This finding may indicate that low-income households abstain from purchasing healthy FAFH items due to higher prices or that their tastes and preferences differ from those of non-low-income households. The results further highlight that SNAP households are less likely to purchase or obtain calories from healthy FAFH than low-income, non-SNAP households. Given acquisition of healthy FAFH, APEs indicate that SNAP households allocate 2.53 and 1.28 percent less of their FAFH expenditures and

	Healthy FAFH expenditure share				Healthy FAFH calorie share			
	Participation	Expenditure share	Participation probability	Conditional expenditure share	Participation	Calorie share	Participation probability	Conditional calorie share
Income								
SNAP	−0.15***	−3.53**	−0.03***	−2.53**	−0.18***	−1.97*	−0.03***	−1.28*
Low-Inc/ Non-SNAP	−0.09**	−0.93	−0.02**	−1.71E−04	−0.13*	−2.24	−0.02*	−1.44
Food acquisition								
FAFH QSR Exp Share	−0.01***	−0.24***	−0.01***	−0.24***	–	–	–	–
FAFH QSR Cal Share	–	–	–	–	−0.01***	−0.17***	−0.01***	−0.22***
FAFH Visits	0.03***	−0.18**	0.01***	−0.03**	0.04***	−0.29***	0.01***	−0.06***
Health preferences								
Dieting	0.03	3.46***	0.01	2.47***	0.07	4.07***	0.01	2.68***
Nutrition Education	0.11	0.13	0.02	0.07	0.11	2.48	0.02	1.65
Healthy Time	0.06	0.24	0.01	0.10	0.07	−0.76	0.01	−0.49
Household characteristics								
Kids	−0.01	−1.53***	−2.65E-03	−0.03***	−0.04	−1.16**	−0.01	−0.02**
Seniors	0.01	1.90**	2.07E-04	0.01**	0.03	1.31	3.87E-03	0.01
Single	−0.08	−0.55	−0.02	−0.48	−0.01	0.08	1.96E-03	0.06
Separate	−0.10	1.21	−0.02	0.57	−0.12	0.03	−0.02	0.02
College	0.09	2.66	0.02	1.83	0.07	0.14	0.01	0.09
African-American	−0.07	0.30	−0.01	−0.23	0.01	2.01	1.12E-03	1.32
Asian	−0.04	9.23***	−0.01	6.01***	−0.16	10.67***	−0.03	7.57***
Hispanic	−0.01	−0.85	−2.55E-03	−1.01	−0.04	1.49	−0.01	0.98
Rural	−0.10	−3.68**	−0.02	−2.64***	−0.11	−0.72*	−0.02	−0.47*
Midwest	−0.08	−5.66***	−0.02	−4.11***	−0.14	−2.59	−0.02	−1.66
South	−0.07	−3.69**	−0.01	−2.46*	−0.06	−0.85	−0.01	−0.55
West	−0.01	−2.44	−2.21E-03	−1.97	−0.09	−0.02	−0.02	−0.01
Fall	−0.12*	0.06	−0.02*	0.16	−0.07*	0.40	−0.01*	0.26
Winter	0.43*	7.28	0.06*	5.47	0.79*	2.82	0.07*	1.88
Spring	−0.07	1.98	−0.01	1.60	−0.10	2.22	−0.02	1.46
TFP Price	7.83E-04	0.02	1.47E-04	0.14	1.68E-03	0.01	2.22E-04	0.07
IMR	–	129.13	–	–	–	−198.39	–	–
Constant	1.42***	50.20***	–	–	1.06***	36.93***	–	–

Notes: *,**,***Significance at the 0.10, 0.05 and 0.01 level

Table III. Cragg's double-hurdle model and average partial effects estimates

calories to healthy FAFH items than do non-low-income households. In contrast, low-income, non-SNAP households' FAFH expenditure and calorie shares do not differ significantly from those of non-low-income households. Taken together, these results suggest that low-income households are less likely to acquire healthy FAFH, and given acquisition, allocate less of their FAFH expenditures and calories to healthy items.

Food acquisition characteristics

Households' acquisition of healthy FAFH is further associated with their food acquisition characteristics, including restaurant type and purchase frequency. Obtaining FAFH primarily from quick-service, as opposed to full-service restaurants, is inversely associated with healthy FAFH acquisition. A 1 percent increase in households' quick-service expenditure (calorie) share is associated with a 1 percent decrease in the probability of acquiring healthy FAFH. This finding may reflect that there are fewer healthy options available at quick-service vs full-service restaurants, or that households dining at quick-service restaurants are less concerned with the nutritional content of their purchases.

Given acquisition, quick-service expenditure and calorie shares have minimal impact on households' healthy FAFH expenditure and calorie shares. A 1 percent increase in households' quick-service expenditure (calorie) share is associated with a 0.24 percent (0.22 percent) decrease in their healthy FAFH expenditure (calorie) shares. Overall, these findings suggest that households frequenting quick-service restaurants are less likely to acquire healthy items than those at full-service restaurants; however, restaurant type has no meaningful association with households' healthy FAFH expenditure and calorie shares.

Contrary to expectations, an additional FAFH visit is associated with a 1 percent increase in both the probability of purchasing healthy FAFH and the probability of obtaining calories from healthy FAFH. In contrast, increasing FAFH frequency is associated with a decrease in both healthy FAFH expenditure and calorie shares. In combination, these results suggest that households frequently consuming FAFH will eventually purchase a healthy item, but that increased FAFH frequency is associated with a decrease in the nutritional quality of total FAFH acquisitions.

Health preferences

Households' acquisition of healthy FAFH is also impacted by their health preferences. Households reporting that at least one member is dieting were no more likely than non-dieting households to purchase healthy FAFH or to obtain calories from healthy items. This finding may reflect that households are unable to identify healthy items or that they choose not to adhere to their diets when dining away from home. However, given acquisition of healthy FAFH, dieting is associated with households allocating 2.47 and 2.68 percent more of their FAFH expenditures and calories to healthy items, respectively. Collectively, these findings suggest that households that are able to identify healthy FAFH items and choose to adhere to their diets when dining away from home allocate a greater share of their FAFH expenditures and calories to healthy items.

The double-hurdle model estimates further indicate that receiving nutrition education does not significantly affect households' acquisition of healthy FAFH. This result may indicate that households receiving nutrition education consciously choose not to purchase healthy FAFH items or that nutrition education inadequately prepares households to make healthy decisions away from home. It may also be the case that nutrition education does improve the nutritional quality of households' FAFH acquisitions, but that the relationship is confounded by the relatively small number of households ($n = 225$) receiving nutrition education and the inability to distinguish the type of nutrition education received in the FoodAPS data set.

Household characteristics

Households' acquisition of healthy FAFH further varies with household characteristics. The number of children in a household is associated with lower healthy FAFH expenditure and calorie shares. This finding may reflect that additional children further constrain a household's budget, leading the household to limit the acquisition of healthy FAFH in favor of more economical, less healthy FAFH items. Furthermore, the number of seniors in a household is associated with greater healthy FAFH expenditure shares. These results potentially reflect that seniors purchase more expensive healthy FAFH items due to health preferences, concerns and/or dietary restrictions.

Mirroring findings by Hiza *et al.* (2013), estimates indicate that healthy FAFH acquisition varies by race, with Asian households allocating 6.01 and 7.57 percent more of their FAFH expenditures and calories to healthy items than Caucasians. Given acquisition, households located in rural areas allocate 2.64 percent less of their expenditures and 0.47 percent less of their calories to healthy FAFH items. This result

provides further support for Sharkey *et al.*'s (2011) and Morton and Blanchard's (2007) finding that rural households have lower dietary quality.

Household acquisition of healthy FAFH also varies across geographic regions. Midwest and south indicator variables are inversely related to healthy FAFH expenditures shares, but have no significant impact on healthy FAFH calories shares. This suggests that there may be regional variation in the price of healthy FAFH across the USA, but that it does not affect calorie obtainment. The double-hurdle model estimates also indicate the presence of seasonal trends in healthy FAFH acquisition. Relative to the summer, households are less likely to acquire healthy FAFH in the fall, but more likely to acquire healthy FAFH in the winter. These finding are consistent with Pope *et al.*'s (2014) finding that household acquisition of healthy food declines during the fall holiday season and then increases in the winter when households set post-holiday resolutions to improve their dietary quality.

Discussion

The primary objective of this study was to analyze households' acquisition of healthy FAFH from restaurants. Using the National Household FoodAPS Survey, Cragg's double-hurdle model is estimated in order to identify determinants of households' decision to purchase healthy FAFH when dining away from home, the share of households' FAFH expenditures allocated to healthy items and the share of households' FAFH calories obtained from healthy items. Based on the UK Food Standards Agency's nutrient profiling model, 37 percent of households' FAFH expenditures are allocated to healthy items and 32 percent of their FAFH calories are obtained from healthy items, respectively. Results indicate that households' acquisition of healthy FAFH varies with income, SNAP, FAFH purchase frequency, dieting, restaurant type, household composition, region and season. There is little difference in the impact of these factors on healthy FAFH expenditure shares vs calorie shares, suggesting that healthy FAFH expenditures proxy the contribution of healthy FAFH to a household's diet.

Results provide evidence that households may be unable to identify healthy items when dining away from home. Households with dieting members are no more likely than non-dieting households to purchase or obtain calories from healthy FAFH. However, given the acquisition of healthy FAFH, dieting households allocate a greater share of their FAFH expenditures and calories to healthy items. These findings potentially indicate that despite attempting to eat healthy, dieting households are unable to identify healthy menu items when dining away from home. Improved transparency of nutritional information at FAFH retailers could aid households in identifying healthy choices. The Affordable Care Acts mandate that calorie counts be displayed at chain restaurants in the USA by 2018 likely will not be adequate to improve households' ability to identify healthy FAFH choices. In a review of the literature, Van Epps *et al.* (2016) find that calorie labels at restaurants have little effect on calories purchased. Findings by Hwang and Lorenzen (2008) suggest that menu labels containing additional nutritional information such as macronutrient and fat content are more effective at helping households make informed FAFH purchase decisions.

Furthermore, results suggest that households may consciously choose not to purchase healthy items when dining away from home. Households receiving nutrition education are no more likely than those not receiving nutrition education to purchase or obtain calories from healthy FAFH. Given that nutrition education programs adequately inform households on identifying healthy food choices, households may consciously choose to purchase less healthy FAFH items. This finding suggests that increasing the availability of healthy options at restaurants alone may not be sufficient to improve the dietary quality of households' FAFH purchases. Similar results have been found in the food at home literature, where studies by Bodor *et al.* (2008) and Martin *et al.* (2012) find increased availability

results in no change in the acquisition of some healthy items such as fruit and reduced fat milk, but increased purchases for other healthy items, such as vegetables. In addition to availability, results indicate that tastes, preferences and habits continue to drive FAFH purchases. Combined with increasing the availability of healthy options, targeted advertisement and promotion of healthy FAFH items by restaurants is one potential approach to further encourage households to make healthy FAFH choices.

In addition to targeted advertisement and promotion of healthy FAFH, results suggest that current nutrition education programs should be evaluated based on their effectiveness at educating households on making healthy choices away from home. Instead of consciously choosing not to purchase healthy FAFH, some households receiving nutrition education may not have received adequate instruction on how to identify healthy FAFH choices. While prior research shows that USDA nutrition education programs do improve participants' overall dietary quality, no evaluation distinguishes between food at home and FAFH purchases (USDA-FNS, 2010). It may be the case that nutrition education programs adequately prepare households on making healthy food at home purchases, but may provide inadequate instruction for making healthy FAFH purchases. In order to improve households' dietary quality, current food education programs and policy may need to be revised to place greater emphasis on households' FAFH decision making, in addition to food at home decision making. Results from this analysis identify potential population subgroups that may benefit most from nutrition education focused on FAFH. These subgroups include low-income, SNAP and/or dieting households, as well as households that frequently consume FAFH and frequent quick-service restaurants.

Considering socio-economic status, results indicate that price may discourage low-income households from purchasing healthy FAFH. Estimates show that both SNAP and low-income, non-SNAP households are less likely to acquire healthy FAFH than non-low-income households. While this finding may result from differences in tastes and preferences, it also likely reflects that healthy FAFH items tend to be more expensive than less healthy FAFH items. This explanation would mirror prior studies' finding that healthy food at home is more expensive than less healthy food at home, making it cost prohibitive for some low-income households (Rao *et al.*, 2013; Jetter and Cassady, 2006). Thus, for low-income households eating away from home, prices may prohibit them from making healthy choices. Further research on the price of healthy vs less healthy FAFH menu items is needed to better understand this finding. However, these results suggest that FAFH retailers concerned with improving the dietary quality of their offerings should consider adding lower priced healthy items that are accessible to low-income households.

Limitations and future research

Although this study provides an important contribution to the FAFH literature, it is not without limitations. Despite being one of the most comprehensive data sets on household food acquisition, the coding of nutritional data to specific FAFH items within FoodAPS is subject to error, particularly for food items purchased from non-top-chain restaurants. Thus, it is important to keep in mind when interpreting this study's results that the actual nutritional content of food items may vary slightly from their coded nutritional content in FoodAPS. Another limitation of FoodAPS is the relatively low number of households ($n = 225$) receiving nutrition education and the inability to distinguish which type of nutrition education program(s) households participated in. Implications drawn based on the relationship between healthy FAFH acquisition and nutrition education should thus be considered with these limitations in mind. Finally, it is important to note that healthy FAFH acquisition almost certainly depends on the relative price of healthy and less healthy FAFH items. However, as the first analysis of healthy FAFH acquisition, creation of such a price index was beyond the scope of this research.

Additional research is needed to address the weaknesses of this study and to obtain a clearer understanding of the role of healthy FAFH in households' diets. Analysis of the relative price of healthy and less healthy FAFH items would provide further insight on whether price discourages low-income households from purchasing healthy items. Additional research on the impact of nutrition education on diet quality is also needed to determine whether nutrition education programs are equally as effective at improving the nutritional quality of FAFH and food at home purchases. Analysis of healthy FAFH expenditures segmented by retailer type and meal type would also provide insight on the types of healthy FAFH households purchase and where households choose to purchase healthy FAFH. Furthermore, future research employing a systems demand approach would give valuable insight on households' substitution among healthy FAFH, unhealthy FAFH, healthy food at home and unhealthy food at home.

Note

1. Note that acquisition of FAFH refers to both purchasing FAFH and obtaining FAFH for free.

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