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ABSTRACT

Characterizing food pantry (FP) clients' FP usage patterns may provide opportunities to tailor health-related interventions. Respondents (n = 245) at seven FPs reported their frequency and reliance on FPs and their sociodemographics, health status, and health-related trade-offs. Clients were categorized via latent class analysis. Higher FP usage was associated with being older, having a household member with heart disease, and putting off buying medicine to buy food. Lower FP usage was associated with higher levels of education and having a household member with cancer. Findings highlight the potential importance of measuring FP clients' degree of FP use.

Introduction

Approximately 13.7 million United States (US) households (10.5%) were food insecure in 2019.[1] Food insecurity is defined as having difficulty providing sufficient food for all household members due to lack of resources.[1] Food insecurity has been linked to exacerbation and prevalence of several chronic diseases, including hypertension, diabetes, cancer, depression, anxiety, asthma, chronic obstructive pulmonary disease, hyperlipidemia, and coronary heart disease.[1–3] Food insecure households face many risk factors for disease, including poor diet quality.[4,5] Understanding the strategies through which food insecure households are accessing food is essential to address their health needs.

One strategy used by food insecure households to acquire food is accessing food pantries (FPs).[6,7] FPs are local hunger relief organizations that assist food insecure households by distributing unprepared food for offsite consumption.[7] In 2019, 27.7% of food insecure US households accessed FPs.[7] Most FP clients

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are food insecure, and they experience a number of socioeconomic needs (e.g. difficulties with housing, utilities, or medical bills).[6,8] FP use has also been associated with a range of health risks, including obesity[9] and poor diet quality.[10] As a result, many FP clients engage in health-related trade-offs, foregoing healthcare in order to conserve money to buy food.[6,11] For example, FP use has been associated with medication underuse or foregoing needed medication.[6,12,13]

In research, FP use is often categorized according to a simple yes/no binary variable where a household is a FP user or not. Specific FP use patterns have not been well characterized. Many studies do not summarize client characteristics according to duration, frequency, or other indicator of intensity of FP use. The few studies that present those data have focused primarily on duration, characterizing long-term (e.g. ≥24 months) vs. short-term users[14–16] or distinguishing between long-term higher frequency and long-term lower frequency users.[17] Long-term users tend to be older than short-term users[17]; however, apart from mobility challenges,[16] neither the health status nor health-related trade-offs of long-term vs. short-term users have been documented.

Duration of use is insufficient to characterize the extent of clients' current reliance on FPs. The degree of households' food insecurity fluctuates with changes in income and employment status.[18] These fluctuations affect the strategies households use to acquire food. There is a knowledge gap with respect to documenting the differences between FP clients who continuously rely on FPs to provide much of their households' food most months vs. FP clients who occasionally rely on pantries for smaller proportions of their households' food over time. The present study seeks to document how households characterized by high FP use differ from those with lower use patterns.

Research Objectives

The objective of this study was to characterize FP use patterns of clients from a sample of FPs in Arkansas. First, we identified categories of FP use based on: (a) self-reported number of months that respondent households obtained food from FPs in the past 12 months and (b) self-reported proportion of respondent households' food obtained from FPs in the past month. Second, we examined associations between the FP use categories and selected predictors (sociodemographic characteristics, health status, and health-related trade-offs).

Methods

Respondents and Recruitment

The research team partnered with seven FPs to recruit their clients as participants. FPs were located in Washington or Benton counties in Northwest Arkansas, where there are approximately 119 food bank affiliated FPs. The seven FPs were chosen by the research team to provide representation of diverse types of FPs in the region: these FPs varied according to the number of clients served per month, their clients' racial/ethnic demographics, their hours and days of operation, their location across the major cities in the region, and the extent to which clients received food pre-selected by the FPs or had choice over food received.

Respondents were recruited in the seven food pantries by bilingual (English/Spanish or English/Marshallese) or English-speaking research staff with extensive research training. Research staff approached FP clients who were in line for food pick up and asked them to participate.

Respondents were 18 years or older and spoke English, Spanish, or Marshallese. To avoid duplicate responses, clients were asked if they or anyone in their household had participated in the survey previously and, if so, were not surveyed again.

Survey data collection was completed in July and August 2018. Surveys were administered in English, Spanish, or Marshallese, according to each respondent's preference. Surveys were administered face-to-face with tablet computers using the Research Electronic Data Capture (REDCap)[19,20] mobile application. Respondents were compensated with a $10 gift card for completing the survey.

Survey

A 27-item survey was used to assess food pantry clients' food insecurity, FP usage and duration of use, household food received from FPs, Supplemental Nutrition Assistance Program (SNAP) benefits, and individual and household health characteristics, medical expenses and trade-offs, and demographics. The survey included yes/no items, ordinal response scales, multiple choice items, and open-ended items in order to capture clients' responses.

Survey items were selected based on the research team's previous work in FPs in Arkansas,[21–24] Maryland,[25] and Minnesota.[26,27] Items were selected (and in some cases adapted) from existing survey instruments (see descriptions of items below), including the Hunger Vital Sign,[28,29] Feeding America's Hunger in America Client Survey 2014,[6] B'More Healthy: Communities for Kids Adult Impact Questionnaire,[30] Food Independence, Security, and Health client survey,[31] and the 2018 Behavioral Risk Factor Surveillance Survey.[32] To select and adapt items, the research team selected

an initial list of items to adapt and then completed three rounds of refinement and adaptation before a final survey draft was approved via consensus. Item adaptation focused on providing face-valid categorical and ordinal response options with which FP clients would be familiar and could quickly complete. The survey instrument is included as a supplementary file. Items central to analysis are described below.

FP Usage

Respondents were asked "during how many of the past 12 months (including this one) did your household get food from any food pantry?,"[6] and their responses were recorded numerically from 1–12. For this question, respondents were asked to provide their best estimate if they were uncertain of the exact number.

Household Food Received from FPs

Respondents were asked how much of their household's food came from FPs in the past 30 days.[6] Responses were on an ordinal scale where 1 = *only a few days' worth of food in a month*, 2 = *1–2 weeks' worth of food in a month*, 3 = *more than half of our food in a month*, or 4 = *almost all of our food in a month*.

Food Insecurity

Respondents completed the two-item Hunger Vital Sign food security screener,[28,29] a valid, sensitive, and specific instrument adapted from longer United States Department of Agriculture (USDA) household food security measures. The two items are: "within the past 12 months, we worried whether our food would run out before we got the money to buy more" and "within the past 12 months, the food we bought just didn't last and we didn't have money to get more." Response options were "often true," "sometimes true," or "never true." A household is considered food insecure when a respondent responds affirmatively to question 1 and/or question 2.

SNAP Benefits

Respondents were asked a yes/no question: "In the past 12 months . . . did you or anyone in your household receive SNAP benefits?"

Health Conditions

Respondents were asked if a doctor or nurse ever told them that they have: high blood pressure, overweight or obesity, type 2 diabetes, heart disease, or cancer.[30] For each health condition, response categories were *no, yes*, and *I don't know*. Clients were then asked about the same conditions but were told to consider if anyone in their household (not including themselves) had ever been told that they had any of the previous conditions.

Medical Expenses and Trade-offs

Respondents were asked a yes/no question: "In the past 12 months, did you or anyone in your household have problems paying or were unable to pay any medical bills? Include bills for doctors, dentists, hospitals, therapists, medication, equipment, nursing home, or home care."[31] Respondents were asked two questions about trade-offs related to food and medicine: "In the past 12 months, how often did you or anyone in your household put off buying medicines or take less medicine than you were supposed to so that you would have money to buy food?" and "In the past 12 months, how often did you or anyone in your household put off buying food so that you would have money to buy your medicines?"[31] Response options for these two questions were 1 = never, 2 = only 1 or 2 months, 3 = some months but not every month, 4 = almost every month, and 5 = every month. In analyses, the response options 4 = almost every month and 5 = every month were grouped into a single category.

Health Care Coverage and Demographic Variables

Respondents were asked to indicate whether or not they had any kind of health care coverage and to provide their age, race/ethnicity, sex, educational attainment, household composition, and employment status. Those items were adapted from the 2018 Behavioral Risk Factor Surveillance Survey.[32] Respondents were also asked to describe their current housing status (stable housing vs. no/temporary housing).[6]

Analytic Strategy

Descriptive Statistics

Frequency distributions and descriptive statistics (e.g. means and standard deviations) were computed.

Latent Class Analysis

Latent class analysis (LCA) was used to identify behavior patterns of FP clients. LCA is a modeling technique that identifies subgroups – or latent classes – within a population. The construct is *latent* in the sense that it is unobservable but inferred from individuals' membership to a class measured with indicators. Latent classes are mutually exclusive and exhaustive.[33]

Two indicators were used to create the classes: (1) Proportion of food from FPs measured on an ordinal scale: "*Thinking of all the food pantries you visited in the past 30 days (including this one), how much of your household's food would you say was from food pantries?*" (range: 1–4) and (2) Number of recent months respondents obtained food from FPs measured on a continuous scale: "*During how many in the past 12 months (including this one) did your household get food from a food pantry?*" (range: 1–12).

A specified latent class model was fit to the data. Existence of distinct homogenous categories of FP clients and ordinality of the classes was assumed (e.g. that we would find classes representing more reliance on FPs vs. less reliance on FPs). Information was generated to select the number of classes for the model by running a 1-class model followed by 2-class, 3-class, and 4-class models. Class interpretability and goodness-of-fit (Akaike's information criterion [AIC], Schwarz's Bayesian information criterion [BIC]) were used to determine the optimal model due to the lack of a strong theory to make a solid assumption about the number of classes to extract. BIC performed better than AIC to differentiate the models and is more widely accepted with LCA.[34]

Based on model goodness-of-fit, a 3-class model was selected (i.e., three latent subgroups in the population of adults visiting FP in northwest Arkansas). These categories exhibited a natural ordering on two dimensions: the number of recent months visiting FPs and the proportion of food from FPs. This new ordinal variable was labeled as FP Use, with *Low, Medium*, and *High* categories. We obtained the probability that respondents of each class had in answering questions about the proportion of food from FP and average number of recent months they obtained food from FP. Standard errors for the probabilities were derived from the delta method.

Ordinal Logistic Regression

We used ordinal logistic regression (OLR) to examine associations between independent variables (sociodemographic characteristics of consumers, health status, and health-related trade-offs) and the dependent variable (the resultant latent class FP Use variable). The models did not incorporate the pantry site from which the respondents were recruited. We were unwilling to assign each respondent to a single site because we encountered some of the respondents at multiple sites (although each respondent only participated once).

OLR is based on the proportional odds (PO) model, which assumes that each predictor has the same effects across categories of the ordinal dependent variable. The non-significant test Brant test for the OLR indicated that the assumption of PO was not violated, $\chi 2(24) = 26.69; p < .319$.[35] We thus analyzed the model as ordinal. For each polytomous variable, we obtained an overall p-value for the variable as a predictor. For any variables with an overall p-value <0.05, we examined each category of the variable as a predictor compared to a reference category. To assess overall adequacy of the ordinal model, we calculated two goodness-of-fit statistics (ordinal Hosmer-Lemeshow test and the Lipsitz Likelihood-ratio-tests).[36,37]

All analyses were conducted using STATA 16/SE.[38] Statistical significance was determined at alpha α = 0.05.

Table 1. Respondents' demographic characteristics, health status, and trade-offs presented by food pantry use categories.

| SOCIODEMOGRAPHIC AND HEALTH CHARACTERISTICS | Food Pantry Use Classes | | | |
	Low	Medium	High	Total
	N = 86	N = 69	N = 90	N = 245
Age (Mean ± SD)	41.1 ± 13.9	46.9 ± 13.3	51.5 ± 14.7	46.5 ± 14.7
Race/Ethnicity				
Nonwhite	41 (47.7%)	27 (39.1%)	36 (40.0%)	104 (42.4%)
White	45 (52.3%)	42 (60.9%)	54 (60.0%)	141 (57.6%)
Sex				
Male	27 (31.4%)	18 (26.1%)	26 (28.9%)	71 (29.0%)
Female	59 (68.6%)	51 (73.9%)	64 (71.1%)	174 (71.0%)
Health Care Coverage*				
No	23 (27.1%)	19 (27.9%)	28 (31.1%)	70 (28.8%)
Yes	62 (72.9%)	49 (72.1%)	62 (68.9%)	173 (71.2%)
Education				
Never/Completed grades 1–8	6 (7.0%)	6 (8.7%)	19 (21.1%)	31 (12.7%)
Completed grades 9–11	8 (9.3%)	21 (30.4%)	13 (14.4%)	42 (17.1%)
Completed grade 12/GED	43 (50.0%)	27 (39.1%)	36 (40.0%)	106 (43.3%)
Completed one or more years of college	29 (33.7%)	15 (21.7%)	22 (24.4%)	66 (26.9%)
Employment Status				
Employed	30 (34.9%)	15 (21.7%)	21 (23.3%)	66 (26.9%)
Not employed	34 (39.5%)	31 (44.9%)	32 (35.6%)	97 (39.6%)
Retired	3 (3.5%)	7 (10.1%)	10 (11.1%)	20 (8.2%)
Unable to work	19 (22.1%)	16 (23.2%)	27 (30.0%)	62 (25.3%)
Housing Status				
Stable housing	78 (90.7%)	63 (91.3%)	79 (88.0%)	220 (89.9%)
Temporary or no housing	8 (9.3%)	6 (8.7%)	11 (12.0%)	25 (10.1%)
Food Security Status				
Food secure	4 (4.7%)	3 (4.3%)	6 (6.5%)	13 (5.3%)
Food insecure	82 (95.3%)	66 (95.7%)	84 (93.5%)	232 (94.7%)
SNAP Benefits*				
Did not receive SNAP benefits in past year	52 (61.9%)	35 (50.7%)	61 (67.8%)	148 (60.9%)
Received SNAP benefits in past year	32 (38.1%)	34 (49.3%)	29 (32.2%)	95 (39.1%)
Number of Children in Household (Mean ± SD)	1.7 ± 2.1	1.6 ± 1.8	1.5 ± 1.8	1.6 ± 1.9
HEALTH CONDITIONS Anyone in household (including respondent) has:				
High blood pressure				
No	37 (43.0%)	29 (42.0%)	39 (43.3%)	105 (42.9%)
Yes	49 (57.0%)	40 (58.0%)	51 (56.7%)	140 (57.1%)
Overweight/obesity				
No	51 (59.3%)	41 (59.4%)	52 (57.8%)	144 (58.8%)
Yes	35 (40.7%)	28 (40.6%)	38 (42.2%)	101 (41.2%)
Type 2 diabetes*				
No	61 (70.9%)	49 (71.0%)	61 (68.5%)	171 (70.1%)
Yes	25 (29.1%)	20 (29.0%)	28 (31.5%)	73 (29.9%)
Heart disease*				
No	69 (81.2%)	55 (79.7%)	61 (69.3%)	185 (76.4%)
Yes	16 (18.8%)	14 (20.3%)	27 (30.7%)	57 (23.6%)
Cancer*				
No	70 (81.4%)	58 (84.1%)	76 (86.4%)	204 (84.0%)
Yes	16 (18.6%)	11 (15.9%)	12 (13.6%)	39 (16.0%)
MEDICAL BILLS In past 12 months, did household have problems paying or were unable to pay medical bills?				
No	47 (54.7%)	37 (53.6%)	34 (38.2%)	118 (48.4%)
Yes	39 (45.3%)	32 (46.4%)	55 (61.8%)	126 (51.6%)

(*Continued*)

Table 1. (Continued).

SOCIODEMOGRAPHIC AND HEALTH CHARACTERISTICS	Food Pantry Use Classes			
	Low	Medium	High	Total
	N = 86	N = 69	N = 90	N = 245
TRADE-OFFS				
In the past 12 months, how often did respondents put off …				
Buying/taking medications to afford food?				
Never	50 (58.1%)	34 (49.3%)	38 (42.2%)	122 (49.8%)
Only 1 or 2 months	16 (18.6%)	7 (10.1%)	10 (11.1%)	33 (13.5%)
Some months but not every month	10 (11.6%)	14 (20.3%)	23 (25.6%)	47 (19.2%)
Almost every month/every month	10 (11.6%)	14 (20.3%)	19 (21.1%)	43 (17.6%)
Buying food to afford medications?				
Never	62 (72.1%)	45 (65.2%)	49 (54.4%)	156 (63.7%)
Only 1 or 2 months	7 (8.1%)	9 (13.0%)	14 (15.6%)	30 (12.2%)
Some months but not every month	14 (16.3%)	11 (15.9%)	16 (17.8%)	41 (16.7%)
Almost every month/every month	3 (3.5%)	4 (5.8%)	11 (12.2%)	18 (7.3%)

SNAP, Supplemental Nutrition Assistance Program.
*Respondents answering "I don't know" were omitted from percentage calculations.
This contingency table shows cell frequencies and percentages for categorical variables. Missing data were not taken into account in percentage computation. Means and standard deviations (SD) are presented for continuous variables (age and number of children in household).

Results

Descriptive Analysis

The survey recruitment rate was 83.6%; 287 clients were approached, 247 clients agreed to participate, and 40 refused. Two respondents discontinued participation after only a few questions because they were called to pick up their food, so data from 245 respondents are included in all analyses. Table 1 presents the self-reported sociodemographic characteristics, health status, and health-related trade-offs of respondents. Respondents' mean age was 46.5 years, and 71.0% of respondents were female. The majority (70.2%) of respondents had completed high school/GED or had at least some college education. The majority of respondents were not working, either because they were not employed (39.6%) or were unable to work (25.3%). Most respondents (94.7%) were classified as food insecure by responding affirmatively to at least one of the two Hunger Vital Sign items. A minority of respondents (39.1%) reported receiving SNAP benefits. Many respondents reported that they or someone in their household has high blood pressure (57.1%), overweight/obesity (41.2%), type 2 diabetes (29.9%), or heart disease (23.6%). The majority of respondents (57.8%) indicated they have been receiving food from FPs for at least two years. Several respondents indicated that they put off buying medicines to save money for food (36.8%) or put off buying food to save money for medicines (24.0%) more than two months in the past year.

Latent Class Analysis to Identify Patterns of FP Use

Information Criterion statistics (AIC, BIC) were obtained after fitting each LCA model to gauge model fit for the 1-class (AIC = 1970.12; BIC = 1987.67), 2-class (AIC = 1828.68; BIC = 1863.77), 3-class (AIC = 1724.83; BIC = 1777.48), and 4-class (AIC = 1708.74; BIC = 1778.93) models. As described in the **Analytic Strategy**, the 3-class model was selected (i.e., FP Use, with ordinal *Low, Medium*, and *High* categories) based on the lowest BIC and class interpretability.

Table 2 presents the probabilities for FP clients to belong to a specific class as well as the class-specific response probabilities and means of each item.

LCA revealed a 35% chance that FP clients fall into the *Low* FP users category, a 37% chance that they fall into the *Medium* FP users category, and a 28% chance that they fall into the *High* FP users category.

Table 2. Probabilities for food pantry clients to belong to a specific pantry use category and item-level category-specific response probabilities and means: results from latent class analysis.

	Probability	Mean	SE	p-value	95% CI	
Low Food Pantry Users	**0.35**[†]				0.25	0.42
Proportion of food from FP						
Only a few days' worth of food in a month	0.54		0.06		0.43	0.65
1–2 weeks' worth of food in a month	0.32		0.05		0.23	0.43
More than half of our food in a month	0.09		0.03		0.04	0.17
Almost all of our food in a month	0.05		0.03		0.02	0.13
Number of months respondents obtained food from FP (past 12 months)		1.98	0.12	<0.001	1.75	2.22
Medium Food Pantry Users	**0.37**[†]				0.31	0.41
Proportion of food from FP						
Only a few days' worth of food in a month	0.43		0.06		0.31	0.56
1–2 weeks' worth of food in a month	0.39		0.06		0.27	0.51
More than half of our food in a month	0.15		0.04		0.08	0.26
Almost all of our food in a month	0.03		0.02		0.01	0.13
Number of months respondents obtained food from FP (past 12 months)		5.79	0.15	<0.001	5.50	6.09
High Food Pantry Users	**0.28**[†]				0.22	0.34
Proportion of food from FP						
Only a few days' worth of food in a month	0.25		0.05		0.17	0.35
1–2 weeks' worth of food in a month	0.34		0.05		0.25	0.45
More than half of our food in a month	0.23		0.04		0.15	0.33
Almost all of our food in a month	0.18		0.04		0.11	0.27
Number of months respondents obtained food from FP (past 12 months)		11.85	0.10	<0.001	11.65	12.05

FP, food pantry; SE, standard error; CI, confidence intervals.

For the continuous variable *number of months respondents obtained food from FP*, the latent class analysis is based on linear regression. For the ordinal variable *proportion of food from FP*, the latent class analysis is based on ordinal logistic regression. The probability statistics for Low, Medium, and High Food Pantry Users indicates the probability of a respondent from the total sample to be classified in that grouping. The probability statistics for *proportion of food from FP* indicates the relative probability of that classification for respondents in that pantry usage grouping.

† Designates the proportion of respondents assigned to a classification. This assignment was based on the respondent's most likely latent class membership.

Low FP users obtained food from a FP in a mean of 1.98 months (95% confidence intervals [CI]: 1.75–2.22) during the past 12 months. *Medium* FP users obtained food from a FP in 5.79 months (CI: 5.50–6.09) during the past 12 months. *High* FP users obtained food from FP in 11.85 months (CI: 11.65–12.05) during the past 12 months.

Low FP users had a 14% chance of obtaining between half and almost all of their households' food from a FP in the past 30 days. *Medium* FP users had an 18% chance of obtaining between half and almost all of their households' food from a FP in the past 30 days. *High* FP users had a 41% chance of obtaining between half and almost all of their households' food from a FP in the past 30 days. *High* FP users also had an 18% chance (CI: 0.11–0.27) of almost all of their food coming from a FP in the past 30 days.

Table 3. Determinants of food pantry use patterns of clients in Arkansas, 2018: results from ordinal logistic regression.

Measures	OR	95% CI	p-value
Age	1.05	1.03, 1.08	<0.001*
Race/Ethnicity	1.68	0.90, 3.15	0.105
Sex	1.18	0.63, 2.20	0.592
Health Care Coverage	0.81	0.43, 1.54	0.524
Education			
Never/Completed grades 1–8†	–	–	–
Completed grades 9–11	0.86	0.31, 2.39	0.770
Completed grade 12/GED	0.37	0.15, 0.93	0.036*
Completed one or more years of college	0.30	0.11, 0.81	0.017*
Number of Children in Household	1.06	0.90, 1.25	0.506
Employment Status	1.01	0.77, 1.31	0.960
Housing Status	2.01	0.76, 5.31	0.158
SNAP Benefits	0.75	0.43, 1.31	0.312
HEALTH CONDITIONS			
Anyone in household (including respondent) has:			
Overweight/obesity	1.11	0.61, 2.02	0.714
Heart disease	2.07	1.01, 4.62	0.048*
High blood pressure	0.70	0.37, 1.27	0.235
Type 2 diabetes	0.70	0.40, 1.32	0.266
Cancer	0.35	0.15, 0.78	0.010*
TRADE-OFFS			
In the past 12 months, how often did respondents put off …			
Buying/taking medications to afford food?			
Never†	–	–	–
Only 1 or 2 months	1.23	0.52, 2.90	0.632
Some months but not every month	2.89	1.27, 6.56	0.011*
Almost every month/every month	2.44	1.05, 5.64	0.038*
Buying food to afford medications?	1.17	0.84, 1.61	0.354
Problems Paying Medical Bills, Past 12 Months	1.71	0.95, 3.09	0.074

OR, odds ratio; CI, confidence intervals; SNAP, Supplemental Nutrition Assistance Program.
* Statistical significance at $p < 0.05$
† Reference category
Food insecurity was not entered in the regression model because of the very high proportion of food insecure clients (i.e., there was not enough variability in this variable). Regression was based on complete cases analysis.

Variables Associated with FP Use

Table 3 presents ordinal logistic regression analysis from a set of predictor variables to estimate the ordinal dependent variable class of FP clients. We interpreted estimates of the fitted model in terms of proportional odds ratios (OR) with CIs. Neither the ordinal Hosmer-Lemeshow (statistic = 17.156, $_{df(17)}$; p = .4438) nor the Lipsitz Likelihood-ratio-test (statistic = 9.613, $_{df(9)}$; p = .3828) indicated lack of fit.

Older respondents used FPs more. The odds of shifting into higher use categories (*Low* to *Medium* or *Medium* to *High*) increased by 5% (proportional OR = 1.05; CI: 1.03–1.08; p < .001) for each year increase in age, when all the other predictors remained constant.

More educated respondents used FPs less. The odds of shifting into a higher FP use category (*Low* to *Medium* or *Medium* to *High*) were 63% lower among respondents with a high school diploma/GED compared to those who had completed no higher than eighth grade, when all the other predictors remained constant (proportional OR = 0.37; CI: 0.15–0.93; p = .036). The odds of shifting into a higher FP use category (*Low* to *Medium* or *Medium* to *High*) were 70% smaller among respondents with education beyond high school compared to those who had completed no higher than eighth grade, when all the other predictors remained constant (proportional OR = 0.30; CI: 0.11–0.81; p = .017).

Respondents in households in which someone (either the respondent or other household member) has heart disease used FPs more. The odds of shifting into a higher FP use category (*Low* to *Medium* or *Medium* to *High*) for households with heart disease were 2.07 times as high as for households without heart disease, when holding all the other predictors constant (CI: 1.01–4.62; p = .048).

Respondents in households in which someone (either the respondent or other household member) has cancer used FPs less. The odds of shifting into a higher FP use category (*Low* to *Medium* or *Medium* to *High*) were 65% lower among households who reported cancer compared to those who did not, when holding all the other predictors constant (proportional OR = 0.35; CI: 0.15–0.78; p = .010).

Respondents who reported more frequently putting off buying medicine to buy food used FPs more. The odds of shifting into a higher use category (*Low* to *Medium* or *Medium* to *High*) for respondents who put off buying medicine to buy food some months but not every month were 2.89 times as high as for those who never engaged in this trade-off, when holding all the other predictors constant (CI: 1.27–6.56; p = .011). The odds of shifting into a higher use category (*Low* to *Medium* or *Medium* to *High*) for respondents who put off buying medicine to buy food almost every month or every month were 2.44 times as high as for those who never engaged in this trade-off, when holding all the other predictors constant (CI: 1.05–5.64; p = .038).

There were no differences among the class categories with regard to race/ethnicity, sex, health care coverage, employment status, housing status, number of children in household, being a SNAP participant, having difficulty paying medical bills, putting off buying food to buy medicine, or having or living with someone who has overweight/obesity, high blood pressure, or type 2 diabetes (all p-values > 0.05).

Discussion

The High, Medium, and Low FP user categories identified via LCA differed meaningfully by the number of months in the past year respondents obtained food from FPs and the proportion of their households' food they reported receiving from FPs. High users visited FPs more regularly and reported receiving a greater proportion of their food from FPs than did Medium and Low users. Similar to previous findings about frequency of FP use,[16,17] older respondents had increasingly greater odds of engaging in higher use of FPs.

Similar to previous studies,[6,11] Arkansas FP clients reported regularly putting off buying medicines in order to save money for food. This study adds important new information as the first study to document that putting off buying medicine to buy food was associated with the extent to which people rely on FPs. Putting off buying medicine to buy food was associated with higher use of FPs. Like previous studies,[6,8] the present study found that a majority of food pantry users report difficulty paying medical bills; however, difficulty paying medical bills was not related to increased usage of FPs. Together these findings suggest that the categories of FP usage identified in the present study may predict a broad set of characteristics (e.g. age, education, putting off buying medicine to buy food) related to food insecurity.

Similar to previous studies of FP clients, the sample in the present study was 71.0% female, had a mean age of 46.5 years,[6] and many (29.9%) had a household member with type 2 diabetes.[6] However, race/ethnicity, sex, and type 2 diabetes status did not predict households' degree of recent FP use.

The positive association between the degree of recent FP use and reporting heart disease in the household aligns with previous studies showing associations between food insecurity and heart disease.[2] The negative association between degree of recent FP use and having a household member with cancer was unexpected. Previous studies have shown associations between food insecurity and cancer.[2] Cancer had not previously been explicitly connected to FP use patterns. Recent reviews[24,39] of disease prevention and management interventions in FPs identified only one cancer-focused intervention[40] and one heart disease-focused intervention.[41] Further research is needed to replicate

the associations among heart disease, cancer, and FP use and, if they replicate, to understand what factors affect FP use among households in which a member has heart disease or cancer.

Limitations

Limitations of the present study include those typical of survey studies that rely upon a convenience sample of respondents. Despite a high response rate, respondents may not have been representative of the entire population of FP clients in this region. For example, the high percentage of female respondents in the sample may have affected findings related to sex. In addition, in the present study, 94.7% of FP clients were food insecure, in contrast to ~65% of FP clients in USDA's *Household Food Security in the United States in 2019* report.[7] This difference may be in part due to the different measurement instruments in the present study (i.e., Hunger Vital Sign 2-item screener) compared with the USDA report, and it may be related to the present survey recruiting a local convenience sample of FP clients rather than a national probability sample of households.[1,42]

A second limitation is that data were collected at a single point in time from each respondent. This cross-sectional approach does not provide insight into whether specific behaviors or circumstances (e.g. difficulty paying medical bills or presence of heart disease) preceded, followed, or began simultaneously with changes in degree of recent FP use. A third limitation is that this survey relied exclusively on self-report data of food pantry use and health-related variables. Future research can evaluate the robustness of the present study's findings using pantry records and health records. A final limitation is that the distances between the High, Medium, and Low user categories are unknown. However, the Brant test revealed that the proportional odds assumption was not violated, and the goodness of fit tests of the fitted model did not give evidence of lack of fit. Therefore, our assumption of ordinality of the categories seems appropriate.

Conclusions

While studies have documented how food insecure households differ from food secure households by sociodemographic characteristics, health status, and health-related trade-offs,[1,6–8,12] this is the first study to categorize degree of recent FP use and its associations with FP users' characteristics, making a significant contribution to the literature. The three categories of FP users (i.e., High, Medium, and Low users) were associated with important sociodemographic, behavioral, and health-related characteristics, including age, education, putting off buying medicine to buy food, and presence of heart disease or cancer in the household. This study addresses a gap in knowledge by identifying a straightforward, two-item approach to differentiate users' reliance on FPs. Existing studies have sorted

participants into simple binary categories (e.g. pantry users vs. non-users) or sorted based primarily on duration of use, rather than combining frequency of visits and proportion of household food obtained. With further validation and refinement, the classes identified in the present study may provide a tool to understand how recent reliance on FPs is related to clients' current diet quality and health status. This approach could eventually inform development of interventions tailored to improve the health of High, Medium, and Low FP users, respectively.

Disclosure Statement

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving research study participants were reviewed by the Institutional Review Board at the University of Arkansas for Medical Sciences, which approved this study as exempt (IRB#217560).

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