BRIEF REPORT

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Factors Associated With Food Insecurity Among U.S. Elderly Persons: Importance of Functional Impairments

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Objectives. The authors examined factors associated with the food insecurity of elderly persons in the United States and particularly how functional impairments were associated with food insecurity.

Methods. Data were from the Third National Health and Nutrition Examination Survey (1988–94) and the Nutrition Survey of the Elderly in New York State (1994). The authors used multiple logistic regression and a hierarchical logistic regression analyses to examine how functional impairments as well as sociodemographic and economic factors contributed to food insecurity in elderly persons.

Results. Low income, low education, minority status, food assistance program participation, and social isolation were significantly related with food insecurity. Functional impairments were significantly related with food insecurity among elderly persons even after those factors were controlled.

Discussion. Food security in elderly persons is associated with functional impairments, suggesting that food insecurity in elderly persons comprises not only limited food affordability, availability, and accessibility but also altered food use. Food-insecure elderly persons experience multiple problems that prevent them from achieving nutritional well-being and seeking food assistance programs. Nutrition services should recognize and provide services to cover those needs.

HUNGER and food insecurity are a persistent problem in the United States (Alaimo, Briefel, Frongillo, & Olson, 1998; Burt, 1993; Hamilton et al., 1997; Nord, Jemison, & Bickel, 1999; President's Task Force in Food Assistance, 1984; Wehler, Scott, & Anderson, 1995). The relation of food insecurity to poor nutritional and health status, as well as the ethical unacceptability of its presence within our society, has drawn significant efforts to understand the nature, extent, and prevention of food insecurity in the past decade (Campbell, 1991; Eisinger, 1998). These efforts culminated in the development of the first national food insecurity and hunger module in the Current Population Survey (CPS), which researchers designed to further understand and monitor food insecurity in the United States (Rose, 1999).

One gap in current understanding is the nature of food insecurity among elderly persons, whose number and proportion will dramatically increase through the 21st century. Most widely accepted definitions and measures of food insecurity in the United States are from research on younger adults and children. The concept of food insecurity is mainly focused on limited or uncertain food affordability, accessibility, and availability due to lack of resources. Previous research showed that food insecurity is related to sociodemographic and economic conditions that limit the household resources available for food acquisition (Alaimo et al., 1998; Campbell, 1991; Hamilton et al., 1997; Nord et al., 1999; Rose, Gunderson, & Oliveira, 1998).

The current concept of food insecurity has not taken into account limited or uncertain food use, which has an important relevance in elderly persons because their functional impairments and health problems alter ability to use food. Ability to use food is the ability to prepare, gain access to, and eat food that is available in the household. Ability to use food is not the only—but is an essential—component in maintaining adequate food use in elderly persons, which includes ways in which individuals prepare foods and combine foods into dishes, meals, and meal patterns (Quandt, Arcury, & Bell, 1998; Quandt, Vitolins, DeWalt, & Roos, 1997).

Although accurate characterization of food-insecure elderly persons has only recently begun, previous research found that functional impairments, health problems, and lack of social support have significant relationships with food insecurity (Burt, 1993; Frongillo, Rauschenbach, Roe, & Williamson, 1992; New York State Department of Health and Office for the Aging, 1996; Quandt & Rao, 1999; Roe, 1990; Wolfe, Olson, Kendall, & Frongillo, 1996). These studies suggest that the concept of food insecurity in elderly persons may include altered food use (i.e., inability to use food) due to functional impairments and health problems, as well as inadequate availability, affordability, and accessibility of food.

In this study we examined factors associated with food insecurity in elderly persons and particularly how factors related to altered food use, as well as inadequate food affordability, availability, and accessibility, contribute to food insecurity among U.S. elderly persons. We hypothesized that functional impairments were associated with food insecurity independent of other sociodemographic and economic factors. We used multivariate analysis with nationally and state representative samples from the Third National Health and Nutrition Examination Survey (NHANES III, 1988–94)

and the Nutrition Survey of the Elderly in New York State (NSENY, 1994). The results will provide a better understanding of food insecurity among elderly persons, foster discussion for better measurement of food insecurity, and provide information to improve nutrition services to reduce food insecurity in elderly persons.

METHODS

Data and Study Sample

NHANES III.—Elderly persons aged 60–90 years (N = 6,596) were sampled in NHANES III. The survey was designed to obtain nationally representative information on health and nutritional status in the U.S. population. Specifically, NHANES III included aged and very old persons and used a home examination to provide reliable estimates in older persons for the first time (McDowell, Harris, & Briefel, 1991). More detailed information on the survey design and operation is published elsewhere (U.S. Department of Health and Human Services, National Center for Health Statistics, 1996).

The analytic sample included all individuals who had complete information on food insufficiency, health problems, physical functioning, sociodemographic, and economic variables that are described below. Because of missing information on food insufficiency, 38 individuals were excluded.

NSENY.—Data were taken from elderly persons aged 60–96 years (N = 553) who were sampled in the supplemental survey to the NSENY. The NSENY was intended to obtain information to improve the effectiveness of services provided by the Elderly Nutrition Program (ENP) in New York State. New York State elderly persons have characteristics that mirror the heterogeneity of the U.S. population (Frongillo, Williamson, Roe, & Scholes, 1987). A strength of the NSENY is its inclusion of a wide range of data, such as sociodemographic characteristics, nutritional screening, food insecurity, and functional impairment variables. More detailed information of the survey design, operation, and questionnaire has been published elsewhere (New York State Department of Health and Office for the Aging, 1996). The analytic sample included all individuals who had complete information on food insecurity, nutritional risk, eligibility for a home-delivered meal program, and potential controlling variables that are described in the following sections. Of the 484 elderly persons whose food insecurity data were available, 406 had complete data and were included in the final analysis.

Dependent Variable—Food Insecurity

In NHANES III, we used the family food insufficiency question to determine food insecurity status. The question on family food insufficiency, defined as "an inadequate amount of food intake due to lack of resources," asked "Do you have enough food to eat, sometimes not enough to eat, or often not enough to eat?" (Briefel & Woteki, 1992). An elderly person was classified as food insecure if he or she reported positively to "sometimes or often did not get enough food to eat," a convention that has been adopted in other research on this topic. This question has undergone cognitive testing and it has been shown to be valid, and it has also been demonstrated to be associated with food expenditures and reduced nutrient and food group intake, mostly in younger adults (Alaimo et al., 1998; Alaimo, Olson, & Frongillo, 1999; Basiotis, 1992; Briefel & Woteki, 1992; Cristofar & Basiotis, 1992; Frongillo, Rauschenbach, Olson, Kendall, & Colmenares, 1997; Rose & Oliveira, 1997; Wolfe, Olson, Kendall, & Frongillo, 1998).

In NSENY, we used a three-item food insecurity measurement to decide food insecurity status during the last 6 months. Questions were, "Do you have enough money to buy the food you need most of the time?" "Have you skipped one or more meals because you had no food in the house or you thought that soon you might not have enough food?" "Have you had to choose between buying food or paying bills or buying something else you needed?" Content validity of the items was established by previous research in intensive pretests of the instruments in various rural and urban settings. These items were associated with low income, food assistance program participation, race-ethnicity, and eating alone (Burt, 1993; Quandt & Rao, 1999). An elderly person was classified as food insecure if he or she reported affirmative responses to at least one of the three items.

Independent Variables

Variables found to be associated with food insecurity in previous research (e.g., functional impairments, adverse health conditions, low income, minority status, low education, and food assistance program participation) were considered as potential independent variables contributing to food insecurity (Alaimo, 1997; Campbell, 1991; Frongillo et al., 1992; Hamilton et al., 1997; Nord et al., 1999; Quandt & Rao, 1999; Rose et al., 1998; Wolfe et al., 1996). We also considered variables that might intervene in the relationships between functional impairments and food insecurity, such as age and adverse health problems. Only variables that were known to be reasonably associated with food insecurity and functional impairments, available in the data set, and demonstrated not to result in multicollinearity were chosen as independent variables. Some variables were categorized for simplicity of interpretation or because of restricted distributions; in each case, models with either a continuous or categorical version of a variable gave similar results.

Physical functioning.—Activities of daily living (ADL) and instrumental activities of daily living (IADL) have been the most frequently assessed indicators of disability (Kovar & Lawton, 1994). NHANES III included four items on ADL (dressing, eating, getting in or out of bed, and transferring) and two items on nutrition-related IADL (preparing own meals and managing money). NSENY included five items on ADL (getting in or out of chair/bed, feeding self, getting dressed, taking bath/shower, and toileting) and five items on IADL (getting around by car, using public transportation, doing light housework, managing money, and taking medicine). Physical functioning included three categories: no problem (having no difficulty in ADL and IADL), IADL problem (having at least one difficulty in the IADL), and ADL problem (having at least one difficulty in the ADL).

Chronic disease.—Chronic disease variables were the presence of serious health problems (in NSENY) or at least one of eight self-reported clinically diagnosed diseases that are highly prevalent and affect nutritional and health status among elderly persons (in NHANES III; arthritis, hypertension, health failure, stroke, cataract, cancer, diabetes mellitus, and emphysema). Of those with at least one chronic disease in NHANES III, about three quarters had either one or two diseases. Preliminary analysis showed that similar results were obtained when we used a chronic disease variable as either categorical or continuous.

Sociodemographic and economic variables.—Age was divided into three groups for comparison by decade: younger old (60–69), older old (70–79), and oldest old (80 and older). Race-ethnicity was categorized into three groups (non-Hispanic White and others, non-Hispanic Black, and Hispanic). A three-category indicator of living arrangement included living with spouse, living with others, and living alone. Educational status was broken down into two groups (high school graduate or less vs more than high school graduate). A continuous social support variable included information about how often respondents saw friends or relatives per week in NHANES III. A dichotomous social isolation variable included information about whether respondents had any friends or relatives to see or talk with at least once each week in NSENY. Location included two categories: metro or nonmetro in NHANES III, New York City or non–New York City in NSENY. Poverty index ratio (PIR), computed as the midpoint of the observed family income category in household interview divided by the poverty threshold, was split into five groups (less than 50%, 50–100%, 100–130%, 130–200%, and more than 200%) in NHANES III and two groups (less than or equal to 150% vs more than 150%) in NSENY. Food assistance program participation indicated whether respondents currently participated in programs available in their community. Programs for which information was available were the Food Stamp Program and ENP in NHANES III and ENP in NSENY. In addition, we constructed dichotomous variables to indicate gender and dietary change due to health problems.

Statistical Analysis

Descriptive statistics of study population by age and the prevalence of food insecurity by each of the independent variables were analyzed. We used multiple logistic regression analysis to assess the relationships between food insecurity and other factors. We used a hierarchical logistic regression analysis to test the relative contributions of five separate groups of risk factors (physical functioning, health problems, social supports, sociodemographic, and economic) for food insecurity. Model fit was measured by area under the receiver operating characteristics (ROC) curve. The ROC area is analogous to R^2 and ranges between 0.5 and 1.0 (Frongillo et al., 1992). We conducted the analysis by using the SVY command in STATA (Statacorp, 1997), which takes into account sample weights and the complex survey effect adjusting for oversampling, noncoverage, and nonresponse.

RESULTS

Weighted percentages and means for descriptive statistics of the study population by three age groups from two data sets are presented in Table 1. Of the study population in NHANES III, the average age was 70.8 years (SE = 0.2), more than 15% were in their 80s, 57% were female, and

Table 1. Sociodemographic, Economic, and Functional Characteristics, and Prevalence of Food Insecurity of U.S. Elderly Persons for NHANES III (1988–94) and NSENY (1994)

	NHANES III				NSENY			
Independent Variable	Aged 60–69	Aged 70–79	Aged 80 and Older	Prevalence of Food Insecurity	Aged 60–69	Aged 70–79	Aged 80 and Older	Prevalence of Food Insecurity
Male	46	42	35	1.7	49	26	26	14
Hispanic and Black	12	10	10	14.5	24	19	16	61
More than high school	65	53	43	0.7	NA	NA	NA	NA
Living in metro or New York City	48	42	47	1.8	42	42	47	13
Living alone	19	33	46	2.1	29	63	75	18
Living with others	13	11	21	3.8	22	21	17	30
Living as married	68	56	32	1.0	48	15	8	8
PIR less than or equal to 130% or 150%[a]	16	20	28	19.7	23	55	53	24
Food assistance or ENP participation	7	8	17	8.4	14	32	37	24
Having disease or serious health problem	72	82	89	1.9	40	58	56	21
ADL problems	15	22	40	3.9	17	17	38	35
IADL problems	8	13	15	1.8	26	39	39	21
Medication use	66	75	80	1.7	NA	NA	NA	NA
Dietary change	25	21	12	2.0	NA	NA	NA	NA
Social isolation	NA	NA	NA	NA	12	4	12	37

Notes: N = 6,558 in NHANES III, 406 in NSENY. NHANES III = Third National Health and Nutrition Examination Survey; NSENY = Nutrition Survey of the Elderly in New York State; ADL = activities of daily living; IADL = instrumental activities of daily living; PIR = poverty index ratio; ENP = Elderly Nutrition Program; NA = not applicable. Estimates were calculated with NHANES III or NSENY sample weights.

[a]For NHANES, less than or equal to 130%; for NSENY, less than or equal to 150%.

11% were minority. The study sample from NSENY was similar: Mean age of the study sample was 67.7 years (*SE* = 0.73), 19.9% were in their 80s, 61.6% were female, and 20.9% were minority. Almost half of the NSENY respondents were widowed (42.5%), living alone (47.0%), and functionally impaired (21.9% for ADL and 30.37% for IADL). One third of them had a low income, less than or equal to 150% of PIR. Overall, younger old persons were more likely to live with their spouse and to have higher education, income, and physical functioning than older and oldest old persons. Oldest old persons were more likely to be White, female, living alone, and participating in food assistance programs.

Table 1 also shows the prevalence of food insecurity among elderly persons by sociodemographic, economic, physical functioning, and health characteristics. Overall, more than 1.7% of the older population in NHANES III were food insecure. Food insecurity was not equally distributed across race-ethnicity: Hispanic elderly persons had the highest prevalence of food insecurity and non-Hispanic Black persons were next highest. Poverty was related to the prevalence of food insecurity; persons with income less than 50% of PIR had the highest prevalence of food insecurity. Food insecurity existed, however, even among the 34.6% whose income was over poverty line. Food assistance program participants showed a higher prevalence of food insecurity. Functional impairment, particularly ADL problems, increased prevalence of food insecurity, compared with those without physical functioning problems. Similar results were shown in NSENY. The prevalence of food insecurity was higher among low-income, minority, functionally impaired, and socially isolated elderly persons.

Table 2. Odds Ratios of Reporting Food Insecurity From Multiple Logistic Regression Models for NHANES III (1988–94) and NSENY (1994)

	NHANES III		NSENY	
Independent Variable	Odds Ratio	95% Confidence Interval	Odds Ratio	95% Confidence Interval
Aged 60–69	2.39	1.33–4.29	1.65	0.68–1.03
Aged 70–79	1.79	1.05–3.06	0.16	0.44–3.08
Poverty Index Ratio				
Less than 50%	3.47	1.70–7.06	NA	
50–100%	3.80	2.38–6.06	NA	
100–130%	2.78	1.38–5.59	NA	
130–200%	1.25	0.62–2.53	NA	
Less than 150%	NA		1.99	1.04–3.79
Hispanic	4.04	2.46–6.65	3.52	1.41–8.78
Black	1.30	0.83–2.01	3.04	0.97–9.56
High school graduate	2.36	1.34–4.16	NA	
Living in metro or New York City	0.75	0.50–1.11	0.62	0.30–1.03
Living alone	0.84	0.52–1.39	1.14	0.36–3.60
Living with others	1.29	0.80–2.08	3.69	1.38–9.92
Food assistance or ENP participation	2.53	1.56–4.09	0.51	0.25–1.03
Having disease or serious health problem	0.87	0.59–1.29	1.26	0.63–2.55
ADL problems	1.94	1.34–2.79	2.8	1.04–4.56
IADL problems	1.39	0.82–2.36	2.17	1.04–4.56
Social isolation	0.999	0.998–1.00	3.17	1.39–7.25

Notes: N = 4,618 in NHANES III, 406 in NSENY. NHANES III = Third National Health and Nutrition Examination Survey; NSENY = Nutrition Survey of the Elderly in New York State; ADL = activities of daily living; IADL = instrumental activities of daily living; ENP = elderly nutrition program; NA = not applicable.

Multiple logistic regression analysis showed that younger age, poverty, minority status, less education, and food assistance program participation were significantly associated with food insecurity in NHANES III (Table 2). Similarly, poverty, minority status, living with others, and social isolation were significantly associated with food insecurity in NSENY. Even after we controlled for these significant factors, elderly persons with ADL functional impairments had significantly increased odds of reporting food insecurity in both NHANES III (OR = 1.9, CI = 1.34–2.80) and NSENY (OR = 2.8, CI = 1.04–7.54). Thus, this relation between food insecurity and functional impairments was independent of other sociodemographic and economic characteristics.

A hierarchical logistic regression analysis showed the independent effect of five groups of risk factors predicting food insecurity (results not shown). The first model included the physical functioning group only, and the ROC was 0.60 in NHANES III and 0.65 in NSENY. Then, each of the remaining four groups of variables were added in the order of health problems, social supports, sociodemographic, and economic groups; the ROC areas were, respectively, 0.61, 0.66, 0.82, and 0.87 in NHANES III and 0.66, 0.71, 0.77, and 0.77 in NSENY. Thus, functional impairments and sociodemographic variables made particularly substantial contributions to predicting food insecurity.

Discussion

Elderly persons possess nutritional and health characteristics distinct from people in other age groups, and the phenomenon of food insecurity is also distinct in this population. As with other age groups, sociodemographic and economic factors, such as poverty, low education, race-ethnicity, and food program participation, limit the resources available for household food acquisition. Consistent with previous research, older minorities were more likely to be at risk of food insecurity than their nonminority counterparts. Special attention needs to be paid to older minorities, who comprise a dramatically increasing proportion of elderly persons.

Food insecurity results from more than the constraints of financial resources in elderly persons, however. Functional impairments had a significant relation with food insecurity, even after we controlled for other significant factors. The importance of functional impairments in predicting food insecurity suggests that the concept of altered food use should be considered a part of food insecurity in elderly persons.

The significant risk factors for food insecurity tend to occur simultaneously, putting subgroups of elderly persons at much higher risk of food insecurity. The prevalence of food insecurity among elderly persons with functional impairments in addition to being minority and poor increased from 8.6% to 13.4% in NHANES III and from 19.1% to 37.5% in NSENY.

The negative effects of functional impairments on food insecurity can be moderated by the quality and quantity of social supports elderly persons have, although there has been equivocal evidence on the buffering effect of social support for those elderly persons who have functional impairments (Newsom & Schulz, 1996; Unger, McAvay, Bruce, Berkman, & Seeman, 1999). Functionally impaired elderly persons who have adequate social supports to prepare and cook may maintain adequate food use. Elderly persons who live with a spouse or others may compensate for their altered food use problems compared with those living alone. It is important to take into account social supports in understanding the effects of functional impairments on altered food use and food insecurity. Moderating effects of social support on the negative effects of functional impairments on food insecurity were not found in this study, however; there were no significant interactions among these variables.

The potential underestimation of the prevalence of food insecurity among elderly persons has been recognized because of the possibility that elderly persons have different physical and socioeconomic conditions, perceptions, attitudes, and experiences throughout their life toward food problems (Wolfe et al., 1996). National surveys—including the CPS that incorporated the first direct food insecurity and hunger module—showed that households headed by an elderly person had lower rates of food insecurity than those of younger adults (Alaimo et al., 1998; Hamilton et al., 1997; Rose et al., 1998). Furthermore, the prevalence from national surveys is usually lower than that of local studies done exclusive for elderly persons (Burt, 1993; Frongillo et al., 1992; New York State Department of Health and Office for the Aging, 1996; Wolfe et al., 1998). A likely explanation for these findings is that the limited concepts and measures used in these studies do not reflect the special characteristics of food insecurity in elderly persons.

These results suggest that altered ability to use food due to functional impairments, regardless of the availability of food and social supports in the household, has an independent role in characterizing food insecurity among elderly persons. That is, functional impairments are related to the special nature of food insecurity among elderly persons. In comparison with other age groups, food insecurity in elderly persons includes not only limited food affordability, availability, and accessibility, but also altered food use. Food-insecure elderly persons are those who have multiple problems that prevent them from achieving nutritional well-being. They are more likely to participate in food assistance programs designed to ameliorate their problems than food-secure elderly persons. Therefore, nutrition programs should recognize and provide services to cover those needs.

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