Understanding Needs Is Important for Assessing the Impact of Food Assistance Program Participation on Nutritional and Health Status in U.S. Elderly Persons

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ABSTRACT This study aimed to assess the impact of food assistance programs on nutritional and health status of nutritionally needy elderly persons. Two cross-sectional and one longitudinal data sets were used: Third National Health and Nutrition Examination Survey (1988–94), Nutrition Survey of the Elderly in New York State (1994) and Longitudinal Study of Aging (1984–1990). Multiple logistic and linear regression analyses were used to examine whether food assistance participants among food insecure elderly (i.e., those whose needs for food assistance programs are met) have better nutrient intake, skinfold thickness and self-reported health status and less nutritional risk, hospitalization and mortality than nonparticipants (i.e., those whose needs are unmet) and whether the benefit is larger than that among food secure elderly persons. Across three data sets, food insecure elderly persons had poorer nutritional and health status than food secure elderly persons. Contrary to the hypotheses, among food insecure elderly persons, food assistance participants had similar or poorer nutrient intakes, skinfold thickness, nutritional risk, self-reported health status, hospitalization and mortality than nonparticipants. Food secure participants had similar nutritional and health status as food secure nonparticipants. Lack of information on the dynamic nature and changes in needs with program participation in the three data sets likely did not allow accurate estimation of the impact of food assistance participation. Different study designs, as well as theory and knowledge of needs that clarifies need status and its change within each older individual across an appropriate time interval, are necessary to accurately assess impacts of food assistance programs. J. Nutr. 131: 765–773, 2001.

KEY WORDS: need • food insecurity • food assistance program • impact • study design • humans

A variety of food and nutrition programs have been implemented at the federal, state and local levels during the past few decades to reduce hunger and malnutrition in elderly persons. Among them, the Food Stamp Program and Elderly Nutrition Program (ENP)3 have been the primary U.S. sources of food assistance for elderly persons (Ponza 1990 and 1996, U.S. Department of Agriculture Food and Nutritional Services 1999). The role of these programs as a food safety net is emphasized in Healthy People 2010 (U.S. Department of Health and Human Services, 2000). The unprecedented increase in the aging population, changes in the health care system and welfare reform challenge food assistance programs to continue meeting the food needs of elderly persons and to become more effective and efficient in doing so.

It is essential to assess the effectiveness of food assistance programs, especially among the nutritionally needy elderly persons, and to tailor programs so they are more effective and efficient in service delivery. Research methods for assessing the impact of food assistance programs, however, have been limited in that randomized study designs usually cannot be carried out ethically to evaluate food assistance programs.

From a research design perspective, the ideal way to assess the impact of food assistance programs would be to compare outcomes between participants and nonparticipants, where both groups would have equal or comparable needs for food assistance programs. However, this approach is difficult in practice because the nutritional needs of elderly persons for food assistance program participants are not well characterized. The concept of need is most often understood as the gap between an existing and a desired nutritional state. This gap, which in principle is measurable, becomes a need in the context of social policy when it potentially can be prevented or ameliorated by the use of food assistance programs (Blum and Stein 1981). There has not been a full consensus on the nature and extent of need among elderly persons because need, as a value judgment, is identified and measured differently according to the perspective of need chosen (i.e., felt, expressed, normative and comparative) (Bradshaw 1972) and...
the approaches used in need assessments (i.e., rationalistic, empirical and relativistic) (Nguyen et al. 1983). Therefore, an inherent problem in research on the effectiveness of food assistance programs is finding a relevant comparison group or norm against which to judge the impact of a program.

Several approaches to finding the best comparison group have been tried in the past. Ideally, the comparison group would be as similar as possible to the program participants, except for program participation and random variation. Lower economic status measured by comparing household income with the Poverty Index Ratio (PIR) has been conventionally used to define elderly persons who are in need of food assistance programs. The PIR, as a normative concept of need and with the rationalistic approach, may not, however, fully reflect the complex conditions of need for food assistance among elderly persons whose need is determined by the culmination of multiple factors throughout their lives.

Groups have been made more comparable in two ways: through analysis and study design. Statistical control has been widely used in analysis to try to make groups (i.e., participants and eligible nonparticipants) comparable in terms of the needs status. The most commonly used method has been multiple ordinary least squares, which allows statistical control for some observable characteristics that might be different between participants and nonparticipants. Even after control for observed characteristics, however, program participants may still differ systematically from eligible nonparticipants in ways that can confound the estimation of food assistance program impact. In other words, it is probable that some determinants of program participation that are not fully observed are related to the outcomes, resulting in biased estimation of program impacts because of the noncomparable need status of participants and nonparticipants.

Selection models have been extensively used to try to deal with this issue. The assumption of a selection model is that some identifying variables affect only participation and not outcome variables. This assumption, however, does not hold across different studies. Especially in elderly persons, it has been difficult to identify measures that have a substantial effect on program participation but do not affect the outcome. Selection models also have not been capable of achieving equal selection by a direct link to poverty status and to mediate the link between risk factors and malnutrition; the income-based poverty measure may not account for these relations (Institute of Medicine 1996, Roe 1990, Rose et al. 1998, Rose and Oliveira 1997, Vailas et al. 1998). Food insecure elderly persons are regarded as having needs that can be solved by the use of food assistance programs. They are expected to have higher potential to benefit from food assistance participation than food secure elderly persons (Institute of Medicine 1996, Ruel et al. 1996). Thus, the null hypothesis was that there are no differences in nutritional and health status (i.e., nutrient intakes, skinfold thickness, self-reported health status, nutritional risk, hospitalization and mortality) of elderly persons regardless of whether the need for food assistance programs, it is not certain whether the characteristics considered for matching were the best ones. Another study that enhanced the comparability between comparison groups chose nonparticipants from those who were on the waiting list. This study showed that participation in home-delivered meals had significantly positive impacts on nutrition and health outcomes (Edwards et al. 1993). These studies suggest that as groups become more comparable in terms of their needs for food assistance programs, the impact of food assistance programs among elderly persons can be more accurately measured.

In an environment of shrinking government resources, it is more important than ever to use convincing research designs and methods to provide evidence that food assistance programs have beneficial impacts on nutritionally needy elderly persons. More careful consideration of the need for food assistance programs among elderly persons and incorporation of these concepts into evaluation of the impacts of food assistance programs is required.

In this study, in which we used established concepts of human service needs (Blum and Stein 1981, Bradshaw 1972, Nguyen et al. 1983, Siegel et al. 1978), we assessed the impact of food assistance programs on nutritional and health status among the nutritionally needy elderly persons using the best available cross-sectional and longitudinal data: Third National Health and Nutrition Examination Survey (NHANES III, 1988–94), Nutrition Survey of the Elderly in New York State (NSENY, 1994) and Longitudinal Study of Aging (LSOA, 1984–1990). Food insecurity was chosen to specify nutritional need among elderly persons in addition to the poverty measure, because food insecurity reflects the need for nutritional services perceived by both elderly persons themselves and society. In addition, food insecurity has been shown to have a direct link to poor nutrition and health status and to mediate the link between risk factors and malnutrition; the income-based poverty measure may not account for these relations (Institute of Medicine 1996, Roe 1990, Rose et al. 1998, Rose and Oliveira 1997, Vailas et al. 1998). Food insecure elderly persons are regarded as having needs that can be solved by the use of food assistance programs. They are expected to have higher potential to benefit from food assistance participation than food secure elderly persons (Institute of Medicine 1996, Ruel et al. 1996). Thus, the null hypothesis was that there are no differences in nutritional and health status (i.e., nutrient intakes, skinfold thickness, self-reported health status, nutritional risk, hospitalization and mortality) of elderly persons regardless of their food insecurity status and food assistance program participation. The alternative hypotheses of interest were: 1) food assistance participants have better nutritional and health status than nonparticipants, and 2) the benefits of program participation are larger among food insecure elderly persons than among the food secure.

**MATERIALS AND METHODS**

**Data and study sample**

**NHANES III.** Elderly persons 60–90 y old (n = 6596) were sampled in the NHANES III (1988–94). The survey conducted by the National Center for Health Statistics was designed to obtain nationally representative information on health and nutritional status in U.S. population through extensive interviews and an examination in a mobile examination center. Specifically, the NHANES...
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III included the aged and very old and used a home examination to monitor nonresponse at the time of data collection to provide reliable estimates in older persons (McDowell et al. 1991). More detailed information about the survey design and operation has been published elsewhere (U.S. Department of Health and Human Services National Center for Health Statistics 1996).

NSENY. The data were taken from elderly persons 60–96 y old (n = 553) who were sampled in the supplemental survey to the NSENy (April 18 to July 7, 1994). The NSENy was conducted by the New York State Department of Health in collaboration with the State Office for the Aging to obtain information to improve the effectiveness of services provided by the ENP in New York State. This survey included a wide range of data related to eligibility for home-delivered meals program, sociodemographic characteristics, nutritional risk, food insecurity and functional impairment variables. More detailed information on the survey design, operation and questionnaire has been published elsewhere (New York State Department of Health and Office of the Aging 1996).

LSOA. The LSOA was a prospective survey of 7527 civilian noninstitutionalized persons aged ≥70 y who were selected from the 1984 National Health Interview Survey, Supplement on Aging. Three follow-up interviews were conducted at 2-y intervals (1986, 1988 and 1990). The LSOA was designed to provide information on changes in health, social functioning, functional impairments, health service use and mortality for a cohort of older Americans. More detailed information on sampling design, questionnaire and operation has been reported elsewhere (Kovar et al. 1992). Due to budget constraints, 2376 individuals were not reinterviewed in 1986. This analysis focused on the 1984 and 1988 data to ensure the largest possible analytic sample (n = 7527).

Comparison groups

Food insecurity. In the NHANES III, the family food insecurity question was used to determine food insecurity status. The family food insecurity question, defined as “an inadequate amount of food intake due to lack of resources,” was designed to measure individual food insecurity based on the reported adequacy of the family’s food resources (Briefel and Woteki 1992). An elderly person was classified as “food insecure” if he or she reported that the family “sometimes or often did not get enough food to eat.” Several studies have confirmed the validity of the family food insecurity question as a measure of food insecurity, despite some limitations (Alaimo 1997, Alaimo et al. 1999, Basiotis 1992, Briefel and Woteki 1992, Cristofar and Basiotis 1992, Frongillo et al. 1997, Rose and Oliveira 1997).

In the NSENy survey, three items were used to measure food insecurity status during the past 6 mo (“Do you have enough money to buy the food you need most of the time?” “In the past 6 mo, 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?” and “In the past 6 mo, have you had to choose between buying food or paying bills or buying something else you needed?”). Previous research established content and construct validity of the items (Burt 1993, Quandt and 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.

In the LSOA, a direct question asking food insecurity status was not available. We chose the question “Do you have difficulty in preparing your own meals?” to indicate need for food assistance among elderly persons. Functional impairments including the inability to prepare meals is significantly associated with food insecurity in elderly persons (Lee and Frongillo 2001). This question has been used to determine food insecurity status in elderly persons in previous research (Burt 1993, Quandt and Rao 1999).

Food assistance program participation. Food assistance program participation indicated whether a respondent took part in food assistance programs available in their community at the present time. Programs for which information was available were the Food Stamp Program and ENP in NHANES III, ENP in NSENy, and ENP and homemaker services (HMS) in the LSOA.

Comparison group construction. In both NHANES III and NSENy, four groups were constructed based on food insecurity and food assistance program participation: 1) food insecure and participant (FIP), 2) food insecure and nonparticipant (FINP), 3) food secure and participant (FSIP) and 4) food secure and nonparticipant (FSNP).

In the LSOA, three levels of need status were broken down into four groups each depending on whether or in how many food assistance programs they participated. Among 12 possible groups, 4 were excluded because those groups had either small or no sample; those excluded were nonparticipants with severe difficulty, ENP participants with severe difficulty, HMS participants with no difficulty and participants in both programs with no difficulty.

Nutritional and health status

Nutrient intake. In NHANES III, detailed nutrient intake information was available based on one 24-h dietary recall method in the mobile examination center. The NHANES III incorporated several strategies for improving dietary recall performance in both healthy and poor/frail older persons, such as memory enhancement techniques and proxy respondents. Also, data on drinking water intake, vitamin/mineral supplementation and medication use were included to estimate total nutrient intake (McDowell et al. 1991, U.S. Department of Health and Human Services National Center for Health Statistics 1996).

Energy and 20 nutrients were selected for the analysis based on previous research reflecting concerns for excessive or deficient intake in elderly persons (Barrocas et al. 1995, Fonza et al. 1994, Schlenker 1998).

Skinfold thickness. Anthropometric measurements provide information about the adequacy of an individual’s energy balance and body composition. Weight, arm circumference and triceps, subscapular, suprailiac and thigh skinfold thicknesses were selected to assess energy stores in NHANES III. To help interpret the results on skinfold thickness, the sum of four skinfold measures was expressed also as percentile values of elders aged 60 y old who were examined in NHANES III.

Nutritional risk. The NSENy included a nutritional risk scale adopted from the 10-item Nutritional Screening Initiative Checklist (NSIC). The NSIC was designed as a brief risk-appraisal questionnaire that could be self-administered and scored by older persons, family members or caregivers (Nutrition Screening Initiative 1991). The construct and scoring system of NSIC have been validated (Posner 1993 and 1994), and it has been extensively used to evaluate nutritional risk across various fields specializing in the care of elderly persons.

In our study, a modified version of nutritional risk was used after excluding one item (“Do you have enough money to buy the food you need most of the time?”) that was also included in food insecurity measurement. The questions that were included are one or less meals per day, consumption of fruits/vegetables/milk everyday, dietary change due to health problems, tooth and mouth problems, unable to shop/cook/fed self, loss/gain weight, use of three or more drugs daily, consumption of three or more alcoholic drinks daily and eating alone. Each item has its own weight score depending on attributable seriousness to nutritional and health risk in elderly persons, and the total score is 17.

Self-reported health status, hospitalization and mortality. Self-reported health status is known to provide a simple, direct and global way of capturing perceptions of health criteria that are as broad and inclusive as the responding individual chooses to make them (Idler and Benyamini 1997, Krause and Jay 1994). The validity of perceived health status has been shown by its strong predictive power for mortality, disability, survival and health care service use, especially in elderly persons (Idler and Benyamini 1997, Kaplan 1988, Mor et al. 1994, Mossey and Shapiro 1982). Self-reported health status was asked “Would you say your health in general is excellent, very good, good, fair, or poor?” For analyses, the response was recoded into two categories: 1) good, including excellent, very good and good, and 2) poor, including fair and poor. This information was available for both NHANES III and LSOA.

The LSOA had information on the number of short-stay hospital episodes in the past 12 mo. A dichotomous hospitalization variable
TABLE 1
Estimated characteristics of food insufficiency and food assistance participation in U.S. elderly persons: NHANES III, 1988–94

<table>
<thead>
<tr>
<th>Variable</th>
<th>FIP2</th>
<th>FINP3</th>
<th>FSP4</th>
<th>FSNP5</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>95</td>
<td>117</td>
<td>841</td>
<td>5482</td>
</tr>
<tr>
<td>Mean age, y</td>
<td>69</td>
<td>70</td>
<td>74</td>
<td>71</td>
</tr>
<tr>
<td>Male, %</td>
<td>42</td>
<td>45</td>
<td>30</td>
<td>44</td>
</tr>
<tr>
<td>Hispanic or black, %</td>
<td>34</td>
<td>33</td>
<td>26</td>
<td>9</td>
</tr>
<tr>
<td>More than high school, %</td>
<td>27</td>
<td>24</td>
<td>34</td>
<td>60</td>
</tr>
<tr>
<td>Living in metropolitan area, %</td>
<td>27</td>
<td>24</td>
<td>34</td>
<td>60</td>
</tr>
<tr>
<td>Living alone, %</td>
<td>29</td>
<td>41</td>
<td>49</td>
<td>26</td>
</tr>
<tr>
<td>Living with others, %</td>
<td>31</td>
<td>28</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td>Living as married, %</td>
<td>39</td>
<td>32</td>
<td>26</td>
<td>62</td>
</tr>
<tr>
<td>Poverty Index Ratio ≤130%, %</td>
<td>76</td>
<td>61</td>
<td>59</td>
<td>15</td>
</tr>
<tr>
<td>Have disease, %</td>
<td>86</td>
<td>89</td>
<td>90</td>
<td>77</td>
</tr>
<tr>
<td>ADL problems, %</td>
<td>32</td>
<td>61</td>
<td>43</td>
<td>19</td>
</tr>
<tr>
<td>IADL problems, %</td>
<td>15</td>
<td>8</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Medication use, %</td>
<td>73</td>
<td>72</td>
<td>84</td>
<td>70</td>
</tr>
<tr>
<td>Dietary change, %</td>
<td>29</td>
<td>24</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td>Nutrition supplement use, %</td>
<td>30</td>
<td>37</td>
<td>42</td>
<td>28</td>
</tr>
</tbody>
</table>

1 Estimates were calculated with Third National Health and Nutrition Examination Survey (NHANES III) 1988–94 sample weights.
2 FINP, food insecure and program participant.
3 FIP, food insecure and program participant.
4 FSP, food secure and program participant.
5 FSNP, food secure and program nonparticipant.
6 ADL, Activities of Daily Living (dressing, eating, transferring, getting in or out of bed).
7 IADL, Instrumental Activities of Daily Living (preparing meal, managing money).
8 Dietary change, During the past 12 mo, have you changed what you eat because of any medical reason or health condition?

Chronic disease

This variable reflected the presence (versus absence) of serious health problems in NSENYS or at least one of self-reported clinically diagnosed diseases that are highly prevalent and affecting nutritional and health status among elderly persons available in NHANES III and LSOA (arthritis, hypertension, health failure, stroke, cataract, cancer, diabetes mellitus, osteoporosis and emphysema).

Sociodemographic and economic variables

Age was divided into three groups: 1) younger old (60–69 y), 2) older old (70–79 y) and 3) oldest old (≥80 y). Race ethnicity was categorized into three groups: 1) non-Hispanic/white, 2) non-Hispanic/black and 3) Hispanic. Marital status and household size questions were used to create a three-category living arrangement variable: 1) living with spouse, 2) living with others and 3) living alone. Educational status was broken down into two groups: 1) high school was completed and 2) high school not completed.

TABLE 2
Estimated characteristics of food insufficiency and food assistance participation in New York State elderly persons: NSENYS, 1994

<table>
<thead>
<tr>
<th>Variable</th>
<th>FIP2</th>
<th>FINP3</th>
<th>FSP4</th>
<th>FSNP5</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>27</td>
<td>53</td>
<td>92</td>
<td>311</td>
</tr>
<tr>
<td>Mean age, y</td>
<td>71.9</td>
<td>61.8</td>
<td>73.5</td>
<td>67.6</td>
</tr>
<tr>
<td>Male, %</td>
<td>37</td>
<td>32</td>
<td>35</td>
<td>42</td>
</tr>
<tr>
<td>Hispanic or black, %</td>
<td>37</td>
<td>38</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>Living in New York City, %</td>
<td>51</td>
<td>53</td>
<td>47</td>
<td>38</td>
</tr>
<tr>
<td>Living alone, %</td>
<td>58</td>
<td>51</td>
<td>68</td>
<td>42</td>
</tr>
<tr>
<td>Living with others, %</td>
<td>31</td>
<td>28</td>
<td>68</td>
<td>42</td>
</tr>
<tr>
<td>Living as married, %</td>
<td>10</td>
<td>20</td>
<td>18</td>
<td>45</td>
</tr>
<tr>
<td>Poverty Index Ratio ≤150%, %</td>
<td>40</td>
<td>60</td>
<td>52</td>
<td>27</td>
</tr>
<tr>
<td>Transportation service, %</td>
<td>8</td>
<td>4</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Homemaker service, %</td>
<td>32</td>
<td>8</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Long-term care service, %</td>
<td>32</td>
<td>8</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>Serious health problem, %</td>
<td>68</td>
<td>56</td>
<td>56</td>
<td>42</td>
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<tr>
<td>ADL problems, %</td>
<td>19</td>
<td>26</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>IADL problems, %</td>
<td>68</td>
<td>33</td>
<td>43</td>
<td>29</td>
</tr>
<tr>
<td>Social isolation, %</td>
<td>10</td>
<td>29</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Dietary change, %</td>
<td>62</td>
<td>45</td>
<td>41</td>
<td>28</td>
</tr>
</tbody>
</table>

1 Estimates were calculated with Nutrition Survey of the Elderly in New York State (NSEYS) 1994 sample weights.
2 FINP, food insecure and program participant.
3 FIP, food insecure and program participant.
4 FSP, food secure and program participant.
5 FSNP, food secure and program nonparticipant.
6 ADL, Activities of Daily Living (dressing, eating, getting in or out of bed, bathing, toileting).
7 IADL, Instrumental Activities of Daily Living (getting around by car, using public transportation, doing light housework, managing money, taking medicine).
8 Social isolation, see or talk with friends and relatives at least once a week.
9 Dietary change, During the past 12 mo, have you changed what you eat because of any medical reason or health condition?

Dietary change, During the past 12 mo, have you changed what you eat because of any medical reason or health condition?

Controlling variables


Physical functioning

The Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) have been the most frequently assessed indicators of disability (Kovar and Lawton 1994). The NHANES III included four items of ADL (dressing, eating, getting in or out of bed and transferring) and two items of nutrition-related IADL (preparing own meals and managing money). The NSENYS included five items of ADL (getting in/out of chair/bed, feeding self, getting dressed, taking bath/shower and toileting) and five items of IADL (getting around by car, using public transportation, doing light housework, managing money and taking medicine). The LSOA included seven ADL (bathing, dressing, eating, getting in/out of bed, walking, getting outside and toileting) and six IADL (preparing meals, shopping, managing money, using telephone, doing heavy housework and doing light housework). A three-category indicator of physical function was constructed in the following way: 1) no problem (having no difficulty in both ADL and IADL), 2) IADL problem (having at least one difficulty in IADL) and 3) ADL problem (having at least one difficulty in ADL).
graduate or less (≤ 12 y) and 2) more than high school graduate (>12 y). A social support variable was made with information about how often the respondent got together with friends or relatives, such as going out together or visiting in each other's home. Location included two categories: metropolitan or nonmetropolitan in NHANES III and New York City or non--New York City in NSENY. As an economic factor, PIR, computed as the midpoint of the observed family income category in household interview divided by NHANES III and New York City or non--New York City in NSENY. Included two categories: metropolitan or nonmetropolitan in addition, dichotomous variables were constructed to indicate gender (female versus male), dietary change due to health problems and use of vitamin/mineral supplementation.

**Statistical analysis**

SAS PROC GLM for linear regression was used to assess the extent to which food assistance program participation was associated with nutritional and health status in food insecure elderly. This analysis compared means of nutrient intake, skinfold thickness and nutritional risk among comparison groups while controlling for other confounding variables. To assess the association of food assistance program participation with self-reported health status, hospitalization and mortality, logistic regression was used with SAS PROC LOGISTIC.

Descriptive statistics were analyzed using sample weights and complex survey methods that take into account oversampling, noncoverage and nonresponse among three data sets. The complex sample design was taken into account when calculating variance estimates using SVY commands in STATA (StataCorp 1997). The use of sample weights, however, made the analysis much less efficient and precise in NHANES III. The approximate inefficiency of the sample weights calculated with the equation from DuMouchel and Duncan (1983) was 56.8%. Our preliminary analysis showed that coefficients of regression analysis without sample weights were consistently smaller but similar to coefficients with sample weights. Analysis without sample weights did not change our results. Thus, unweighted analyses were made while controlling for the variables related to the design adjustments in the analysis to maintain its efficiency and precision (Korn and Graubard 1991). Also, unweighted analyses were made in LSOA, because previous study using LSOA found that the sampling design of the LSOA has little impact in variance estimation (Fitti and Kavor 1987).

**RESULTS**

**Descriptive statistics.** Sociodemographic, economic and health characteristics of the study populations from the three data sets by group are presented in Tables 1, 2 and 3. Of the study population in NHANES III, 1.7% were food insufficient; 8.9% were currently participated in either the Food Stamp Program (5.0%), Senior Meals Programs (3.3%) or both (0.6%). Program participants, particularly multiple program participants, were more likely to be functionally impaired and poor. Food insufficient elderly persons were more likely to participate in food assistance programs than were food sufficient elderly persons (45.3% versus 8.3%). Among the program participants, food insufficient elderly persons were more likely to participate more in the Food Stamp Program (86.5% versus 53.9%), whereas food sufficient elderly persons were more likely to participate in Senior Meals Program (39.6% versus 7.0%). The mean age of the study population was 70.8 ± 0.21 y old (means ± SE); >15% were in their 80s; 57% were female and 11% were minority. The study sample from the NSENY had similar characteristics to those from the NHANES III (Table 2). The prevalence of food insecurity and program participation in the NSENY (16.1 ± 0.02 and 22.8 ± 0.02%) was higher than that of the NHANES III. Similar to the NHANES III, food insecure elderly persons were more likely to participate in the ENP (34.0% versus 20.7%). Among the four groups, the FSNP group had the highest economic attainments, and they were more likely to live with their spouse in a noncity area. They had better physical functioning (63.6% with no ADL or IADL problems), and only 11.3% were homebound. At the other extreme, the FINP group had the worst economic attainments, the youngest mean age (61.8 ± 3.46 y), the highest prevalence of ADL problems (26.0%) and the highest prevalence of being homebound (35.5%); about two thirds of them were of low

### TABLE 3

**Characteristics of need and food assistance participation in the elderly: LSOA, 1984–88**

<table>
<thead>
<tr>
<th>Variable</th>
<th>No difficulty¹</th>
<th>Moderate difficulty</th>
<th>Severe difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO² (n = 5620)</td>
<td>ENP³ (n = 727)</td>
<td>NO (n = 76)</td>
</tr>
<tr>
<td>Mean age, y</td>
<td>76</td>
<td>77</td>
<td>79</td>
</tr>
<tr>
<td>Male, %</td>
<td>37</td>
<td>31</td>
<td>11</td>
</tr>
<tr>
<td>Hispanic or black, %</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>More than high school, %</td>
<td>19</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>Poverty Index Ratio &lt;100%, %</td>
<td>17</td>
<td>25</td>
<td>32</td>
</tr>
<tr>
<td>Living alone, %</td>
<td>37</td>
<td>54</td>
<td>65</td>
</tr>
<tr>
<td>Living with others, %</td>
<td>37</td>
<td>54</td>
<td>65</td>
</tr>
<tr>
<td>Living as married, %</td>
<td>42</td>
<td>32</td>
<td>23</td>
</tr>
<tr>
<td>Have diseases, %</td>
<td>77</td>
<td>83</td>
<td>92</td>
</tr>
<tr>
<td>ADL problems, %</td>
<td>19</td>
<td>22</td>
<td>82</td>
</tr>
<tr>
<td>IADL problems, %</td>
<td>11</td>
<td>14</td>
<td>18</td>
</tr>
<tr>
<td>Fair/poor health status, %</td>
<td>28</td>
<td>31</td>
<td>71</td>
</tr>
</tbody>
</table>

¹ No, moderate or severe difficulty refers to no, moderate or severe need for help to prepare their own meals.

² NO, nonparticipant for either Elderly Nutrition Program or homemaker services.

³ ENP, participant for Elderly Nutrition Program.

⁴ HMS, participant for homemaker services.

⁵ ENP/HMS, participant for either Elderly Nutrition Program or homemaker services.

⁶ ADL, Activities of Daily Living (bathing, dressing, eating, getting in and out of bed, walking, getting outside, toileting).

⁷ IADL, Instrumental Activities of Daily Living (preparing meals, shopping, managing money, using telephone, doing heavy and light housework).
income, and they were the most socially isolated. The FIP group had the highest proportion of serious health problems (67.7%) and functional impairments (86.7% for both ADL and IADL). They were less likely to be living with a spouse. The FSP group had the highest proportion of the oldest old (32.6%), widowed (62.87%) and those who lived alone (68.2%).

The characteristics of study sample from LSOA were similar to those of the other two study samples (Table 3). They were predominantly female (62.0%) and white (89.1%) and had diseases (78.7%). Almost one tenth of the study population had problems in preparing their own meals. Elderly persons who were more likely to have severe difficulty in preparing their meals were more likely to be poor, less educated, functionally impaired and in poor health, to live alone and to participate in food assistance programs.

**Analytical results.** Figure 1 shows adjusted nutrient intake as a percentage of RDA among the four groups in the NHANES III with control for potential confounding factors: age, gender, race-ethnicity, PIR, education, living arrangement, disease, physical functioning, dietary change due to health problems, use of vitamin/mineral supplementation and medication use. The intakes of energy, protein, calcium, magnesium, zinc and vitamins A, E and B-6 were lower than 100% of recommended daily allowance in elderly persons. Overall, food sufficient elderly persons had higher percentages of recommended daily allowances for most nutrient intakes than did food insufficient elderly persons. The FSNP group had higher nutrient intakes than the other three groups. Contrary to the two specified alternative hypotheses, participants did not have higher intakes than nonparticipants, regardless of food insufficiency status. Instead, the FIP group consumed a lower level of energy, protein, vitamins E and C, thiamin and iron than did the FSNP group. Also, intakes of energy, some of the vitamins (thiamin, riboflavin and vitamins A, E, B-6, B-12 and C), niacin and iron were lower in the FIP group than in the FSNP group. Adjusted means of nutrient intakes of seven other nutrients (i.e., total fatty acids, saturated fatty acids, carbohydrate, cholesterol, folate, phosphate and sodium) showed similar nutrient intake patterns among the four groups (data not shown).

Table 4 presents adjusted skinfold thickness, nutritional risk and percentage of reporting poorer health status among four groups with control for confounding factors. Contrary to the two alternative hypotheses, the FIP group had a lower sum of skinfold thickness (42.5th percentile) than any of the other three groups (FINP, 48.7th; FSP, 52.6th; FSNP, 54.9th); they had a lower suprailiac (40.3th percentile) and thigh skinfold (50.5th percentile) thickness than the FSNP group (53.6th and 55.8th percentiles, respectively). Multiple logistic regression analysis with control for sociodemographic, economic, psychological, physical functioning, health and behavioral and adverse health conditions calculated adjusted odds ratio of reporting fair/poor health status in the NHANES III. Compared with the FSNP group, the other three groups had increased odds of reporting poorer health status. Specifically, the FIP group was most likely to report poorer self-reported health status (odds ratio = 3.5, 95% confidence interval = 2.1–5.6).

In the NSENY, contrary to the two alternative hypotheses, the FIP group had the highest nutrition risk even after controlling for age, gender, race, PIR, living arrangement, social isolation, location, serious health problems and functional impairments, and the FSP and FSNP groups were not different.

In the LSOA, contrary to the two alternative hypotheses, elderly persons with greater difficulty in preparing meals had higher odds of having poorer self-reported health status, hospitalization rates and mortality rates (Fig. 2). Participation in either the ENP or HMS did not make significant differences in that pattern. Rather, those who participated in either of the two programs showed higher odds of having poorer self-reported health status, hospitalization rates and mortality rates than did their counterparts within the same level of difficulty.

**DISCUSSION**

The impacts of food assistance programs are determined not only by the efficacy of programs but also by the need status of participants. This study aimed, through understanding, identifying and incorporating the need for food assistance programs among elderly persons, to assess the impacts of those programs. We proposed food insecurity as a way of determining nutritional need among elderly persons for nutritional services.

A consistent trend across groups was found in all three data sets. Food insecure elderly persons were more likely to participate in food assistance programs available in their community, even though only half of them used those services in the nationally representative sample. Contrary to the first alternative hypothesis, food assistance participants had similar or
poorer nutrient intakes, nutritional risk, self-reported health status, hospitalization rates and mortality rates and smaller skinfold thickness than did nonparticipants. Also contrary to the second alternative hypothesis, the benefit of program participation was not greater for food insecure elderly persons than for the food secure. These findings are consistent with previous research using statistical control or selection models that found nonsignificant and minimal impacts of food assistance programs among eligible participants compared with eligible nonparticipants (Akin et al. 1985, Basiotis and Brown 1987, Blanchard 1982, Butler et al. 1985, Deveney and Moffit 1991, Emmons 1987, Hama and Chern 1988, Lane 1978, Lopez and Habicht 1987a and 1987b, Posner et al. 1987b).

Across the three national or statewide representative data sets, either cross-sectional or longitudinal, program participants were more likely to be poor, functionally impaired, living alone and at nutritional risk than nonparticipants. Multiple programs participants tended to have worse sociodemographic nutritional and health status. The process of translating the need for food assistance or food insecurity (i.e., felt needs) into utilization of food assistance programs (i.e., expressed needs) is influenced by availability, accessibility of programs and acceptability to elderly persons (Blanchard 1982, Hollenbeck and Ohls 1984, Trela and Simmons 1971, Wolfe et al. 1996). In particular, perceptions about the need and attitudes for services provided by programs targeted toward elderly persons have been known as important determinants of service use (Krut 1983, Wracker et al. 1998). Not all elderly persons who feel a need for food assistance programs participate in programs. Although nonparticipants among food insecure elderly persons might have greater potential to benefit from food assistance, they may have problems or concerns that make them reluctant to participate. For example, lack of information, eligibility, living in a nonmetropolitan area, functional impairments and negative perceptions or stigma toward the program participation may limit participation. Food assistance program participation implies more than just receiving nutritional and health services provided by programs targeted toward elderly persons; it implies selectivity resulting from serious nutritional need and demand for food assistance programs as well as complicated decision-making processes by elderly persons. Food assistance

| Table 4 | Adjusted mean anthropometry, nutritional and odds ratios of reporting poorer self-reported health status by food insecurity and food assistance participation: NHANES III, 1988–94; NSENY, 1994 |
|---|---|---|---|---|---|
| Anthropometry from NHANES III | FIP | FINP | FSP | FSNP | P-value |
| Height, cm | 163.6 | 162.9 | 164.0 | 164.4 | 0.04 |
| Weight, kg | 71.9 | 69.0 | 71.7 | 72.9 | 0.04 |
| BMI, kg/m² | 27.0 | 25.9 | 26.6 | 26.9 | 0.27 |
| Arm circumference, mm | 30.8 | 30.2 | 30.8 | 31.3 | 0.03 |
| Triceps skinfold, mm | 17.4 | 16.6 | 17.5 | 17.8 | 0.26 |
| Subscapular skinfold, mm | 19.2 | 18.7 | 20.2 | 20.5 | 0.14 |
| Suprailliac skinfold, mm | 16.4 | 18.7 | 19.7 | 19.8 | 0.02 |
| Thigh skinfold, mm | 18.8 | 18.9 | 20.7 | 21.0 | 0.04 |
| Sum of four skinfold thickness, mm | 66.9 | 71.8 | 74.7 | 76.6 | 0.01 |
| Self-reported health status from NSENY | | | | | |
| Fair/poor health status (odds ratio) | 3.5 | 2.2 | 1.4 | 1.0 | 0.00 |
| Nutritional risk from NSENY | | | | | |
| Nutritional Risk Score (of 17) | 5.17 | 4.15 | 2.99 | 2.90 | 0.00 |

1 Adjusted mean anthropometry was calculated from unweighted linear regression analysis controlling for age, gender, race, Poverty Index Ratio (PIR), education, living arrangement and disease.
2 Nutritional Risk Score was calculated from regression analysis controlling for age, gender, race, PIR, living arrangements, social isolation, location, functional impairments and serious health problems.
3 Odds ratios for reporting fair/poor health status were calculated from unweighted logistic regression analysis controlling for age, gender, race, PIR, education, living arrangement, social support, location, disease, functional impairments and medication use.
4 P-values evaluated the null hypothesis that the four groups were equal.

BMI, body mass index; NHANES III, Third National Health and Nutrition Examination Survey; NSENY, Nutrition Survey of the Elderly in New York State; FIP, food insecure and program participant; FINP, food insecure and program nonparticipant; FSP, food secure and program participant; FSNP, food secure and program nonparticipant.
program participants who are food insecure may have been the most nutritionally needy, and they may have chosen to participate in programs regardless of all of the constraints of and negative perceptions toward programs (Ponza and Wray 1990). These ideas are consistent with the observation in this study that the FIP group who are most in need had the similar or worse nutritional and health status than the FINP group, as was the case for the FSNP and FSP groups.

At least two interpretations of these results are possible. One interpretation is that food assistance participation may have either no or little impact on the nutritional and health status of food insecure elderly persons. Another more plausible interpretation is that food assistance program participation may protect food insecure elderly persons from further detrimental nutritional and health problems and may contribute to maintaining food security among food secure persons. That is, programs might help participants to maintain nutritional and health status at least similar to that of nonparticipants within the same level of need status. One cannot, however, easily judge which interpretation is likely to be most correct without more extensive information on their needs.

These two possible interpretations illustrate why our approach to incorporate the concept of need is important in trying to accurately assess impacts of food assistance programs. However, limited information on the dynamic nature of needs in relation to program participation in the three data sets, both cross-sectional and longitudinal, did not allow the achievement of comparability of need status across the groups. The two cross-sectional data sets lacked information on the duration and severity of food insecurity, as well as the pattern and period of program participation. Even the longitudinal data containing information at an interval of 4 y were not sufficient to provide better information on dynamic changes in need status and program participation.

This study suggests that direct comparison between participants and nonparticipants is incapable of assessing the impact of program participation, even with the best-available, typical cross-sectional and longitudinal data. This problem likely cannot be corrected by statistical control, selection models or matching. The incorporation of simple categorization of specific needs was also unable to resolve selection bias related to program participation and to facilitate an examination of the impacts of food assistance programs. Careful understanding and identification of the nutritional needs of elderly persons within appropriate time frames are critical to evaluate the impacts of food assistance programs and whether they are of benefit to the most nutritionally needy. Furthermore, close scrutiny on different manifestations of need for food assistance programs among elderly persons, which is greatly specific to an individual, is vital to assess and interpret the impacts of the program.

These results emphasize the importance of having more extensive information on the complex and dynamic nature of need for nutrition services among elderly persons. Different study designs and approaches to sort out need status and its change within each older individual across an appropriate time frame are necessary to assess unbiased impacts of food assistance programs. In the absence of the ability to conduct randomized intervention trials, time-intensive event history designs may be most able to provide the information required to assess the impacts of programs for elderly persons (Blossfeld and Rohwer 1991, Tuma and Hannan 1984). An event history design study transitions across a set of discrete states, including the length of time intervals between entry into and exit from specific states. The transitions in states are studied in relation to other discrete events and changes in continuous states.

These designs hold advantages for causal inference over both cross-sectional and traditional longitudinal designs and are particularly suited for research with elderly persons because of the highly dynamic nature of factors in their lives that affect their well-being.

In the era of population aging, understanding the dynamic needs along with social psychological dynamics of help-seeking behavior among elderly persons is fundamental to assessing the impact of food assistance programs. Theory and knowledge to understand what, how and why nutritional needs are manifested within the context of food assistance program delivery and to develop study designs are required to examine the impact of food assistance programs and to make food assistance programs a more effective and beneficial intervention for elderly persons.

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LITERATURE CITED


