



12-1998

A Cost-Benefit Analysis of the Expanded Food and Nutrition Education Program

Janie L. Burney

University of Tennessee, Knoxville

Recommended Citation

Burney, Janie L., "A Cost-Benefit Analysis of the Expanded Food and Nutrition Education Program." PhD diss., University of Tennessee, 1998.

https://trace.tennessee.edu/utk_graddiss/3833

This Dissertation is brought to you for free and open access by the Graduate School at Trace: Tennessee Research and Creative Exchange. It has been accepted for inclusion in Doctoral Dissertations by an authorized administrator of Trace: Tennessee Research and Creative Exchange. For more information, please contact trace@utk.edu.

To the Graduate Council:

I am submitting herewith a dissertation written by Janie L. Burney entitled "A Cost-Benefit Analysis of the Expanded Food and Nutrition Education Program." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Human Ecology.

Betsy Haughton, Major Professor

We have read this dissertation and recommend its acceptance:

Paula Zemel, Carol Costello, Robert J. Pursley

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

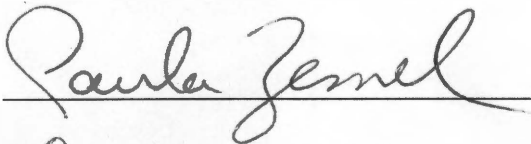
To the Graduate Council:

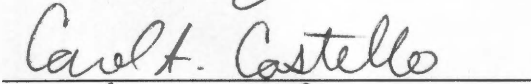
I am submitting herewith a dissertation written by Janie L. Burney entitled, "A Cost-Benefit Analysis of the Expanded Food and Nutrition Education Program." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Human Ecology.

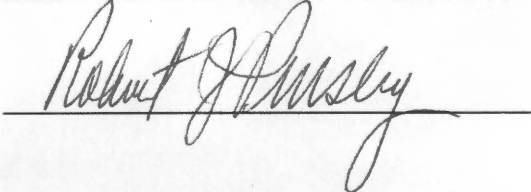


Betsy Haughton, Major Professor

We have read this dissertation
and recommend its acceptance:







Accepted for the Council:



Associate Vice Chancellor and
Dean of the Graduate School

**A Cost-Benefit Analysis
of the Expanded Food and
Nutrition Education Program**

A Dissertation

Presented for the Doctor of Philosophy Degree

The University of Tennessee, Knoxville

Janie L. Burney

December 1998

Copyright © Janie L. Burney, 1998

All rights reserved

DEDICATION

This dissertation is dedicated to the program assistants and Family and Consumer Science agents in the Tennessee Agricultural Extension Service, who work to improve the health and well-being of families in Tennessee through the Expanded Food and Nutrition Education Program. For many of these families, they are a primary source of nutrition information and a major influence on food and nutrition behaviors.

ACKNOWLEDGMENTS

I would like to acknowledge the following people who helped make this research project possible: Dr. Betsy Haughton, my major professor, who guided me through the long process and served as both teacher and adviser; Dr. Gail Disney and Dr. Pat Sobrero, who were a source of encouragement and support that helped me manage a full-time job and graduate school; Dr. Ann Reed for help with statistics; and Dr. Carol Costello, Dr. Jack Pursley, and Dr. Paula Zemel, for their insight and suggestions.

Lastly, I am particularly grateful to Extension Family and Consumer Science agents and program assistants involved in this project.

ABSTRACT

Data on the economic value of nutrition education programs, such as the Expanded Food and Nutrition Education Program (EFNEP), can help decision makers choose between alternative programs based on costs and benefits. A cost-benefit analysis of EFNEP was conducted to determine if savings in food expenditures exceeded implementation costs. Costs were collected over a 6-months using expenditure reports and other records. Benefits were determined using prospective data from 371 females enrolled in EFNEP who completed a 24-hour food recall, behavior survey, and recorded the amount of money spent on food monthly at program entry and exit. Two treatment groups received nutrition education and one group did not receive education. One treatment group estimated food expenditures from recall and the other collected register receipts or recorded expenditures. Control group subjects reported expenditures from recall. Net present value (NPV) was calculated using cost per participant subtracted from the change in food expenditures per participant over a 5-year period at a discount rate of 7%. NPV of EFNEP was \$600.52, i.e., food expenditures were reduced by \$600.52 over a 5-year period. At the same time individuals reduced food expenditures, they increased intakes of iron, vitamin C, vitamin B₆, and fiber. They added less salt when cooking and more often read nutrition labels. They also reported less often running out of food at the end of the month. Findings from this research showed that EFNEP is cost-beneficial. The magnitude of the savings in food expenditures varies with how long participants retain behaviors they learned and by the rate at which future benefits are discounted.

PREFACE

This dissertation was written in two parts. Part 1 consists of an introduction, an extensive review of the literature, and the research questions. Part 2 is the study written in journal format. An extensive methodology is included in Appendix A to explain methods in more detail. To aid the reader, a glossary of terms is included in appendix G.

Table of Contents

	Page
Part 1: Introduction, Purpose, and Literature Review	1
Introduction	2
Purpose	4
Literature Review	5
The Expanded Food and Nutrition Education Program	5
Choosing the Type of Economic Analysis	13
Conducting a Cost-Benefit Analysis	52
Summary	70
Statement of the Problem	72
References	74
Part 2: A Cost-Benefit Analysis of the Expanded Food and Nutrition Education Program	86
Introduction	87
Methods	90
Subjects	90
Research Design	90
Sample Size	92
Data Collection	92
Statistical Analyses	98
Comparing Costs and Benefits	101
Results	104
Sample	104
Program Costs	110
Program Benefits	111
Net Present Value and Array of Effectiveness Measures	119
Discussion	123
Applications	130
References	132
Appendices	137
Appendix A: Extensive Methodology	138
Appendix B: Participant Records	164
B1. Family Record Form	165
B2. Dietary Recall Form	167
B3. EFNEP Survey Form	168
B4. Food Expenditure Record	170
Appendix C: Instructions for Conducting a Cost Benefit Analysis	172
Appendix D: Participant Consent Forms	182

D1. Consent Form for Group A	183
D2. Consent Form for Group B	185
D3. Consent Form for Group C	187
Appendix E: Grant and Contract Budget and Expenditure Report	189
Appendix F: EFNEP Costs by Month	191
Appendix G: Glossary of Terms	196
Vita	199

List of Tables

Table	Page
1. Expected outcomes as a result of participating in EFNEP	7
2. Participation rates by county for each group.	105
3. Demographic characteristics of the sample: race/ethnicity and residence.	106
4. Demographic characteristics of the sample: household composition.	108
5. Participation in public assistance programs	109
6. Number of lessons received by subjects in group A and B.	110
7. Type of instruction received by subjects in group A and B.	110
8. Direct costs for 12 months.	112
9. Average scores for food and nutrition related practices at program entry for the combined experimental group and control group.	114
10. Comparison of the difference between average number of meals and servings from food groups at program entry and program exit for combined experimental group and the control group.	116
11. Comparison of the difference between average nutrient intakes at program entry and program exit for the combined experimental group and the control group.	117
12. Average scores for food selection and preparation practices at program exit for the experimental groups and the control group.	118
13. Net Present Value (NPV) from savings in food expenditures as a result of participation in EFNEP.	120
14. An array of food and nutrient outcomes for the combined experimental group that improved as a result of participation in EFNEP.	121
15. An array of food resource management, food selection, and food preparation outcomes for the combined experimental group that improved as a result of participation in EFNEP	121

16.	The nonequivalent control group design	140
17.	Activities related to the implementation of EFNEP	147
18.	Direct and indirect costs of EFNEP during May, June, and July	192
19.	Direct and indirect costs of EFNEP during August, September, and October	194

Part 1

Introduction, Purpose, and Literature Review

INTRODUCTION

The Problem: Does the Expanded Food and Nutrition Education Program help families use food resources wisely and improve nutritional intake? And, what does it cost to produce program outcomes?

Research suggests that nutrition education programs, such as the Cooperative State Research, Education, and Extension Service's (CSREES) Expanded Food and Nutrition Education Program (EFNEP), improve the quality of diets of low-income individuals by improving their food buying and preparation practices (1-2). Living below the poverty level makes it difficult to consume enough food with adequate nutrients. Diets must be planned wisely and foods must be selected and prepared carefully to make resources meet nutritional needs. When families cannot make their resources last long enough to meet their needs for food, they do without some foods and consume a disproportionate amount of others creating nutritional imbalances. Some families rely on temporary stop-gap measures, such as food banks and pantries in their communities (3).

National food and health surveys have shown that certain populations, such as low-income women and children, consume inadequate diets (4). Over consumption of some nutrients, such as total fat, saturated fat, cholesterol, and sodium, also is a problem for low-income women and children (5). Under- and overnutrition, both forms of malnutrition, are considered important issues because they impact health and well-being. Lack of food interferes with physiological and cognitive function (6) and creates social problems (7). Undernutrition also is associated with poor pregnancy outcome, impaired growth, anemia, and chronic infections (8-10). Over-consumption of some nutrients has been implicated in chronic disease (11).

The United States currently responds to malnutrition through public and private programs that distribute food or resources to buy food and through nutrition education programs. All of these programs have a cost and use resources that could be used for other purposes (12). Any time resources for programs are limited, decision makers must choose among alternatives to distribute those resources. Cost-benefit analysis can be incorporated into program evaluation to help decision makers allocate resources. Allocating resources to programs that are shown to be effective will help solve the problem of malnutrition.

The results of a cost-benefit analysis typically are expressed in a benefit-cost ratio, where benefits (measured in dollars) are related to the cost of an intervention (12). Cost-benefit analyses have been conducted for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (13-15). Cost-benefit analyses for WIC have shown that \$2.84 to \$3.13 was saved in Medicaid expenses for newborns during the first 60 days for every dollar spent to implement WIC (13-14).

Evaluations conducted in EFNEP (1-2) have examined program effectiveness, such as changes in knowledge, attitudes, and behaviors, but few have integrated measures of effectiveness with the costs of implementing the program. This would allow decision makers to choose between spending resources on EFNEP or using resources for other purposes.

PURPOSE

The purpose of this research was to determine the following: 1) Does participation in EFNEP help households use their food resources wisely? 2) Does participation in EFNEP help households increase their nutrient intake? 3) How much does it cost to change food resource management practices of EFNEP participants?

According to Kennedy (16, p. 7), cost analysis in nutrition education “is an area that is ripe for very applied research. The science is there, but the application is lacking at the moment.” This study was designed to apply cost-benefit analysis to EFNEP.

LITERATURE REVIEW

The Expanded Food and Nutrition Education Program

Overview

The Expanded Food and Nutrition Education Program (EFNEP) provides nutrition education to low-income families with children. EFNEP was funded in 1970 with Congressional appropriation under the Smith-Lever Act (Smith-Lever Act - U.S.C. 341-348, Public Law 91-127). It is administered by the Cooperative State Research, Education, and Extension Service (CSREES) of the United States Department of Agriculture (USDA) in cooperation with land grant universities and state and county governments that make up the Cooperative Extension System.

Participants in EFNEP are taught individually or in groups by paraprofessional program aides who, when possible, are indigenous to the audience. Program aides have a high school diploma or equivalent and receive supervision and training from professionals employed by the land-grant universities. Professionals are college/university graduates with training in Family and Consumer Sciences.

To be considered an EFNEP participant, individuals must enroll for a series of lessons on foods and nutrition. How many lessons and the determination that the participant has reached his or her educational objectives and is ready to graduate is decided by the paraprofessional responsible for teaching the participant and her supervisor. In 1995, 2,635 individuals in Tennessee completed the program because they met their educational objectives (17). The majority (84%) completed 7 to 18 lessons. Eighty percent (2,313) completed the program in less than six months (17).

"The objectives of EFNEP are to help low-income families and youth acquire the knowledge, skills, attitudes, and changed behavior necessary for nutritionally sound diets and to contribute to their personal development" (18, p. 5). Nutritionally sound diets are defined as diets that meet the minimum number of servings for each food group recommended in the Food Guide Pyramid (19). Families that participate in EFNEP are expected to improve food security and their health by: 1) improving their ability to select and prepare foods that meet their nutritional needs, 2) improving their resource management abilities, and 3) improving their food safety practices. The outcomes resulting from enrollment in EFNEP could be described using a hierarchal approach (Table 1) (20). Enrollment in EFNEP means low-income families would receive nutrition education, then they would improve their access to nutritious food, and then their health would improve. Intermediate outcomes would be improved food selection and preparation behaviors, improved nutrient intakes, improved food resource management behaviors, and improved food safety behaviors. Ultimately, participants would have improved access to nutritious foods at all times and improved health. Ultimate outcomes may include reduced risk for chronic diseases associated with diet, such as heart disease, cancer, stroke, diabetes. Improved diets may help prevent other health conditions such as obesity, hypertension, and osteoporosis that reduce quality of life and productivity.

Each land-grant university receives federal funds to administer EFNEP following submission and approval of a management plan called a Plan of Work. This management plan is developed to assess program operations, accomplishments, and effectiveness. It is the responsibility of each state to meet program objectives in the most cost-efficient

Table 1. Expected outcomes as a result of participating in EFNEP

<i>Program Hypothesis</i>	<i>Intermediate Outcomes</i>	<i>Ultimate Outcomes</i>
If low-income families receive nutrition education, then they will improve their food security and their health.	<p>Improved food resource management behaviors</p> <p>Improved food selection and preparation behaviors</p> <p>Improved nutrient intakes</p> <p>Improved food safety practices</p>	<p>Improved access to nutritious food</p> <p>Improved health</p>

manner (i.e., achieving program objectives with as many families as possible with the resources allocated). Program sites are selected based on the greatest audience potential using the number of paraprofessionals and professionals needed to achieve program goals with minimal administrative costs.

The national EFNEP Reporting System (ERS) is used to collect and summarize data for county, state, and national program management (21). Program costs and evidence of effectiveness are reported to USDA using data from ERS and other supporting information, such as success stories and descriptions of exemplary programs in yearly progress reports. These reports provide accountability information for national program justification and funding. Accomplishments are reported also to state and county stakeholders to solicit funding and other contributions.

Several researchers have evaluated the effectiveness of EFNEP (1, 2, 22-24). Assessments have been conducted on dietary improvements, increases in nutrition knowledge, and improved food behaviors.

Effectiveness of EFNEP

Dietary improvements. Using a dietary score derived from the Basic Four Food Group 2-2-4-4 diet pattern for 24-hour recalls, Torisky et al. (24) showed that the number of homemakers who consumed optimal diet patterns of 2-2-4-4 increased from 17 of 224 (8%) homemakers at program entry to 83 (37%) at program completion. Length of program enrollment varied from 6 to 18 months. Seventy-two (40%) of 180 homemakers had sustained dietary improvements by 6 to 36 months. The greatest improvements were seen in the milk, fruit and vegetable, and bread and cereal groups.

Dietary improvements also were noted in an evaluation of 24-hour recalls of 355 EFNEP homemakers in California (23). Using a dietary score also derived from the Basic Four Food Group 2-2-4-4 diet pattern, researchers showed that mean total dietary scores for homemakers enrolled in EFNEP for six months increased significantly, while mean total dietary scores of a comparison group did not. Significant increases were noted for the milk, fruit and vegetable, and protein groups.

Twenty-four hour recalls of 50 EFNEP homemakers in New York were analyzed at entry, graduation, and one year follow-up to assess caloric and nutrient content (1). Mean values for calories and other nutrients, except iron, exceeded or were within 80% of the age/gender-specific Recommended Dietary Allowances (RDA) published in 1980 (25)

for each of the three assessments. Significant reductions in the amount and percentage of calories from fat were reported from program entry to graduation. Mean intakes of protein, calcium, and vitamin A were significantly lower one year after graduation compared to graduation.

Data from 24-hour recalls of 35 homemakers were analyzed in Wyoming (2) and compared to the Basic Four Food Group pattern of 2-2-4-4 . Data were collected at program entry and after 20 lessons. Analysis showed significant increases in the number of servings from the milk, bread and cereal, meat, and the fruit and vegetable group after the participant had received 20 lessons. All posttest mean intakes met the 2-2-4-4 pattern except for the fruit and vegetable group which was 3.3 servings.

Amstutz and Dixon (26) showed that EFNEP participants improved their diets while enrolled and maintained some of the improvements for at least 20 months after they graduated. Participants increased their intake of milk, fruits, vegetables, breads, and cereals. Those who had excessive intakes of fat and sugar before enrollment reported reductions in these components by graduation and follow-up 20 months later.

Cox et al. (27) examined the dietary intakes of EFNEP participants before and after receiving a 18-lesson educational series designed to reduce their risk for cancer through dietary and lifestyle changes. Those who received the educational series significantly decreased their intake of total fat ($P=0.0003$), saturated fat ($P=0.0001$), servings from the meat group ($P=0.05$), and servings from the fats/sweets group ($p=.0005$). The experimental group also consumed significantly more vitamin E, dietary fiber, and servings from the vegetable and fruit groups.

Nutrition knowledge. Nutrition knowledge was assessed also in the Brink and Sobal (1) study. Participants had significant increases at program entry, graduation, and one year follow-up. Multiple-choice questions assessed knowledge of the need for breads and cereals and dairy products, good sources of iron, and the frequency with which calcium-rich food sources should be included in the diet.

Colorado EFNEP homemakers (22) also showed improvement in nutrition knowledge following 18 months of participation. Almost all of the 1,960 homemakers surveyed showed increased knowledge about selection of nutritious snacks compared to 38% at enrollment. Knowledge of the desirable number of servings from the Basic Four Food Groups increased from 30 to 99%. Homemakers also showed improvements in knowledge about the importance of breakfast.

EFNEP homemakers in Wyoming (2) scored higher on multiple-choice tests administered after 20 lessons compared to tests given at program entry. Homemakers showed improvement in knowledge concerning food shopping and food selection. Pretest scores on classifying foods into food groups ranged from 8 to 91% compared to posttest scores that ranged from 54 to 100%. However, less than half of the homemakers could identify correct serving sizes for all of the food groups on the posttest. Homemakers significantly increased their ability to choose the best sources of vitamin C, calcium, and iron according to posttest scores. They also could identify proper cooking methods to retain nutrients in vegetables.

Food behaviors. Participants in the Colorado EFNEP study (22) also showed significant improvements in food behaviors. Less than 7% of homemakers reported

always serving nutritious snacks at program enrollment compared to 37% at graduation. The number of homemakers who always used a food budget also improved from 15 to 55% from entry to graduation. Homemakers improved food shopping skills (e.g., menu planning and shopping lists) and food safety and sanitation skills.

In the New York study (1), participants improved 10 out of 12 behaviors surveyed by the time they graduated from EFNEP. They improved their food preparation, food safety, and shopping skills. These changed behaviors were sustained at least until follow-up one year later.

Murphy et al. (28) examined performance in nutrition-related practices (food storage and safety, kitchen sanitation, and food money management) as a function of how long the homemaker participated in EFNEP (six months, one year, eighteen months, and two years or longer). There was a trend toward improved performance among those who had participated six months. The greatest improvements were seen in the first six-months compared to other periods. There was some regression among homemakers who continued after two years. Similarly, Green et al. (29) found improvements in nutrition practices, knowledge, and attitudes, but further gains were minimal after the first year of enrollment.

Limitations of evaluations. In general, results from these published studies showed improvements in dietary intake, nutrition knowledge, and food behaviors, but they have several limitations. Only the Del Tredici et al. (23), Amstutz and Dixon (26), Cox et al. (27), and Green et al. (29) studies included comparison groups and the New York study had a small sample size. Few evaluations used random selection of subjects. The ability

to generalize results from the New York study to Tennessee is questionable because of the high percentage of African-American (62%) and Hispanic-American (34%) participants, but not whites. All participants surveyed lived in urban areas. In Tennessee in 1995, 61% of participants were white and 66% lived in towns of less than 50,000 people or on farms (17). Nationwide, 40% of participants were white, 36% were African-American, and 18% were Hispanic-Americans (30). Forty-five percent lived in central cities of over 50,000 and 55% lived in towns of less than 50,000 people or on farms (30). Because of these limitations, it is important to evaluate effectiveness at various program sites continually.

Since its inception, numerous unpublished studies have been conducted on EFNEP, such as national studies initiated by the Extension Service (31-32), state cooperative agreement projects funded by Extension (33-34), and state- or individual-initiated studies, including those conducted to fulfill requirements for academic degrees (35-36). These studies have examined: paraprofessionals' characteristics, roles, and competencies; program methodology; program development process; program implementation; program impact evaluation; and multi-agency cooperation in program delivery.

EFNEP has been shown to be effective, but at what cost? Should resources be used for other purposes? Some studies have examined the cost-effectiveness of EFNEP in relation to pilot projects that implemented various teaching techniques (33-34, 37). For example, Hannold et al. (38) conducted a cost-effective analysis of three types of nutrition delivery systems that integrated television, mailed lessons, telephone instruction, and traditional one-on-one instruction by paraprofessionals. Although all approaches were

considered effective, the traditional one-on-one instruction proved the least cost-effective while the direct mail and television with no personal contacts by paraprofessionals was the most cost-effective.

These studies examined new delivery strategies and not an ongoing program with typical operations. A review of literature reveals no published studies that examine the costs of implementing an ongoing EFNEP program in relation to benefits expressed in monetary terms.

Choosing the Type of Economic Analysis

Economic analysis refers to the use of cost techniques in program evaluation. It goes beyond the usual program evaluation that measures impact only, because it provides both impact and cost information. Decision-makers who allocate resources need to know both program impact and cost. Resources may not be allocated for a program if the costs are too high no matter how effective the program. Conversely, a program that is ineffective should not be funded simply because it is inexpensive. According to Splett (39), programs with the highest potential for achieving outcomes should receive the resources, particularly when resources are scarce. Both medical and human service systems operate with scarce resources. Therefore, cost has become an essential part of program evaluation.

Examples of Economic Analysis in Literature

Economic analysis in health care. Economic analysis has been used in health care to determine what interventions are most effective given a fixed amount of resources (40).

As medical technology continues to advance, efficacy is no longer the only consideration. Decision makers need to know which technologies provide the most benefit for the cost.

In medicine, economic analysis lends itself best to population-based approaches with the objective of maximizing benefits for persons in a target population. In clinical services, physicians are less likely to use economic analysis because their objective is to maximize the health of individual patients regardless of how it affects other patients (40).

In health care economic appraisal, randomized controlled trials have been used as evidence of effectiveness (41). Evidence of effectiveness from retrospective clinical trials was combined with secondary sources of cost data, such as published literature, insurance claims databases, and expert opinion to develop summary measures of efficiency using a decision analysis model (42). More recently, there has been considerable interest in collecting prospective data as part of clinical trials so that both costs and benefits could be collected on the same patients.

In one example of cost-effectiveness analysis, Greene et al. (43) concluded that community long-term care services were a potential cost-effective alternative to nursing home care. Previous studies of the effect of community long-term services suggested that they were less cost-effective than other alternatives. Greene et al. (43) developed a formal decision analysis model used to determine long-term care costs that took into consideration the probability that individuals would enter a nursing home or need particular community services. Individuals, rather than programs or services, were the unit of analysis. Costs were determined for nursing home care and for each major

category of community service. Marginal economic analysis was used to estimate empirically how much money could be saved for every dollar spent on the community services.

Kwan-Gett et al. (44) studied the cost-effectiveness of prevaccination testing for hepatitis B virus in preadolescents and adolescents. A decision analysis model was developed to compare prevaccination testing for hepatitis B, no testing, and testing at the same time as the first vaccine dose. The main outcome measures were rate of complete vaccination, cost of testing and vaccination for each cohort, and cost per patient protected from hepatitis B vaccine. The authors concluded that no testing was the most cost-effective strategy because, compared to vaccination without testing, prevaccination with testing increased costs by \$2.9 million for 100,000 patients and decreased the rate of complete vaccination by 22%.

Cost-benefit analysis was used to determine how favorably a protocol for studying patients with squamous intraepithelial lesions on Papanicolaou smears compared to other screening and treatment programs (45). Researchers calculated costs based on a model protocol and determined a cost per year of life saved from death due to invasive cervical carcinoma. They concluded that their model protocol compared favorably to other preventative methods and that the cost of performing colposcopy on patients using a Papanicolaou smear with low grade squamous intraepithelial lesions was very low relative to its effectiveness.

Neri et al. (46) used cost-benefit analysis to determine the net cost-benefit of two educational programs on asthma. One program consisted of self-reading a book of asthma

and one program was six lessons based on the same booklet plus educational videotapes. The net cost-benefit ratio of the self-reading program was 1:2.5 (a savings of \$2.50 for every dollar spent) compared to 1:2.6 (\$2.60 saved for every dollar spent) on the lessons and videotapes.

Economic analysis in nutrition. An important goal of the American Dietetic Association (ADA) is to expand and secure stronger financial support for nutrition care services. However, there are a limited number of quality studies of economic analysis in nutrition care services (47). Gilbride et al. (48) concluded from a survey of dietary managers and dietitians that they did not use economic analysis in their workplace, although they believed that it would be required to justify services in the future. In a critical examination of economic analysis published in nutrition care services, Splett (47) concluded that, like research published in medical literature, few had used true economic analysis. Limitations were noted due to poor research design (lack of random assignment or statistical controls), inadequate sample sizes, selection bias, the absence of detailed cost calculations, short time frames, and limited scopes (failure to determine all of the direct and indirect impacts) (47).

In one cost-effective analysis involving prenatal nutrition services, Splett et al. (49) calculated costs of services using standard cost-accounting principles and measured outcomes based on written quality assurance standards. In a health department setting, nutrition services were delivered for \$72 per client. The cost in a hospital-based program was \$121 per client. Ninety-three percent of clients in the hospital improved their diets as a result of the program compared to 87.5% at the health department. Seventy-one percent

of clients from the hospital program achieved adequate weight gain compared to 31% at the health department. When total cost was divided by the number of clients who improved their diet, the city health department was more cost-effective than the county hospital. However, when the total cost was divided by the number of clients who achieved recommended weight gain, the county hospital was more cost-effective than the city health department.

Splett (50) also compared the cost-effectiveness of treatment alternatives to reducing cholesterol levels in adults at risk for coronary heart disease. Changes in blood cholesterol levels before and after intervention were used as measures of effectiveness to compare the impact of education only, education and drugs, and drugs only. Cost-effectiveness ratios were determined for each intervention and were expressed as dollars per one percent of cholesterol change. Data showed that a drop in cholesterol of one percent cost \$16.60 in the education only intervention, \$54.11 in the education plus drugs intervention, and \$50.54 in the drugs only intervention.

At least three cost-benefit analyses have been published of WIC (13-15). In each study, Medicaid and WIC data files were linked to birth certificates. Costs were calculated according to total value of food vouchers redeemed and administrative costs. Using the infant's Medicaid identification number, all Medicaid claims paid for any service were tracked for 30 days in the Schramm study (15) and 60 days in the Buescher (13) and Mathematica (14) studies. The difference between Medicaid costs for WIC participants and non-WIC participants were determined and compared to the WIC costs. In Missouri, Medicaid savings were similar to WIC costs (\$.83 was saved in Medicaid costs for every

WIC dollar spent) (15). In North Carolina, South Carolina, Florida, Texas, and Missouri, \$1.77 to \$3.13 was saved for every dollar spent (14). The Buescher study (13), also in North Carolina, reported a savings of \$2.91 in Medicaid costs for every dollar spent on WIC.

Instead of expenses related to birth weight, Montgomery and Splett (51) examined the reduction in Medicaid expenditures for breast-fed infants enrolled in WIC. Costs to implement WIC included redeemed vouchers and administrative expenses. Benefits were determined from Medicaid expenditures for health care incurred in the first 180 days of life. Researchers concluded that breast-feeding infants enrolled in WIC saved \$478 in WIC costs and Medicaid expenditures for the first six months of life compared to formula-fed infants. After the formula manufacturer's rebate, the difference was \$112 per infant.

Brauer et al. (52) demonstrated the economic benefit of nutrition counseling for non-hospitalized patients with Crohn's disease using cost-effectiveness analysis. Fifty-nine patients received nutrition education once a month for six months with a net savings of \$164 per person. Savings resulted from fewer drugs, fewer missed work days, and decreased hospitalization. This study was one of few economic analyses in nutrition that used a control group.

Types of Economic Analyses

Four types of analytic techniques typically are used in economic analysis: cost-feasibility, cost-benefit, cost-effectiveness, and cost-utility. Each technique is useful if used appropriately for specific applications (12).

Cost-feasibility analysis. Cost-feasibility is a limited form of economic analysis that considers only the cost of an intervention and not the outcome. It is used to determine if an alternative can be considered based on the costs and not whether the alternative should be chosen (12).

Cost-benefit analysis (CBA). Cost-benefit analysis also compares alternatives in terms of cost and outcomes, with both costs and outcomes are expressed in monetary terms (12). The Medicaid savings associated with prenatal WIC participation is an example of cost-benefit analysis. An estimated \$1.77 to \$3.13 in Medicaid savings were reported for every dollar spent on a prenatal woman participating in WIC (14). Every alternative can be examined on its merits, because outcomes are expressed in dollars (12). Alternatives also can be compared when their goals are not similar. A nutrition education program, for example, could be compared to a smoking cessation program. The disadvantage of CBA, however, is the difficulty determining pecuniary values for some outcomes (12). Outcomes, such as improvements in self-esteem or changes in attitude, cannot be expressed in dollars easily.

Cost-effectiveness analysis (CEA). In cost-effectiveness analysis, the cost of an intervention is expressed in dollars and the effect of the intervention is expressed as some outcome or set of outcomes (12). For example, this outcome may be increasing test scores, reducing the risk of chronic disease, or reducing the risk of hunger. These outcomes are not expressed in monetary terms.

The strength of CEA is the ability to use effectiveness data normally gathered from an educational evaluation in combination with program costs (12). In many cases, it requires data that should be available from program evaluation.

A major disadvantage of CEA is the inability to compare programs that do not have similar goals. In order to compare different programs and use CEA as it is intended, comparisons can be made only if the interventions have similar goals and the same measure of effectiveness is used to assess all the interventions (12). CEA, therefore, can not be used to determine the inherent worth of a program. It only can be used to evaluate alternatives being considered to accomplish the same goals (12).

Cost-utility analysis. Cost-utility analysis evaluates alternatives in terms of cost and the estimated values of their outcomes (12). Assessments of effectiveness and their values are estimated and, therefore, are subjective. The advantage of cost-utility analysis is the variety of quantitative and qualitative data that can be used to assess outcomes and estimate their value, compared to CEA that relies on specific types of quantitative data (12). Many outcomes can be included in the evaluation even when the data are less than perfect. The disadvantage is the subjectivity of the measures of effectiveness and their value that make cost-utility analysis difficult to replicate (12). Another evaluator may have different results despite using the same information and methodology because of the subjective nature of the assessments.

Economic analyses help decision makers allocate resources by comparing alternative investments (12). Both costs and outcomes are part of comprehensive program evaluation and must be taken into consideration when choosing among

alternatives. A comprehensive program evaluation consists of three steps: 1) determining if a program was implemented as planned, 2) assessing actual program outcomes against intended outcomes, and 3) determining if funds were used efficiently to carry out an effective program (53).

The outcomes to be measured for EFNEP in this research are related directly to the problem of food resource management and dietary adequacy, are intermediate outcomes, and fall into two domains: 1) food resource management and 2) food selection and preparation. Most evaluations of EFNEP have included process evaluation and assessment of outcomes, but few have determined if funds were used efficiently based on outcomes. To conduct a economic analysis of EFNEP, it is important to identify the problem, possible interventions (alternatives) that might address the problem, the audience for which the analysis is conducted (the perspective), and to select the appropriate analytic technique to use (12).

Identification of the Problem

In 1989, approximately 13% of American families lived below the poverty threshold established by the United States Department of Health and Human Services (54). Over 21.4% of families in Tennessee lived below the poverty level in 1989 (55). Low-income, high housing costs, and other factors make it difficult for families to obtain sufficient amounts of nutritious foods (56).

An estimated 20 to 30 million Americans are hungry or are at risk of hunger at any given time; about 12 million of these are children under 12 years of age (57-58). Hunger

has been defined from a physiological standpoint as the physical sensation resulting from an acute, current lack of food (8). According to Wehler et al. (59) hunger is viewed differently in industrialized countries. Instead of an acute problem it should be viewed as a chronic problem that can be assessed from the availability of food resources. Over time hunger may produce physiological, social, and economic problems. Lack of adequate, nutritious food affects physiological function preconceptionally and at every stage of the life cycle. It is associated with poor growth and development, and the development of chronic disease (60). Hunger impairs cognitive development and, therefore, the ability to learn (6). Billions of dollars are spent annually to combat hunger in the United States by government and private organizations.

Hunger is a public issue and is part of public policy. Because it is part of public policy, many resources have been devoted to defining and measuring hunger (61). To shift the phenomenon of hunger from an individual perspective to a broader, societal perspective, hunger has been defined in terms of food security/food insecurity. Food security is defined as the access to enough food for a healthy life by all people at all times (62). At a minimum, this includes: 1) the ready availability of nutritionally adequate and safe foods and 2) the assured ability to acquire personally acceptable foods in a socially acceptable ways (62). Food insecurity occurs either when the availability of adequate, safe foods is limited or uncertain or when there is the inability to acquire personally acceptable foods in socially acceptable ways (62).

When families cannot make their resources last long enough to meet their needs for adequate amounts of nutritious and acceptable food, they do without some foods and

consume a disproportionate amount of others, creating nutritional imbalances that affect health. Both inadequate nutrient intake and over- consumption of some dietary components have been associated with health problems. Heart disease, cancer, stroke, and diabetes, four of the 10 leading causes of death in the United States, are associated with diets that are too high in calories, fat, saturated fat, cholesterol, and sodium (11). Too few fiber-containing foods also are associated with these conditions (11). Inadequate intake of calcium may be associated with osteoporosis (11). In all, these diet related health conditions, cost society an estimated \$250 billion in medical costs and lost productivity a year (63).

Several health conditions related to diet occur more frequently among low-income individuals compared to individuals in higher socioeconomic strata. Low birth weight, growth retardation, iron-deficiency anemia, and obesity are health conditions that are influenced by nutritional status. These are risk factors for diseases that can lead to debility and death. Low birth weight is associated with the increasing numbers of children afflicted with cerebral palsy and other birth defects (64) that have an estimated cost of \$8 billion in the United States (65). Growth retardation is associated with decreased mental development (66). Iron-deficiency anemia in children, in addition to lowering their resistance to infection, can affect psychosocial and motor development adversely (67). Obesity is a risk factor for cardiovascular diseases, some cancers, stroke, and diabetes mellitus (11). In addition to these health conditions, there are notable differences in health behaviors between low-income individuals and those with incomes above the poverty

level. For example, low-income women are less likely to breast-feed than other women (68).

The real problem is how do we reduce the risk of food insecurity for those 20 to 30 million Americans? The root cause of food insecurity is insufficient resources to buy food. In some instances lack of financial resources is a barrier to consuming an adequate diet no matter how well a family manages its resources. To have an impact on these families, the issue of poverty needs to be addressed at the socioeconomic and political level. For example, standards used to determine food stamp benefits should be addressed. USDA uses the Thrifty Food Plan, the lowest cost plan, to determine the type and quantity of food needed to meet minimum dietary standards for the Food Stamp Program. A study of the 1983 Thrifty Food Plan showed that the plan did not meet current nutritional recommendations for some nutrients and dietary components (69). It uses consumption and cost data from the 1977-78 Nationwide Food Consumption Survey, considered to be out-of-date, and dietary standards based on the 1980 RDA (25). In addition, research has shown that food stamp benefits may not cover the costs of the Thrifty Food Plan, especially in rural areas (70).

The problem addressed in this research is part of the larger problem. How effective is the Expanded Food and Nutrition Education Program at improving the diets and food-related practices of low-income families faced with insufficient resources for food and what does it cost? This research will examine how effectively EFNEP addresses the problem in relation to: 1) food resource management and 2) food selection and preparation.

Food resource management practices. Several food resource management practices have been examined among low-income families. These include participation in food assistance programs, use of temporary emergency food sources, planning and shopping skills, and basic food preparation skills.

For some families, food resources could be stretched if they took full advantage of programs available to them. Nutrition education programs, such as EFNEP, refer low-income families to public assistance programs. Programs, such as the Food Stamp Program and commodity food programs, are available to many low-income families to help them stretch their resources to meet nutrition needs. However, these programs are of no benefit if those who are eligible do not participate.

The Food Stamp Program is a means-tested program by income that serves low-income persons regardless of family status, age, or disability status. Approximately 27 million families in the United States participated in January 1994 (71), which represented about 60% of families who were eligible (72). Because such a large proportion of eligible individuals do not participate, sociologists have attempted to identify factors that are associated with participation (73).

Census data show the poverty rate is higher in rural than in urban areas (74). Average before-tax income of single-parent families was reported to be 13% lower in rural areas compared to urban areas (75). However, individuals who participate in the Food Stamp Program are more likely to live in urban rather than rural areas. A 1990-92 Consumer Expenditure Survey showed that fewer single-parent families (24%) received food stamps in rural areas compared to 36% of single-parent families in urban areas (75).

One reason why individuals living in urban areas are more likely to participate than those in rural areas could be because they are likely to live near or be associated with others who are eligible for public assistance (73). In addition, individuals living in urban areas may receive more accurate eligibility information than those in rural areas (73).

Households that cannot make their resources last, either from lack of money or from poor management practices, turn to temporary stop-gap measures, such as food banks and pantries, or they do without the foods they need. Smith and Hoerr (3) examined the characteristics and food management behaviors of families using food banks to determine if they were different from low-income families that did not use food banks. Families who used food banks were more likely to shop for food more often and to shop at convenience stores than non-users. Smith and Hoerr (3) suggested that frequent food shopping, especially at convenience stores, may be related to fact that they had to either walk or use public transportation, which made carrying large quantities of groceries difficult.

Food purchased with food stamps lasted about three weeks for food bank users compared to almost the whole month for non-users (3). Borrowing money to buy food and sharing or trading food with others was more common among food bank users than other families. Although food stamps are intended to supplement a family's food resources and not provide all of their food needs, many families use discretionary income for other necessities (3).

The types of assistance a family receives influences its management practices. Emmons (76) also reported that low-income families participating in WIC spent over 90%

of their food stamps in the first two weeks of the month. However, they distributed their WIC vouchers more evenly through the month. This could be due to the fact that, in some states, individual vouchers can be spent only within a certain time frame, such as the first two weeks and the last two weeks.

Food bank users were more likely to report meal skipping due to lack of food than non-users (3). Children in one out of five households skipped meals because there was no food. Some mothers reported that rather than making their children skip a meal, they themselves would skip a meal. This supports Campbell and Desjardins' (77, p. 167) hypothesis that "mothers' diets deteriorate before their children's." In some cases, mothers reported that the entire family ate less, although they might not skip meals.

Families surveyed by Smith and Hoerr (3) were similar in income levels, which suggested there were other factors that affected the disposition and management of income. Families that used food banks were more likely to have more children and older children. The researchers speculated that households with younger children may have received WIC foods that contributed to their resources for food.

Low-income families may lack planning and shopping skills or fail to use them to stretch their resources. Some surveys on meal planning and shopping skills suggest that some consumers do not use cost-saving techniques, such as preparing shopping lists, using advertisements for specials, clipping coupons, developing a budget, and comparing foods using unit pricing (78). While other reports suggest that low-income families do use skills developed to help save money on foods (79-80).

Unit pricing information on grocery shelf labels is a method of comparison shopping that helps consumers make comparisons among different package sizes and brands. Variation in price due to size is removed in unit pricing so that comparisons can be made on the basis of price alone. It is estimated that 65% of shoppers use unit pricing (78). Because low-income shoppers must buy foods on a smaller budget than other shoppers, it would seem that they would benefit more by using unit price information. However, Boya (78) concluded that individuals with low-education and low-income were less likely to use unit pricing than other individuals.

In a more recent focus group report of food choices of low income families, Bradbard et al. (79) found that low-income shoppers had developed economical shopping methods. They made shopping lists, checked newspaper advertisements and store circulars to compare prices, and shopped at several stores to save money. However, there were differences among low-income families in how often they shopped. It has been suggested that frequent shopping leads to higher expenditures due to impulse buying (79).

Researchers have examined the characteristics of individuals associated with shopping frequency. In one study, single mothers were observed to shop less frequently than married mothers, which led researchers to conclude that this was part of the reason for their lower consumption of fruits, vegetables, and milk products (81). Bradbard et al. (79) found that Hispanic and white non-Hispanic, low-income shoppers were likely to shop more frequently than African-American shoppers who reported they did major shopping once a month, usually after receiving their food stamps. Many of the employed,

low-income, white females reported they did not plan meals more than a day or two ahead and shopped several times a week.

In addition to frequency of shopping, low-income buyers who received food stamps have reported that their ability to purchase a low-cost diet is affected by time of the month they chose to shop. Some shoppers believe the foods are higher in price during the time immediately following distribution of their food stamps each month (79). These shoppers felt they were unable to take advantage of lower prices at other times of the month because they were unsure that they would have the food stamps.

According to USDA's Economic Research Service (80), the poor face higher food prices than the national average. Many poor people live in central cities and rural areas where stores have higher operating costs because they tend to be smaller and fewer. These factors raise the food prices for poor households by one percent of the national average. In response, low-income households use cost-saving techniques, such as buying lower quality foods, larger package sizes, and generic brands. With the exception of vegetable and fruit juices and eggs, the poorer consumers actually pay less per unit of nearly every major food group than consumers at other income levels.

Use of "convenience" foods is cited as factor that affects the low-income families' ability to purchase a low-cost diet (79). In the Bradbard et al. (79) research, low-income shoppers who were employed purchased convenience foods more often than shoppers who were not employed, because they believed they were easier to prepare. These shoppers acknowledged that convenience foods were more expensive, but they believed they tasted good and were easy to prepare.

These reports of the food management practices suggest that not all low-income families have poor practices and that there are factors that affect their ability to maximize their resources. There are racial and ethnic differences not only in the way low-income families shop, but also in the kinds of assistance they receive, whether or not they are employed, family composition, and where they live.

Food selection and preparation. Through the nutrition monitoring activities of the United States Department of Agriculture, the United States Department of Health and Human Services, and surveys, such as the Bogalusa Heart Study (82), data are available on the dietary and nutritional status of low-income families in the United States.

A comparison of the 1977-78 and 1987-88 Nationwide Food Consumption Surveys (NFCS) conducted by USDA indicated that red meat consumption decreased, but the largest decrease (31%) was among the highest income households (83). Meat consumption decreased by only 11% in low-income households who consumed 5% more than the national average. Focus groups with low-income meal-preparers supported this finding (79). Respondents reported spending a large percentage of their food stamp allotment on meat. Surveys suggest that low-income families spend over one-third of their food expenditures on meat (79). All ethnic groups considered meat as an essential part of a meal. However, African-American respondents were more adamant than other groups. Many cited that meat was always served while growing up so they never had a meal without meat.

The NFCS also showed that the highest income households consumed 26% more cheese, while the lowest income households decreased consumption in 1987-88 compared

to 1977-78 (83). Egg consumption decreased by 29% in the wealthiest households, but increased by 8% in poorest households. The higher income households increased consumption of flour and cereals by 2%, but the lowest income households decreased consumption by 16%. Per capita consumption of breakfast cereals was lower for the poorest households compared to others. Consumption of fresh vegetables rose as income rose, but consumption of fruits declined in all but the wealthiest households (83).

Results from the 1989-91 CSFII indicated that fewer adults with incomes less than \$10,000 a year (21.3%) ate the recommended five servings of fruit and/or vegetables per day compared to other income groups (29.9% to 36.7%) (84). Mean intakes of all fruits and vegetables were lower for these adults (3.6) compared to those with higher incomes (4.1 to 4.8). A similar pattern was seen in data from children. As income rose, fruit and vegetable intake by children increased slightly (84). However, low-income children consumed comparable amounts of starchy vegetables, particularly white potatoes. French fries constituted about 23% of all vegetables and 14% of all fruits and vegetables for all income levels.

Nutrition monitoring through the Continuing Survey of Food Intakes of Individuals (CSFII) has provided information on dietary intakes of low-income children. Data from the 1-day food intake assessment in the 1987-88 CSFII suggested that, overall, mean caloric consumption for the low-income children was similar to that of children at higher income levels (85). For low-income children, average intake of nutrients was above the RDA. However, for some racial/ethnic groups, low-income children consumed more fat and saturated fat than did children in households with higher incomes. In

contrast, Tippet et al. (86) concluded from 1985-86 CSFII data that intakes were below the RDA (25) for iron and zinc. Using 1986 CSFII data, Cook and Martin (87) also reported that significantly larger proportions of low-income children had intakes below 70% of the RDA for energy, folate, iron, magnesium, thiamin, vitamin A, vitamin B₆, vitamin B₁₂, vitamin C, vitamin E, and zinc compared to children from higher income groups.

According to Radimer et al. (88), additional qualitative measures of food insecurity are more useful than income alone. In an effort to obtain more information about the relationship between food security and nutrient intake, several questions on household food security were included in the 1989-91 CFSII. Respondents were asked if their households always had 1) enough of the kinds and amounts of food they wanted to eat, 2) enough food, but not always what they wanted to eat, or 3) sometimes or often not enough to eat (89). Nationally representative samples in the third National Health and Nutrition Examination Survey (NHANES III 1988-91) and CSFII 1989-91 revealed that about 9 to 13 % of individuals in low-income families experienced food insufficiency (90).

Using the food security categories and three-day average intakes suggested that mean energy intake fell from the more food-secure categories to the less food-secure categories (85). Average level of fat and saturated fat increased from the food-secure categories to the less food-secure categories. Data from 3-day average food intake assessment for children suggested that the mean level of energy intake for children in the less food-secure categories was lower than the mean energy intake for children in the food-secure categories (85). However, the average fat and saturated fat intake was higher

among children in the less food-secure categories compared to the food-secure category. The researchers suggested that it is possible that for less food-secure households, higher-fat foods are a less expensive source of calories than other foods and these households rely on them when resources are constrained.

Data from the 1989-90 CSFII using a sample of single-parent female-headed households, the majority of whom were low-income, suggested that mothers and children in these households consumed diets very similar in total calories (81). However, the single mothers consumed fewer fruits, vegetables, and milk products than other households. Their children consumed fewer fruits than children in other households. Overall, the children of married mothers consumed a greater variety of foods. Data from the 1985 and 1986 CSFII suggested that low-income women, both single-parent and married, consumed less than adequate amounts of food energy, vitamin B₆, calcium, magnesium, iron, vitamin E, folacin, and zinc (86).

Emmons (76) reported differences in food and nutrient intakes of low-income families depending on the week of the month. Families consumed fewer high-protein foods, fruits, and vegetables during the last two weeks of the month compared to the beginning of the month. Total calories were lower in the fourth week compared to the first week of the month. For most families, nutrient intakes did not decrease significantly over the course of the month. Intakes of some nutrients (e.g., protein, niacin, and riboflavin) were well above the RDA in both the first and fourth week of the month. Vitamin B₆, vitamin D, magnesium, zinc, calcium, iron, and vitamin E intakes were below the RDA during both weeks.

Results of these surveys of low-income families and individuals suggest that many do not consume enough of some nutrients while consuming too much of others. Some researchers have studied the food habits of low-income to determine why (79, 90-92).

Part of the reason low-income women and children consume poorer diets than other women and children may be due to lack of basic cooking skills as suggested by some researchers. Focus groups with WIC participants revealed they spent little time cooking on a daily basis and relied on sandwiches and convenience foods (91). Women in EFNEP cited the lack of skills necessary to prepare healthy foods as a barrier to eating more healthfully (92). They said they wanted to learn how to cook vegetables so they tasted good. Recipes for fast, easy, and tasty foods with ingredients on hand were highly desirable. It has been recommended that nutrition education programs address the barriers to poor fruit and vegetable consumption and provide practical information on buying, storing, and preparing them (92).

National Nutrition Monitoring and Related Research Program surveys (90) suggest that African-American and low-income female meal planners may be less aware of the diet-health relationships than females who are white and from higher-income households. Other researchers have suggested that the reason low-income homemakers may have trouble making healthy choices is that some have difficulty translating recommendations into specific foods (79). Some use nutritional information on food labels, while others have trouble understanding the labels and how to use the information. Many also believe nutritious foods cost more money than other foods (79).

Data from focus groups of low-income individuals responsible for preparing meals indicate there are several factors that determine food choices (79). Food price was considered the most important consideration (79). This was especially true for individuals with a large number of children. The most important factor to them was making sure no one was hungry. To buy sufficient quantities of food, they were willing to sacrifice taste, which is considered a very important factor when individuals are choosing foods (79).

In addition to food price, the preferences of children are another factor that determines what foods low-income individuals prepare (79). Some low-income parents consider their children as the biggest influence on what they buy and cook. One parent in a focus group stated, "I make sure my kids eat right even if I don't" (79, p. 7).

A third factor that determines food choices is ethnic and cultural traditions (79). For example, despite education about cholesterol and fat, low-income families continue to eat large amounts of high-fat meat. They have learned to prepare culturally familiar foods and spouses and children enjoy eating traditional meals. In many cases family members may resist attempts to change.

Survey data and focus groups have revealed that many low-income families are aware of dietary recommendations, yet knowledge is not enough to change their practices. There are many factors that influence their choices, such as budget and time constraints, lack of food preparation skills, influence of family members, and ethnic traditions. These factors place them at risk for malnutrition.

Nutrition programs are designed to improve the nutritional status of low-income families by making nutritious foods available and/or teaching them how to manage their

food resources, and select and prepare foods. Are some programs more beneficial than others? The premise of economic analysis is that decision makers can choose alternative ways to allocate resources (12).

Alternatives that Address the Problem

The Food, Nutrition, and Consumer Service of USDA administers 15 food assistance programs targeted primarily to low-income Americans. During the first six months of fiscal year 1996, these programs cost taxpayers \$19.7 billion (93). Like EFNEP, the Food Stamp Program, the Emergency Food Assistance Program, and the Food Distribution Program for Soup Kitchens and Food Banks serve a broad segment of low-income families. WIC, Commodity Supplemental Food Program (CSFP), Nutrition Program for the Elderly, Food Distribution Program on Indian Reservations, and Nutrition Assistance Programs in Puerto Rico and the Commonwealth of the Northern Mariana Islands benefit a more narrow segment of the low-income population that meets specific eligibility criteria in addition to income. The National School Lunch Program, School Breakfast Program, Nutrition Education and Training Program, Summer Food Service Program, and Special Milk Program are targeted to children.

The Food Stamp Program. The Food Stamp Program is the largest federal food assistance program designed to help meet the basic nutritional needs of all eligible low-income individuals and families. It is considered a safety net to protect the nutritional health of Americans and families regardless of age or disability. In the first six months of fiscal year 1996, the Food Stamp Program served almost 25.9 million Americans per

month at a cost of nearly \$12.3 billion (93). Participants are provided monthly allotments of coupons or an account they can access with a Electronic Benefit Transfer (EBT) card at the point of sale.

Funds for nutrition education are included as part of the food stamp budget. Each state receives funds as part of the state food stamp administrative budget with a required nonfederal match of 50%. States can participate in the Food Stamp Nutrition Education Program (FSNEP) by submitting a Nutrition Education Plan (NEP) to USDA's Food and Consumer Service (FCS) for approval. The goal of FSNEP is to improve the dietary intake of families on food stamps through activities that increase self-sufficiency. According to federal regulations, nutrition education is provided to food stamp recipients only, unlike EFNEP, which provides nutrition education to recipients of any kind of public assistance. Participants in FSNEP can be of any age, but EFNEP participants are families with children or families with persons in their childbearing years.

States with a FSNEP are encouraged to work with other agencies, but are not to duplicate EFNEP. The FSNEP often reaches individuals and families who are not in the EFNEP target audience, such as the elderly, or may exist in areas that do not have EFNEP. EFNEP is in all states but is not in every county.

Unpublished reports on FSNEP projects suggest that there have been positive impacts in food resource management (94) and nutrition knowledge (95). Oregon families participating in FSNEP were reported to run out of food at the end of the month less often, keep track of expenditures, and use resources more effectively than families that did not participate in FSNEP (94).

Does the Food Stamp Program improve dietary intake? For those who participate, the Food Stamp Program is believed to improve the availability of nutritious food because it increases total food expenditures (96-97). Studies have estimated that a dollar's worth of food stamps increases at-home food expenditures by about 26% (96). However, only 60% of eligible households participate (72). To some individuals, particularly the elderly, there is a stigma attached to food stamps because they are a welfare benefit. Also, some Americans do not understand the complicated application procedures and/or are unaware of their eligibility.

Studies that have concluded that Food Stamp participation increases the availability of nutritious food have not shown that participation increases nutrient consumption (96-97). In a summary of 20 years of research on the effects of food stamps, Fraker (96) concluded that evidence that food stamps increase nutrient consumption is weak despite the ability to improve nutrient availability because nutrient intake is affected by dietary behavior, which is not directly measured. Morgan et al. (98) found no significant evidence that, except for calcium, food stamp recipients purchased more nutritious foods. However, a report from the Center on Hunger, Poverty, and Nutrition Policy at Tufts (87) stated that the Food Stamp Program did improve the nutritional status of low-income children significantly. Using data from the 1986 CSFII, researchers concluded that fewer poor children receiving food stamps consumed inadequate amounts of energy, calcium, folate, iron, magnesium, protein, riboflavin, vitamin B₆, vitamin B₁₂, and zinc compared to poor children not receiving food stamps. Cook et al. (87) concluded that the Food Stamp Program was highly effective in

improving the diets of low-income children. A more recent report using the 1989-91 CSFII for children age 2-17 also suggested that calories were higher for children in households receiving food stamps than for other children, however, total fat, saturated fat, cholesterol, dietary fiber, and sodium also were higher (99). In addition to calories, dietary fiber, calcium, and iron intakes were higher for children living in families receiving food stamps than other children. The later study compared children from households receiving food stamps to other children while the Cook study compared poor children receiving food stamps to poor children not receiving food stamps.

Levedahl et al. (72) calculated a federal benefit/cost ratio for the Food Stamp Program based on the value of program benefits to recipients divided by federal expenditures. Using FY 1990 to 1992 average operating cost (i.e., administrative costs) of 7.6% and the assumption that a dollar of food stamps is equal to a dollar of income, the benefit/cost ratio per dollar of federal expenditures was 0.924 ($\$1.00$ minus 7.6% of $\$1.00$). In reality, participants do not value a dollar's worth of food stamps as a dollar of income (72). Fraker (96) also estimated the value of a dollar in food stamps and found that a dollar in food stamps increases the average at-home food expenditures by 26%. This implies that a dollar of food stamps increases nonfood expenditures by 74%, because food stamps allow households to substitute stamps for previous cash expenditures on food. The benefit/cost ratio is 0.684 ($\$1.00$ minus 7.6% of $\$1.00 \times 0.74$), or less than that calculated by Levedahl et al. (72).

The Emergency Food Assistance Program. The Emergency Food Assistance Program (TEFAP), distributes USDA-donated foods to low-income households through

local agencies, such as churches and food banks. Foods are distributed as surplus commodities from federal inventories and are purchased with additional funds. In the first six months of fiscal year 1996, TEFAP spent \$15.4 million on food assistance (93).

The benefit/cost ratio per federal dollar for TEFAP (derived from market prices) was calculated at 0.95 when foods were donated as surplus commodities and 0.77 when foods were purchased (72). Federal costs were smaller when TEFAP used surplus donations instead of purchased commodities. In addition to the value based on market prices, Levedahl et al. (72) used a recipient evaluation to determine the value of commodity foods. From this evaluation, the researchers calculated that recipients placed a value of \$1.06 on a pound of TEFAP cheese. Since the retail price of the cheese was \$2.60, this implied that the perceived value of a dollar of TEFAP cheese was \$0.41 ($\$1.06/\2.60). To determine the value based on recipient evaluation, each ratio was multiplied by 0.41. Therefore, the benefit/cost ratio according to recipient value was 0.39 (0.95×0.41) if the foods were donated as surplus commodities and 0.29 (0.77×0.41) for commodities that were purchased.

Based on the cost/benefit ratios calculated for the Food Stamps and TEFAP, Levedahl et al. (72) concluded that food stamps are more efficient means of providing food than TEFAP. TEFAP benefits are limited compared to the wide variety of choices available to food stamp recipients. This lowers the recipient value of the foods. In addition, the Food Stamp Program uses the commercial sector to provide benefits, which is considered more efficient. On the other hand, TEFAP reaches eligible persons who do not take advantage of food stamp benefits. The two programs are seen as complementary.

Since TEFAP relies on local volunteer and other charitable organizations who know where the needy individuals are in their communities, TEFAP can refer these people to the Food Stamp Program.

The Food Distribution Program for Soup Kitchens and Food Banks. The Food Distribution Program for Soup Kitchens and Food Banks was created through the Hunger Prevention Act of 1988 primarily to serve the homeless. Churches operating community kitchens, meals-on-wheels programs, soup kitchens, food banks, temporary shelters, correctional institutions, group homes, and hospitals are among the nonprofit, charitable institutions that benefit from donations from USDA. Many serve meals to low-income people on a regular basis. The Commodity Distribution to Soup Kitchens and Food Banks and other food donation programs, such the Food Distribution Program on Indian Reservations, the Nutrition Program for the Elderly, the Commodity Distribution to Charitable Institutions and Summer Camps, and the Disaster Feeding Program along with the Emergency Food Assistance Program cost taxpayers \$32 million in the first six months of fiscal 1996 (93).

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). WIC provides a combination of supplementary food, nutrition education, and referrals for preventive health care for women and children considered to be at nutritional risk. Vouchers are issued for foods, such as milk and cheese, iron-fortified cereal, juice, eggs, peanut butter, and dry beans, that provide specific nutrients. WIC serves pregnant, lactating, and postpartum women and their children up to age five years. EFNEP serves

families with children of any age or families with individuals in their childbearing years.

Approximately \$1.8 billion was spent on WIC in the first six months of fiscal 1996 (93).

Most studies on the effects of WIC examined birth weight, anemia, and anthropometric variables. Various researchers have shown that participation in WIC is associated with fewer low birth weight infants, very low birth weight infants, and premature births (100-101). Owen (102) concluded that these benefits were likely the result of maternal nutritional supplementation, nutrition education, enhanced health care, and social services. Cost analyses have shown that improved outcomes decrease Medicaid costs (13-15).

Surveys of dietary intake suggest that pregnant women who participate in WIC have higher intakes of protein, iron, calcium, vitamin C, magnesium, phosphorus, thiamin, riboflavin, niacin, vitamin B₆, vitamin B₁₂, and energy than pregnant women who do not participate (103). Women who participate in WIC, who receive advice on breast-feeding, report a higher likelihood of breast-feeding than other women who do not receive advice from a physician (104). WIC participants who receive information about initiation of supplemental foods for infants are less likely to initiate feeding cereals before their infants are four months old than other women (104).

The National School Lunch Program and School Breakfast Program. The National School Lunch Program (NSLP) provides foods to school-age children to help ensure their diets are adequate and serves as an outlet for surplus agricultural commodities. In addition to NSLP, the school-based child nutrition programs include the School Breakfast Program (SBP), special milk, and summer feeding programs.

Expenditures for these child nutrition programs were \$4.7 billion for the first half of fiscal 1996 (93). The National School Lunch Program served an average of 24.1 million meals per day during this time with \$3.3 billion in expenditures. An estimated 6.1 million breakfasts were served every day (93).

A USDA-sponsored assessment of the nutritional quality of school meals indicated that while school lunches provide one-third or more of the daily RDA for key nutrients, very few schools meet the dietary guidelines for total and saturated fat (105). Consequently, the Healthy Meals for Healthy Americans Act of 1994 (Public Law 103-448) requires that meals served under the National School Lunch Program and School Breakfast Program meet the Dietary Guidelines for Americans.

A recent study of food and nutrient intakes of children participating in NSLP showed that NSLP participants were more likely than nonparticipants to consume milk, meats, grain mixtures, and vegetables (106-107). As a result NSLP participants had higher intakes of fat, sodium, calcium, vitamin A, and magnesium than nonparticipants. They were more likely than nonparticipants to eat cakes, cookies, soft drinks, and fruitades.

Children participating in SBP consumed more milk and fruit juice than nonparticipants, resulting in higher intakes of calcium, riboflavin, phosphorus, and magnesium (106-107). They also were three times more likely than nonparticipants to consume meat, which explained higher intakes of fat and sodium.

The Nutrition Education and Training Program (NET). NET is a federally funded nutrition education program for child nutrition programs. The goal of NET is to promote

healthy eating habits for children through educational experiences that help them make informed food choices. Funds are used in a variety of ways, including education for teachers and food service personnel, projects that involve parents and the community, and development of nutrition education materials. Because there is no single NET program model, effectiveness has not been established nationally. A study conducted by Abt Associates, Inc. under contract with USDA (108) focused on programs in Nebraska, Georgia, California, and West Virginia between 1979 and 1980, before NET was fully implemented nationwide. Data showed that students improved nutrition knowledge. Changes in attitudes, food preferences, plate waste, and other behaviors were positive for some grades and for some foods, but findings were not consistent across the states.

There are programs, other than EFNEP, that are intended to improve the nutritional status of low-income families. To what extent they improve actual nutrient intakes has not been well-established for some programs. With the exception of WIC, there have been no published evaluations that include economic analysis.

The Perspective

In addition to the type of problem and the alternative interventions, the type of technique used depends on the perspective for analysis (i.e., the audience whose resources are at stake) (109). The audience for whom the analysis will be conducted will determine what costs and outcomes are most relevant.

According to Rossi and Freeman (109), a single perspective should be used to define benefits and costs of an intervention. This would be one of three perspectives

typically used for analysis of social projects: 1) individual, 2) program sponsors, and 3) society (109). For the individual perspective, the analysis is performed from the point of view of the program target (i.e., the person, group or organization that receives the intervention). In EFNEP, the individual perspective would be the EFNEP participant. If the economic analysis were done from the EFNEP participant's point of view, the cost-benefits would be high and the program would seem very effective because the participant contributes little to the costs other than time. The program sponsor's perspective takes the point of view of the funding source. The federal government and to a lesser extent state and local governments would be the program sponsors for EFNEP. This perspective is most appropriate when choices must be made involving distribution of funds. If EFNEP did improve food-related behaviors which resulted in improved nutrient intake, then expenditures for diet-related health problems might decrease. If participants improved their health, they might have fewer health problems and improve their earnings, which would increase tax revenues. The societal perspective includes most of the costs and benefits that are used for the individual and program sponsor perspectives, but they may be valued differently. For example, funds spent on EFNEP mean that those funds can not be used to build roads.

This research was conducted from the societal perspective. The Office of Management and Budget (OMB) of the Federal Government provides guidance for economic analysis of government programs by periodically sending circulars to heads of executive departments and agencies. Circular A-94 distributed by the federal Office of Management and Budget (OMB) clearly states that economic analyses must be provided

and defined from the perspective of society rather than the Federal Government (110). According to Warner and Luce (111), the societal perspective should be assumed unless a more narrow approach is specified by the audience. If the more narrow program sponsor approach were taken, it would exclude some indirect costs carried by individuals and organizations that give to The University of Tennessee. Legislators are concerned with costs and benefits accruing to constituents. Federal dollars for EFNEP are applied to direct costs. Administrators are concerned with all the costs, both direct and indirect, and benefits to society to justify future contributions from both public and private donors.

Establishing the Analytic Framework

The analytic framework for conducting economic analysis must be established before the analysis can begin. Based on the problem identified, the alternative interventions or programs, and the audience for whom the analysis is intended, cost-benefit is the appropriate analytical technique. A benefit-cost ratio could be calculated using the benefit of saving dollars on food each month and the costs of implementing EFNEP. Some amount of dollars might be saved on food per person per month for every dollar spent to implement EFNEP. The following discussion provides the rationale for conducting a cost-benefit analysis.

The problem. The problem can be stated as follows: How effective is EFNEP at improving food resource management practices and food selection and preparation practices of those families that participate and at what cost? These are the intermediate

outcomes expected as a result of participation in EFNEP that will determine nutritional and health status ultimately.

Based on the problem, cost-benefit or cost-effectiveness analyses would be appropriate techniques. In cost-benefit analysis, both costs and benefits must be expressed in monetary terms and compared as a benefit-cost ratio. As a measure of food resource management, EFNEP participants provide an estimate of total money and other resources spent each month on food in dollars when they enroll and when they complete the program. Therefore, a benefit-cost ratio could be identified using the cost of EFNEP in dollars and the dollars saved on the total monthly food bill. The outcomes, food resource management practices (other than dollars saved) and food selection and preparation practices, are not measured in monetary units and could not be converted into dollars in a meaningful way. When the outcomes are not expressed in dollars, cost-effectiveness is the appropriate technique.

The two other techniques, cost-feasibility and cost-utility would not be appropriate. Cost-feasibility would determine if EFNEP is feasible within available resource constraints. EFNEP has been in operation in Tennessee since 1969. Therefore, cost-feasibility has been established. Cost-feasibility can not determine if EFNEP is beneficial or compare its effectiveness with other programs.

Cost-utility analysis could be used to measure the effectiveness of EFNEP. However, to use cost-utility analysis the measures of effectiveness would be expressed as estimated values determined by the probability of the outcomes and an assessment about their relative worth. For example in the case of food safety, some value would have to be

placed on improving food safety practices based on the probability that foodborne illness will be reduced and the worth of reducing foodborne illness. Since estimated value placed on improving food safety practices would be subjective, the cost-utility analysis would not lend itself to replication by alternative programs with similar goals and objectives.

The alternatives. Based on the problem and the alternatives to EFNEP, cost-benefit is the best technique for economic analysis. Both cost-benefit and cost-effectiveness provide information that helps decision makers choose among alternative interventions that address the problem. Cost-effectiveness analysis is the only one that assumes the goals of the interventions are similar or identical and that a common measure of effectiveness can be used to assess them (12). According to Levin (12) and Splett (39), two or more alternatives must be identified for comparison. Therefore, no claim that EFNEP is cost-effective could be made until the cost-effectiveness ratio of EFNEP could be compared to an alternative program with similar measures of effectiveness.

A search of interventions with the goal of improving the nutritional intake of low-income adult and youth resulted in identification of several federal food assistance programs. Evaluations have demonstrated that for several of these programs providing food or the resources to obtain food with some level of nutrition education has a positive effect on dietary intake. However, none measure their effectiveness by improvements in food resource management practices and food selection and preparation.

The program with objectives and measures of effectiveness closest to those of EFNEP is the Food Stamp Nutrition Education Program (FSNEP). However, the measures of effectiveness may vary according to a state's nutrition plan, because there is

no national FSNEP model. FSNEP could be considered an alternative to EFNEP if similar objectives and measures of effectiveness are used. The overall goal of improving diets is the same for all states with FSNEP, but different states may focus on different objectives and, therefore, different measures of effectiveness. In addition, the FSNEP considered would need to be similar in other ways, such as the target audience. The target audience for FSNEP can vary from state to state, but according to federal regulations, the audience must be food stamp recipients. EFNEP would have a broader audience that includes families receiving any type of public assistance.

Since cost-benefit analysis measures both costs and benefits in dollars, it is not necessary that alternative interventions have common objectives or measures of effectiveness. The outcome measured is in monetary terms and can be compared to programs that do not have the same goals and measures of effectiveness.

The perspective. As discussed previously, the societal perspective was used for this research. The societal perspective on costs and benefits is the traditional perspective of cost-benefit and cost-effectiveness analysis (112). Society is not concerned about the feasibility of EFNEP obtained from a cost-feasibility analysis. The outcomes from cost-utility analysis would be subjective and would make comparison of alternative interventions difficult for anyone not directly involved in valuing the benefits.

Theoretical and Historical Background of Cost-Benefit Analysis

Based on the problem identified, the alternatives, and the perspective, cost-benefit was selected as the type of economic analyses for this research. CBA is a technique

developed for the evaluation of public policy issues. It is designed especially for public projects for which outcomes are evaluated on the basis of public interest (112). In contrast to financial analysis, where all costs and benefits are measured in market prices (i.e., cash and revenue flows), CBA measures the costs and benefits in terms of social utility gains (112). Welfare economics and public finance provide the framework to identify and assess costs and benefits from society's perspective.

The use of welfare economics and public finance justify government involvement, which explains why CBA has been used historically in the design and formulation of policies in federal agencies (110). It was part of the Flood Control Act of 1936, used extensively by the Department of Defense in the 1960s, and is used today as an essential evaluation tool by federal agencies under the guidance of the Office of Management and Budget.

Resource allocation decisions are central to the theory of cost-benefit analysis. How much can you improve society's well-being for some individuals without making others worse off? In contrast to an accountant of a private firm who asks whether the owners of an enterprise will become less well off by a firm's participation in one activity instead of another, the economists using a cost-benefit appraisal considers whether society as a whole is better off participating in an activity or alternative activities (113).

In this research, participation in EFNEP resulting in improved dietary intake could benefit society because society would spend less money on health care for chronic diseases related to diet. While it may seem that another benefit of teaching families to save money on their food purchases is to reduce the amount of food stamps they receive, which may

decrease federal spending, research has suggested that the current level of spending on food stamps is not sufficient to meet the minimal nutritional needs of low-income families (70). On the other hand, if families learn to budget their food dollars so they need less money to supplement their food stamps, they can purchase more of other goods, such as education or transportation to a job. Or, families may not require emergency food sources such as food banks as often.

In economics there is the principle of social betterment in relation to resource allocation known as Pareto optimum, defined as “a state of economic affairs where no one can be made better off without simultaneously making at least one other person worse off” (112, p. 11). There is some point reached in resource allocation (the Pareto optimum) in which no further resources can be invested in a project without reducing resources to alternative projects. Therefore, rational decisions must be made to spend resources using an analysis of costs and benefits. Projects that are economically feasible must produce benefits that make everyone in society better off. However, in the real world, someone’s welfare is improved at the expense of at least one person becoming worse off. Therefore, gains in welfare are not viewed as actual Pareto improvement, but as potential Pareto improvement (112-113). In cost-benefit analysis, this is commonly referred to as Kaldor-Hicks improvement (112). Under the Kaldor-Hicks rule, allocation of resources can be justified as long as it raises net social benefits, and as long as those who benefit could compensate those who lose. According to this rule, actual compensation does not have to be carried out but can be a redistribution of gains (112). For example, in this research the

benefits of EFNEP would compensate taxpayers through reduced health care costs for tax dollars that would otherwise be spent on other projects.

Conducting a Cost-Benefit Analysis

Conducting a cost-benefit analysis is a systematic process. Once the objectives of the program to be evaluated are determined and type of economic framework is established, costs and outcomes must be identified and measured (39). Then the outcomes must be compared to costs. Finally, the results must be summarized, interpreted, and reported (39).

Identifying and Measuring Costs

Costs are inputs that are required to produce an intervention (109). Outcomes and benefits of a program need to be evaluated against the costs necessary to deliver the services or intervention (39).

Identifying costs. The first steps, before costs can be identified, are to specify the intervention or program and determine the time horizon or a specific time period. Then, all costs should be identified from client recruitment through achievement of the final outcome (39). Once costs are identified, they must be measured in a systematic manner, summarized, and reported (39).

What is it that must be costed? For example, this may include the cost of prevaccination testing for hepatitis B surface antibodies (44), the cost of providing health checks to a group at risk for coronary heart disease (114), or the costs of nutrition

services for pregnant women in a city health department (49). The target of the implementation or program helps define what is to be costed. The target of nutrition services in the city health department is pregnant women. The target of an economic analysis of EFNEP would be individuals who enroll and complete the program. Therefore, the implementation to be costed would be nutrition education provided by EFNEP.

Once the costs to be measured are identified, a time horizon must be established. The time horizon represents the time frame for the intervention for tracking outcomes and input costs. The time horizon must be realistic and take into consideration the likelihood that the outcomes to be measured will occur within the specified time frame (39). For example, expecting a significant weight loss after one or two contacts is not realistic. Once the intervention is specified, the time frame must be determined. Time horizons can be short or long depending on the type of intervention and the outcomes desired. The majority of EFNEP participants spend from three to six months in the program and graduate when it is determined they have met educational objectives. Therefore, the costs and outcomes will be measured for six months to be sure measurements are collected from the majority of participants who enroll at the beginning of the study.

After establishing the time horizon, activities are defined. Any activities needed to implement a program must be defined before they can be costed (115). Activities in a nutrition education program might include conducting a nutrition assessment, providing individualized counseling, implementing a follow-up evaluation, etc. In EFNEP, activities

may include recruiting homemakers, completing a records, and teaching a homemaker about nutrition.

Measuring costs. Once the activities are defined, costs can be determined.

Determining the cost of an intervention involves calculating both direct and indirect costs of all activities (115). Direct costs are the resources spent to provide the service or intervention, such as personnel, equipment, office supplies, educational materials, and travel. The greatest expense in most programs is personnel, which includes salaries and fringe benefits of all full-time and part-time employees. It includes expenses paid for consultants and the value of volunteers. Resources that support the service or intervention, such as administrative overhead, office space, maintenance, and bookkeeping, are considered indirect costs.

Levin (12) recommends an "ingredients method" to identify and measure costs. Using this method, all ingredients are identified and costs are determined to estimate total costs of an intervention. To facilitate the identification and specification of ingredients, they are divided into four main categories (12). These typically include personnel, facilities, equipment and materials, and other program inputs. Other program inputs are expenses that do not fit into the other categories, such as theft or liability insurance beyond what is typically required by the sponsoring agency. Ingredients must be specified in enough detail to determine how they can be measured and valued (12).

To determine personnel costs, all personnel should be listed according to the responsibilities (e.g. administration, coordination, teaching), qualifications (i.e., training and experience), and time commitment (12). The amount of time committed is the

percentage of a full-time position. In the University of Tennessee Agricultural Extension Service, personnel time is described in full-time equivalent (FTEs). One FTE is equal to 40 hours per week.

Facilities include classrooms space, offices, storage space, or other physical space requirements for the intervention. Facilities are included whether or not they are paid by the project (12). According to the Code of Federal Regulations (116), property and some equipment fulfill cost-sharing or a matching requirement for federal programs, such as EFNEP. Equipment and materials are furnishings, instructional equipment, computers, books and other printed materials, paper, and other supplies. If any other ingredients are needed that do not fall in other categories, they are listed as other inputs, which may include extra liability or theft insurance, and other expenses.

Levin (12) lists three overriding considerations when identifying and specifying ingredients. First, sufficient detail must be provided in order to place a value on each item. Second, when listing ingredients, more consideration must be given to those that contribute the most overall to the total cost of the intervention. In most cases, salaries and fringe benefits represent the largest portion of costs of an intervention. The greater the contribution, the more precisely the costs must be measured. A 10% error in personnel expenses would make a larger difference in the total costs of an intervention than a 10% error in office supplies. Third, there needs to be some consistency when placing items into categories. When determining costs for different programs, how the ingredients are placed in categories should be the same. If theft insurance is categorized under equipment expenses, it also should be done for each alternative costed.

Economic analysis is the process of quantifying costs (115). It involves a series of steps that must be carried out systematically for each alternative included in the comparison. Once activities are listed and principle cost components are identified, data must be collected for components. To estimate the quantity of major cost components for each activity, data may be collected using work schedules and existing reports, such as accounting records, time studies, productivity studies, and other methods. Some expenses can be determined directly from accounting records while others must be estimated using a variety of methods.

Data needed for determining personnel costs can be collected in a variety of ways (115). Personnel may be asked to keep daily logs or time-and-activity reports to estimate the time spent on activities. Time contribution also may be estimated using work sampling, which involves making several observations about time spent on specific activities and then averaging the times. According to Splett and Caldwell (115), times studies are considered the most valid for determining personnel costs. For a specified time period, employees are asked to keep daily records of the time they spend in activities. After the time period, data are tallied and organized by employee classification and activity studied. It is important that forms used for time studies and daily activity logs be detailed enough to differentiate among the activities to be costed. After it has been determined how much time personnel have spent on the specified activities, the personnel time is converted to costs by multiplying the amount of time (in hours) and the hourly pay of the employee. Usually, the mid-range of a salary scale for each employee classification is used to avoid very high salaries for long-term employees and very low-salaries for those

employed a short time. Once the salaries are determined, the cost of fringe benefits are added. Fringe benefits include health and life insurance, employer contributions to social security, pension contributions by employers, and other benefits. Many employers use a standard percentage of the salary, such as 28%, to determine fringe benefits. This percentage is multiplied by the salary to get total personnel costs. After total personnel costs are determined, they are annualized to determine the total personnel cost per year.

Travel costs are the actual dollars paid to employees to conduct the intervention or program. These costs are typically the number of miles traveled multiplied by the allowed travel costs per mile. If an employee travels 100 miles and is reimbursed \$.24 a mile, then travel costs for that employee are \$24.00. The time associated with travel, however, is considered under employee salaries (115).

Continuing education costs are the actual costs associated with an educational opportunity provided through the agency. Only those costs related to the program are considered. Continuing education costs may include honorarium for guest speakers, registration fees, or other costs.

The cost of facilities can be determined in two ways (12). One way is to calculate the cost to rent or lease the space. The second way is based on ownership of the property. When the space used for a program is part of a property that is owned, the replacement value of the property and the life of the property are determined to calculate depreciation for every year of use (12). An opportunity cost of having resources invested in the undepreciated part of the property also is determined from an appropriate interest

rate (12). The annual interest forgone (the opportunity cost) and the annual cost of depreciation are added to determine the annual value (12).

Once the total cost of a facility is calculated, the percentage of space used by the program of interest should be determined from the total cost since most facilities benefit more than one program. Usually, this determination is based on the amount of space, number of employees, or actual usage by the program (115). The cost of the facilities can be calculated by determining the total square feet of space used by all programs multiplied by the cost per square foot per year multiplied by the percentage of time used by the service to derive a cost to the program per year (115).

In addition to the cost of the facilities, other indirect costs such as maintenance, heat and lights, administration, accounting services, and personnel services must be considered in the cost of delivering a program. Many agencies have a fiscal officer who can explain how indirect costs are considered in the overall agency budget. How much of these costs can be attributed to the program being studied then would have to be determined and expressed as a percentage of time used multiplied by the total agency costs.

The cost of equipment can be determined by the cost of leasing or renting. When this information is unavailable or the equipment is owned, the replacement cost of a piece of equipment is used. The replacement cost is annualized, like facilities, taking into consideration depreciation and opportunity costs. When equipment is used by more than one program, the percentage of time used for the programs of interest is determined and costs are calculated as a percentage of the total annual costs.

Costs for supplies often account for less than 5% of the total costs of operating an educational program. Therefore, listing each item and determining market prices is not recommended (12). The cost of supplies can be estimated by adding total expenditures. The cost of educational materials are determined in a similar manner. Like office supplies, only those materials used by the program during the period of time studied are included (115). For example, if 5,000 publications are printed and 500 are used during the period of study, then only 500 are considered a cost to the program.

In some cases, many of the direct costs can be taken directly from budget ledgers kept by the fiscal officer of an agency. All expenses charged to the EFNEP restricted budget account at The University of Tennessee are itemized monthly on a Grant and Contract Budget and Expenditure Report. Expenses listed in the report include salaries, longevity pay, retirement contributions, social security contributions, insurance, travel, printing, telephone, office supplies, and minor equipment.

Once costs are measured, they are summarized by relating them to outcomes. This can be done in different ways (115). Full cost refers to the total cost of a program over a time period (e.g, the cost of implementing EFNEP for one year). Average cost is the cost per unit of outcome (e.g., the cost of implementing EFNEP per dollar saved on food expenditures). Two types of cost summaries relate the extra cost to produce an outcome. Incremental cost is the cost of adding a service or program to an existing program and marginal costs are the cost of doing slightly more or less within a service or program.

Identifying and Measuring Benefits

Assessing the outcomes of a program or intervention is considered to be a prerequisite for cost-benefit analysis. According to Rossi and Freeman (109), how a benefit is specified and measured is central to economic analysis.

Identifying benefits. Outcomes are measurable changes achieved by a participant between entry and exit from a program (20). What is expected to occur as a result of participation in EFNEP? The expected outcomes based on the problem identified are that families will: 1) improve food resource management practices and 2) improve food selection and preparation practices.

Measuring benefits. Once the expected outcomes are specified, some type of measures must be identified. Improved food resource management practices can be measured by the amount of money saved on food as a result of participating in EFNEP. Saving money on food does not necessarily mean food selection or preparation practices improve. Other measures also must be used to establish whether or not families improved their food selection and preparation practices.

It is possible from the EFNEP Reporting System to determine if dollars are saved on food as a result of participation. At the time of program enrollment and graduation, the EFNEP participant is asked to estimate how much the household spends on food in a month. This amount includes all cash, food stamps, and vouchers. Similar questions were part of the 1995-96 CSFII (117).

Solely using a self-report of how much money was spent on food in the past month to measure benefits of EFNEP can be problematic for several reasons. The first problem

is the reliability of the data. It depends on the respondents' ability to recall, which can be poor (118). Second, because a family spends less on food does not necessarily mean that dietary intake is adequate. It can mean the family is purchasing less food or less expensive food.

Using other methods of recording purchases, such as register receipts, may improve the reliability of the data. Mean monthly expenditures reported in the 1995 EFNEP Reporting System (17) had large standard deviations indicating possible inconsistencies in data collection. Keeping register tapes might improve the accuracy of recording food expenditures.

Register tapes have been used to assess food and nutrient intake (119-120). They can help respondents recall food items they have eaten and are useful tools for nutrition education (120). In the case of recalling dollars spent on food, the register tapes may help prompt respondents to recall their expenditures.

Using register tapes is considered a relatively low cost method of data collection. Gerace (120) asked patients to collect register tapes when initial clinic appointments were made over the telephone and provided no training. In contrast, DeWalt et al. (119) gave mothers a collection packet with instructions on how to collect register tapes and keep logs of foods eaten away from home, foods from home production, foods from household stores, foods from gifts, and foods purchased from stores without itemized receipts. Because the researchers were using the receipts to analyze dietary intake, there was no mention of nonfood items on the receipts because these items could be eliminated without

affecting data analysis. In a study using receipts to calculate food expenditures, it would be necessary to subtract the nonfood items from the total grocery bill.

Collecting register tapes requires more effort on the part of respondents to remember to save the tapes. In addition, some factors may confound the analysis of tapes, such as expenditures for food eaten away from home, food produced by the household (e.g., gardens), food from household stores (e.g., freezers), food gifts, and food from commodity programs (119). Results of consumer expenditure surveys show that in 1993, Americans spent \$282.9 billion on away-from-home meals, an increase of 5.5% from 1992 to 1993 (121). As income increased, the percent of total food expenditures away from home increased. Therefore, eating away from home would still need to be considered when estimating total food costs, but to a lesser extent with low income families.

According to the EFNEP Summary of Adult Participant Profiles in Tennessee (17), of the participants who reported household income (64%), the majority (70%) had incomes 75% or less of the poverty level. Very few EFNEP participants have gardens or household stores of food, and commodity foods are distributed infrequently due to recent federal budget cuts. Therefore, it is expected that these factors would have minimal influence on total food expenditures of the EFNEP population.

If nutrient intake improved at the same time the family spent less money on food, with other factors remaining constant, this could be viewed as a benefit from EFNEP. Therefore, the benefit could be stated as: the difference between dollars EFNEP families spent on food before participating in EFNEP and after participating in EFNEP.

In addition to nutrient intake, other benefits, such as improved food selection and preparation, could be measured in nonmonetary terms using the national EFNEP Reporting System. Data are collected from participants using a Dietary Recall Form (Appendix B1), EFNEP Survey (Appendix B2), and Family Record (Appendix B3). These surveys are implemented upon entry into EFNEP before education occurs and upon graduation from EFNEP, when it is determined by the paraprofessional and supervising Home Economist that the homemaker has met educational objectives.

Outcome measures for dietary intake are determined from a 24-hour recall taken on the Dietary Recall Form. Measures include mean number and percent of homemakers who ate a specific number of servings from each food group using the recommended number of servings from the Food Guide Pyramid (19). Energy and the following nutrients also are measured: mean percentage of calories from carbohydrate, fat, and protein; and mean nutrient intake and percent of RDA for protein, iron, calcium, vitamin A, vitamin C, and vitamin B₆. Appropriate RDA are used for age and gender of each participant and when the participant is pregnant or lactating.

The 24-hour recall has been used to evaluate dietary intake in EFNEP for many years. The recall typically is taken by the paraprofessional in a personal interview. In some cases, such as during group instruction, the participant may be asked to complete the recall with help from the paraprofessional. This method is fairly easy to administer, does not take a lot of time away from teaching, and requires little burden on the part of the respondents. The 24-hour recall method has been demonstrated to be comparable to other

methods that take more resources to administer when used to analyze dietary intake for groups (122).

Behavior scores based on how often a homemaker followed recommended practices would be measures of food resource management practices and food selection and preparation practices. Information about food-related practices comes from the EFNEP Survey (Appendix B3). The majority of measures from the survey are ordinal with the following five values on a scale: Do Not Do, Seldom, Sometimes, Most of the Time, and Almost Always. Three questions require an interval number response, one question a categorical (yes or no) response, and two questions require one response to four items on a 5-point Likert-type scale.

Both content and face validity have been established for questions on the survey instrument (123). Content validity refers to whether the questions represent the concepts taught in EFNEP (124). To establish content validity the researchers identified all major food-related practices from the EFNEP curriculum, “Eating Right is Basic” (125) and various state-produced lessons. In Tennessee, most lessons are taught from “Eating Right Is Basic.” Practices identified were reviewed by randomly selected EFNEP paraprofessionals and supervising agents, then practices were confirmed and ranked in order of importance. Those with low ranking were dropped and the remaining practices were prioritized by randomly selected state EFNEP Coordinators to derive a list of items with a Likert-type scale (123).

Face validity is an assessment made by the researchers of whether the questions actually measure what they are intended to measure (124). Face validity was established

for this survey through subjective judgement by experts in nutritional assessment, instrument development, educational research, and EFNEP (123).

Responsiveness and cultural sensitivity of the instrument also were established. Responsiveness refers to ability of the questions to detect change over time or to detect minimally important differences between subjects (126). Responsiveness was established using a "different-groups" method that compared responses to the survey by a group of new EFNEP participants to responses by a graduated group of participants (123). The survey was administered to both groups by paraprofessionals and the completed instruments were scored. A student's t-test was used to determine which items distinguished between the two groups. If the group of graduated clients scored higher than the group of new clients, the questions were considered responsive.

Cultural sensitivity refers to the use of simple, concrete words and phrases that the EFNEP clientele can understand. Bowens et al. (123) used simple, direct sentences to improve the readability for low-literacy audiences based on meanings of words and phrases to the clients. Items that caused confusion were eliminated.

Both responsiveness and cultural sensitivity also were established through additional field tests with 147 new EFNEP participants. Mean pre- and posttest scores from the field tests were significantly different, indicating the survey questions were responsive to detecting change (123).

The EFNEP Survey is designed to measure overall change in food-related practices; however, it is possible that the survey could be divided into separate subscales representing different concepts. Bowens et al. (123) determined that the questions could

be classified into four subscales: A) planning, selecting, and buying food, B) food handling, C) limiting fat in foods, and D) reading food labels. Data from the field test were used to perform a factor analysis, which determined if the different subscales were addressed by the subgroups of questions. Low factor loadings and low item total correlations were used to eliminate items to refine the scales.

Reliable questions consistently convey the same meaning to all people surveyed with the instrument (127). Cronbach's alpha coefficients (128) were used to determine internal consistency reliability for the subscales (129). Questions related to subscales A, B, C, and D had pretest alpha coefficients of 0.74, 0.63, 0.69, and 0.90, respectively. If 0.70 is considered the minimally acceptable level, then subscales B and C, and possibly A, had questions considered reliable. When posttest alpha coefficients (A=0.62, B=0.40, C=0.68, D=0.90) were compared to pretest coefficients, subscales C and D remained about the same, indicating they replicated well. The authors concluded that more research was needed to determine what items could more accurately measure subscales A and B.

How well the benefits of participation in EFNEP are measured and the ability to generalize the benefits to the EFNEP population depend on how well the evaluation is designed. The elements of design include who is measured and what measures are made at what times (130).

Measuring the benefits of EFNEP involves collecting data about a federally funded program that serves a special population of low-income people. Because laws that prohibit discrimination rule out evaluation designs that withhold services, it is not possible to form a true control group using random assignments to treatment groups. Therefore, a

quasi-experimental design called the Nonequivalent Control Group is recommended so that individuals who participate in EFNEP (the experimental group) are matched as closely as possible to individuals who do not participate in EFNEP (the control group) (129-130). Without the control group, it is difficult to attribute the benefits measured to participation in EFNEP. The control group also will help account for factors considered a threat to the reliability of the measurements, such as history, maturation, testing, and instrumentation (130).

Comparing Costs and Benefits

After the costs and benefits of a program are measured, they are compared in an analysis (39). In some cases, costs and benefits must be discounted before they are compared (112). Discounting is “a mathematical procedure used to convert future costs and future outcomes to present value” (39, p. 55). When costs and benefits are determined over a period of years or when costs and benefits between programs are compared for different years, the dollar value of costs and benefits for the study period must be considered.

Costs and benefits often are presented in a benefit-cost ratio with both sides of the ratio expressed in dollars. The benefit-cost ratio is considered by many to be an appropriate way to express the worth of a program relative to competing alternatives (111). However, the measure of a program’s worth in cost-benefit analysis also can be expressed as terms of net benefit. According to Warner and Luce (111), a ratio may sometimes be misleading, while net benefit always identifies how a program compares to

alternatives when programs are ranked. When analyzing costs and benefits of program, benefits can be considered as benefits or as negative costs. If a program reduces future medical costs, the dollars saved can be subtracted from the costs or added as a benefit. This affects the benefit-cost ratio, but it makes no difference when calculating net benefit.

Because it is difficult to reduce many different outcomes to a single benefit in dollars in CBA, or to a single measure of effectiveness in CEA, an array of multiple effectiveness measures sometimes is used to express the worth of program (39, 111). Several outcomes can be expressed in an array associated with a total cost of a program

Summarizing, Interpreting, and Reporting Findings

Readers of CBA typically focus on the summaries of the analyses, such as abstracts and news briefs. Therefore it is important that the analyst present findings clearly and fully, no matter how costs and benefits are presented (111). This includes giving careful attention to any specific problems and making any assumptions explicit (39, 111).

In the real world of public projects, there are uncertainties and limitations to cost and benefit data because it is difficult to control for all variables. Therefore, some assumptions must be made. For example, in health care practices, some differences always exist among different settings, such as the skill level of staff. It is important to state explicitly assumptions made in the investigation and then test the conclusions if different assumptions were used (47,111). Sensitivity analysis is a technique designed to test the assumptions used to determine costs and outcomes.

The more uncertain the costs or outcomes, the more important it is to conduct sensitivity analysis. For example, if the costs to implement EFNEP were estimated using salaries of Extension agents with short tenure, it is possible that personnel costs would be underestimated if several Extension agents actually had many years of service and higher salaries. Sensitivity analysis would test how using a lower or higher salary would affect costs when actual salaries were not used in the analysis.

The basic principles of CBA include discounting, explicitly stating assumptions made, and using sensitivity analysis to test assumptions. Only three of 77 economic analyses in medical articles published in 1978 to 1980, or 1985 to 1987 and reviewed by Udvarhelyi et al. (131) adhered to recommended principles of economic analysis. It is recommended that researchers conducting economic analyses use these principles and that reports be interpreted cautiously when the principles are not used (131).

Selecting a Project or Program

Once the findings of an economic analysis are presented, alternative programs can be compared and one or more programs selected for implementation. CBA is intended to be a practical tool to provide decision makers with the information they need to allocate resources. It is not intended to be the sole criterion for policy decisions.

According to Splett (45), ethical issues arise when programs are judged solely on the basis of economic analysis. For example, although many of the poorest families live in rural areas, reaching these families can be more expensive than reaching poor families in

urban areas. When the results are reported for an economic analysis, ethical considerations should be part of the discussion and implications (111).

There also has been some concern about conflicts of interest. Many economic analyses in health are supported by grants from the National Institutes of Health. However, there is some concern among physicians that some analyses supported by private industry, such as drug companies, may be biased and will be used to justify prices. The policy of the *New England Journal of Medicine* is that economic analyses are reviewed carefully before they are considered for publication to determine any biases or conflicts of interest (132).

Summary

It can be concluded from food and nutrition surveys and other sources of data on the dietary intakes and food-related practices of low-income families that these families consume less than adequate amounts of some dietary components and too much of others. Lack of sufficient resources to obtain enough nutritious food is a major reason low-income families consume less adequate diets than other families. However, there may be other factors, such as poor resource management practices and poor food selection and preparation. Because low-income families consume inadequate diets, their risk for chronic disease increases. This increases health care costs in a system already consuming more and more of our resources.

There are several assistance programs that have been shown to improve the diets of low-income populations. However, programs and services are no longer funded on the

basis of efficacy alone. It has become imperative that programs maximize efficacy while minimizing costs. For this reason, economic analysis has become a tool for establishing the value of programs, including those delivering nutrition services, in relation to other programs also competing for fixed resources.

STATEMENT OF THE PROBLEM

Data collected from national surveys and surveillance systems suggest that low-income households and individuals consume diets that place them at risk for health problems that result in premature mortality and morbidity (90). Low-income populations have the highest prevalence of anemia, low-birth weight deliveries, growth retardation, overweight, high serum total cholesterol, hypertension, and osteoporosis (90). The second nutrition monitoring report indicated that low-income adolescents and adults were less likely to consume adequate intakes of vitamin A, vitamin C, vitamin B₆, folate, calcium, iron, and zinc compared to higher-income groups (90).

Malnutrition, both under- and over-, in low-income populations has been attributed to lack of resources to acquire adequate food and lack of knowledge and skills needed to acquire adequate diets with limited incomes (3). For some families, limited incomes make it difficult to acquire adequate food no matter how well they manage food resources (56). For other families the knowledge and skills needed to plan, shop, and prepare foods may help them to manage their resources (3). Managing resources wisely might help them meet their nutritional needs so they are not forced to do without some foods, while consuming disproportionate amounts of others.

Several federal food assistance programs currently serve low-income populations with the goal of improving their ability to acquire food and increase nutrient intakes. Many of these programs are implemented at a large cost to taxpayers. For example, the Food Stamp Program cost American taxpayers over \$26.6 billion in FY 1995 (71). Yet evidence that food stamps increase nutrient intake is not conclusive (96). Welfare reform

and budget accountability require that federally funded agencies develop and implement an accountability system based on performance measurement, which is the basis for the Government Performance and Results Act of 1993 (133). As resources become more scarce, programs that are the most effective at the least cost are likely to be funded. Evaluating programs on the basis of effectiveness and cost can be accomplished through analytic techniques such as cost-benefit analysis.

Based on the problem of consuming an adequate diet with limited resources, the research questions in this study will be:

1. Does participation in EFNEP improve the ability of participants to manage resources wisely?
 - 1.1. How much money do EFNEP families report spending on food each month before and after three to six months of instruction?
 - 1.2. What is the magnitude of the difference between changes in food resource management practices before and after EFNEP as a result of three to six months of instruction?
2. Does participation in EFNEP improve the nutritional status of families?
 - 2.1. What is the magnitude of the difference between mean food and nutrient intakes before and after EFNEP as a result of three to six months of instruction?
 - 2.2. What is the magnitude of the difference between changes in food selection and food preparation practices before and after EFNEP as a result of three to six months of instruction?
3. How much does it cost to change food resource management practices of EFNEP participants?
 - 3.1. How much money, if any, do participants save on food after three to six months of instruction for every dollar spent to implement EFNEP.

REFERENCES

1. Brink MS, Sobal J. Retention of nutrition knowledge and practices among adult EFNEP participants. *J Nutr Educ.* 1994;26:74-78.
2. Romero VA, Medeiros DM, Melcher L. Use and effectiveness of Wyoming EFNEP's lesson series. *J Nutr Educ.* 1988;20:15-19.
3. Smith PK, Hoerr SL. A comparison of current food bank users, non-users and past users in a population of low income single mothers. *J Nutr Educ.* 1992; 24(suppl):59S-66S.
4. Tippet KS, Mickle SJ, Roidt L. Food and nutrient intakes of low-income women and children in metro/nonmetro areas, 1985/86. *Family Econ Rev.* 1990;3:12-15.
5. Kennedy E, Goldberg J. *Review of What American Children Are Eating.* Washington, DC: US Department of Agriculture, Center for Nutrition Policy and Promotion; 1995.
6. Center for Hunger, Poverty and Nutrition Policy. *The Link Between Nutrition and Cognitive Development in Children.* Medford, MA: Tufts University; 1993.
7. Food security and methods of assessing hunger in the United States. Testimony by S. Margen. Washington, DC: US House of Representatives, Select Committee on Hunger; 1989, Page 9. Serial No. 101-2.
8. Allen LH. Functional indicators and outcomes of undernutrition. *J Nutr.* 1990;120:924-932.
9. Food and Nutrition Board, Institute of Medicine. *Nutrition During Pregnancy.* Washington, DC: National Academy Press; 1991.
10. Peterson KE, Chen LC. Defining undernutrition for public health purposes in the United States. *J Nutr.* 1990;120:933-942.
11. *The Surgeon General's Report on Nutrition and Health.* Washington, DC: US Dept of Health and Human Services; 1988. DHHS (PHS) publication 88-50210.
12. Levin HM. *Cost-Effectiveness: A Primer.* Newbury Park, CA: Sage Publications, Inc.; 1983.
13. Buescher PA, Larson LC, Nelson MD, Lenithan, AJ. Prenatal WIC participation can reduce low birth weight and newborn medical costs: a cost-benefit analysis of WIC participation in North Carolina. *J Am Diet Assoc.* 1993;93:163-166.

14. *The Savings in Medicaid Costs for Newborns and Their Mothers from Prenatal Participation in the WIC Program.* Washington, DC: Prepared by Mathematica Policy Research Inc for Food and Nutrition Service, Office of Analysis and Evaluation, US Dept of Agriculture; 1991.
15. Schramm WF. WIC prenatal participation and its relationship to newborn Medicaid costs in Missouri: a cost/benefit analysis. *Am J Public Health.* 1985;75:851-857.
16. Kennedy E. Contemporary budget and policy realities: the state of nutrition education in USDA and the importance of evaluation. In: Doner L, ed. *Charting the Course for Evaluation: How Do We Measure the Success of Nutrition Education and Promotion in Food Assistance Programs?* Washington, DC: Food and Consumer Service, Office of Analysis and Evaluation, US Dept of Agriculture. Washington DC; 1997.
17. Summary of Adult Participant Profiles, EFNEP Reporting System. Knoxville, TN: The University of Tennessee Agricultural Extension Service; 1995.
18. *Expanded Food and Nutrition Education Program: Guide to Program Management and Supervision.* Washington, DC: Cooperative Extension System, US Dept of Agriculture; 1983.
19. *The Food Guide Pyramid.* Washington, DC: Human Nutrition Information Service, US Dept of Agriculture; 1992. Home and Garden Bulletin No. 252.
20. Kettner PM, Moroney RM, Martin LL. *Designing and Managing Programs: An Effectiveness-Based Approach.* Newbury Park, CA: Sage Publications, Inc.; 1990.
21. *EFNEP Evaluation/Reporting System User's Guide, Version 3.0.* Laurel, MD: Cooperative Extension System, US Dept of Agriculture; 1993.
22. Anderson JEL. EFNEP evaluation in Colorado using a simplified progression form. *J Nutr Educ.* 1988;20:227-231.
23. Del Tredici AM, Omelich CL, Laughlin SG. Evaluation study of the California Expanded Food and Nutrition Education Program: 24-hour food recall data. *J Am Diet Assoc.* 1988;88:185-190.
24. Torisky DM, Hertzler AA, Johnson JM, Keller JF, Hodges PAM, Mifflin BS. Virginia EFNEP homemakers' dietary improvement and relation to selected family factors. *J Nutr Educ.* 1989;21:249-258.

25. Food and Nutrition Board. *Recommended Dietary Allowances*. 9th ed. Washington, DC: National Academy Press; 1980.
26. Amstutz MK, Dixon DL. Dietary changes resulting from the Expanded Food and Nutrition Education Program. *J Nutr Educ*. 1986;18:55-60.
27. Cox RH, Gonzales-Viligar MCRV, Novascone MA, Silva-Barbeau I. Impact of a cancer intervention on diet-related cardiovascular disease risks of white and African-American EFNEP clients. *J Nutr Educ*. 1997;28:209-218.
28. Murphy MJ, Wright HS, Heasley DK, Hamilton LW. Impact of EFNEP on some nutrition-related practices. *J Am Diet Assoc*. 1980;76:570-574.
29. Green LW, Wang VL, Ephross PH. A 3-year longitudinal study of the impact of nutrition aides on the knowledge, attitudes, and practices of rural poor homemakers. *Am J Public Health*. 1974;64:722-724.
30. *Summary of Adult Participant Profiles*, EFNEP Reporting System. Washington, DC: Cooperative State Research, Education, and Extension Service; US Dept of Agriculture; 1994.
31. *An Experimental Evaluation of Nutrition Education Methods*. Menlo Park, CA: Prepared by SRI International for the Food and Nutrition Service, US Dept of Agriculture; 1981. Contract Number: 53-3198-1-105.
32. French AM, Roesel CJ, Shieh SJ. *An Assessment of the Objectives, Implementation and Effectiveness of the Adult Expanded Food and Nutrition Education Program*. Rosslyn, VA: Prepared by Inter-American Research Associates, Inc for the Cooperative Extension Service, US Dept of Agriculture; 1981. Contract Number: 531-3K06-0-103.
33. Enyart Y. *Evaluation of Limited One-to-One Nutrition Lessons Plus Mailed Lessons and Follow-up Telephone Contacts*. Columbia, MO: Prepared by The University of Missouri for the Cooperative Extension Service, US Dept of Agriculture; 1984. Cooperative Agreement Number: 12-05-300-550.
34. Jackson RW. *Cost Efficiency and Effectiveness of Two Nutrition Education Methods for Food Stamp Recipients*. Burlington, VT: Prepared by The University of Vermont for the Cooperative Extension Service, US Dept of Agriculture; 1986. Cooperative Agreement Number: 12-05-300-550.

35. Ezell P. *Comparisons Among Dietary Parameters for Wayne County, Tennessee, Homemakers, Preschool Children, and Families Enrolled in the Expanded Food and Nutrition Education Program*. Knoxville, TN: The University of Tennessee; 1981. Master's Thesis.
36. Kucharski B. *Characteristics of High and Low Performing Extension Food and Nutrition Education Program Assistants in Tennessee*. Knoxville, TN: The University of Tennessee; 1976. Master's Thesis.
37. Neilan AM. *Evaluating the Effectiveness of Small Group Methods in Nutrition Education for Young Mothers Receiving Public Food Assistance*. Blacksburg, VA: Virginia Polytechnic Institute and State University; 1985.
38. Hannold RH, Kristiansson KK, Coffey FA, Gunn B, Yancy E. *Cost Effectiveness of Three Nutrition Education Delivery Systems*. Burlington, VT: Cooperative Extension Service, The University of Vermont; 1980.
39. Splett PL. *The Nutrition Practitioner's Guide to Cost Effectiveness Analysis of Nutrition Interventions*. Arlington, VA: National Center for Education in Maternal and Child Health; 1996.
40. Detsky AS, Naglie G. A clinician's guide to cost-effectiveness analysis. *Annal Intern Med*. 1990;113:147-154.
41. L'Abbe KA, Detsky AS, O'Rourke K. Meta-analysis in clinical research. *Annal Intern Med*. 1987;107:224-233.
42. Luce BR, Elixhauser A. *Standards for Socioeconomic Evaluations of Health Care Products and Services*. Berlin:Springer-Verlag. 1990.
43. Greene VL, Lovely ME, Ondrich JI. The cost-effectiveness of community services in a frail elderly population. *Gerontologist*. 1993;33:177-189.
44. Kwan-Gett TSC, Whitaker RC, Kemper KJ. A cost-effectiveness analysis of prevaccination testing for Hepatitis B in adolescents and preadolescents. *Arch Pediatr Adolesc Med*. 1994;148:915-920.
45. Chesebro MJ, Everett WD. A cost-benefit analysis of colposcopy for cervical squamous intraepithelial lesions found on Papanicolaou smear. *Arch Fam Med*. 1996;5:576-581.
46. Neri M, Migliori GB, Spanevello A, Berra D, Nicolin E, Landoni CV, Ballardini L, Sommaruga M, Zanon P. Economic analysis of two structured treatment and teaching programs on asthma. *Allergy*. 1996;51:313-319.

47. Splett PL. Phase I: Status report of existing data on the effectiveness, cost, and cost effectiveness of nutrition care services. *J Am Diet Assoc.* 1991;91(suppl):S9-S14.
48. Gilbride JA, Parks SC, Palakurthi RR. Attitudes and opinions of dietetics professionals toward cost-benefit and cost-effectiveness analyses. *J Am Diet Assoc.* 1994;94:386-389.
49. Splett PL, Caldwell HM, Holey ES, Alton IR. Prenatal nutrition services: A cost analysis. *J Am Diet Assoc.* 1987;87:204-208.
50. Splett PL. *The Cost-effectiveness of Education for Cholesterol Reduction: A Three State Investigation.* Minneapolis, MN: The University of Minnesota; 1990. Dissertation.
51. Montgomery DL, Splett PL. Economic benefit of breast-feeding infants enrolled in WIC. *J Am Diet Assoc.* 1997;97:379-385.
52. Brauer PM, Imes S, Thomson ABR. Economic impact of nutrition counseling in patients with Crohn's disease in Canada. *J Can Diet Assoc.* 1988;49:236-240.
53. Simco MD, Conklin MT. Focusing on the effectiveness side of the cost-effectiveness equation. *J Am Diet Assoc.* 1989;4:485-487.
54. *Census of Population and Housing, 1990, Individual States and Earlier Censuses.* Washington, DC: US Dept of Commerce, Dept of Census; 1990. Summary Tape File 3A, Individual States and earlier censuses.
55. *Census of Population and Housing, 1990: Tennessee and Current Population Reports.* Washington, DC: US Dept of Commerce, Dept of Census; 1990. Summary Tape File 3A, Series P-60, No. 181, and earlier editions.
56. Clancy K, Bowering J. The need for emergency food: Poverty problems and policy responses. *J Nutr Educ.* 1992;24(suppl):12S-17S.
57. *Hunger 1994: Transforming the Politics of Hunger.* Silver Spring, MD: Bread for the World Institute; 1994.
58. Food Research and Action Center, Community Childhood Hunger Identification Project. *A Survey of Childhood Hunger in the United States.* Washington, DC: Food Research and Action Center; 1991.

59. Wehler CA, Scott RI, Anderson JJ. The Community Childhood Hunger Identification Project: A model of domestic hunger — demonstration project in Seattle, Washington. *J Nutr Educ.* 1992;24(suppl):29S-35S.
60. Life Sciences Research Office. *Nutrition Monitoring in the United States: An Update Report on Nutrition Monitoring.* Washington, DC: Life Sciences Research Office, US Public Health Service, US Dept of Health and Human Services; 1989. DHHS Publication No. (PHS) 89-1255.
61. Leidenfrost N. *Definitions Concerned with Food Security, Hunger, Undernutrition and Poverty.* Washington, DC: Cooperative Extension System, US Dept of Agriculture; 1993.
62. Campbell CC. Food insecurity: a nutritional outcome or a predictor variable? *J Nutr.* 1991;121:408-415.
63. Frazao E. *The American Diet: Health and Economic Consequences.* Washington, DC: Economic Research Service, US Dept of Agriculture; 1995. Agriculture Information Bulletin Number 711.
64. Hack M, Klein NK, Taylor HG. Long-term developmental outcomes of low birth weight infants. In: *The Future of Children*, Vol. 5. Los Altos, CA: Center for the Future of Children, The David and Lucille Packard Foundation; 1995.
65. CDC. Economic costs of birth defects and cerebral palsy — United States, 1992. *MMWR.* 1995;44:694-699.
66. Pipes PL, Trahms CM. Nutrition: Growth and development. In: Pipes PL, Trahms CM, eds. *Nutrition in Infancy and Childhood.* St. Louis, MS: Mosby-Year Book, Inc.; 1993.
67. Lozoff B, Jimenez E, Wolf AB. Long-term developmental outcome of infants with iron deficiency. *N Engl J Med.* 1991;325:687-694.
68. Ryan AS, Pratt WF, Wysong JL, Lewandowski G, McNally JW, Krieger FW. A comparison of breast-feeding data from the National Surveys of Family Growth and the Ross Laboratories Mothers Surveys. *Am J Public Health.* 1991;81:1049-1052.
69. Gerrior S. Does the 1983 Thrifty Food Plan provide a nutritionally adequate diet at the cost level currently used? *Fam Econ Nutr Rev.* 1995;8:2-16.

70. Crockett EG, Clancy KL, Bowering J. Comparing the cost of a Thrifty Food Plan market basket in three areas of New York State. *J Nutr Educ.* 1992;24(suppl):71S-78S.
71. 1995 Farm Bill: Guidance of the Administration: Section 5: Food and Nutrition. Washington, DC: US Department of Agriculture; 1995.
72. Levedahl JW, Ballenger N, Harold C. *Comparing the Emergency Food Assistance Program and the Food Stamp Program.* Washington DC: Economic Research Service; 1994. Agricultural Economic Report No. 689.
73. Rank MR, Hirschl TA. The link between population density and welfare participation. *Demography.* 1993;30:607-622.
74. *Poverty in the United States: 1991.* Washington, DC: US Bureau of the Census; 1992. Current Population Report, Series P-60, No. 181.
75. Lino M. Income and spending of rural single-parent families. *Fam Econ Nutr Rev.* 1995;8:17-26.
76. Emmons L. Food procurement and the nutritional adequacy of diets in low-income families. *J Am Diet Assoc.* 1986;86:1684-1693.
77. Campbell CC, Desjardins E. A model and research approach for studying the management of limited food resources by low income families. *J Nutr Educ.* 1989;21:162-171.
78. Boya YO. Consumer usage of unit pricing. *J Consumer Studies Home Econ.* 1987;11:279-293.
79. Bradbard S, Michaels EF, Fleming K, Campbell M. *Understanding the Food Choices of Low Income Families: A Summary of Findings.* Alexandria, VA: Food and Consumer Service, Office of Analysis and Evaluation, US Dept of Agriculture; 1997.
80. Kaufman PR, MacDonald JM, Lutz SM, Smallwood DM. *Do the Poor Pay More for Food? Item Selection and Price Differences Affect Low-Income Household Food Costs.* Washington, DC: Food and Rural Economics Division, Economic Research Service, US Dept of Agriculture; Agricultural Economic Report No. 759; 1997.
81. Lino M, Guthrie J. The food situation of families maintained by single mothers: expenditures, shopping behavior, and diet quality. *Family Economics Rev.* 1994;7:9-21.

82. Nicklas TA, Webber LS, Koschak ML, Berenson GS. Nutrient adequacy of low fat intakes for children: The Bogalusa Heart Study. *Pediatr.* 1992;89:221-228.
83. Lutz Z, Blaylock J, Smallwood D. Household characteristics affect food choices. *Food Review.* May-August, 1993.
84. Krebs-Smith SM, Cook A, Subar AF, Cleveland L, Friday J, Kahle LL. Fruit and vegetable intakes of children and adolescents in the United States. *Arch Pediatr Adolesc Med.* 1996;150:81-86.
85. Kennedy E, Goldberg J. *Review of What American Children Are Eating.* Washington, DC: Center for Nutrition Policy and Promotion, US Dept of Agriculture; 1995.
86. Tippet KS, Mickle SJ, Roidt L. Food and nutrient intakes of low-income women and children in metro/nonmetro areas, 1985/86. *Family Economics Review* 3:12-15; 1990.
87. Cook JT, Martin KS. *Differences in nutrient adequacy among poor and non-poor children.* Medford, MA: Center on Hunger, Poverty and Nutrition Policy, Tufts University; 1995.
88. Radimer K, Olson CM, Greene JC, Campbell CC, Habicht JP. Understanding hunger and developing indicators to assess it in women and children. *J Nutr Educ.* 1992;24:35-45.
89. Briefel RR, Woteki CE. Development of food sufficiency questions for the third National Health and Nutrition Examination Survey. *J Nutr Educ.* 1992;24(suppl):24S-28S.
90. Life Sciences Research Office. *Third Report on Nutrition Monitoring in the United States.* Vol 1. Washington, DC: Life Sciences Research Office, Federation of American Societies for Experimental Biology; 1995.
91. Treiman K, Freimuth V, Damron D, Lasswell A, Anliker J, Havas S, Langenberg P, Feldman R. Attitudes and behaviors related to fruits and vegetables among low-income women in the WIC program. *J Am Diet Assoc.* 1996;28:149-156.
92. Reicks M, Randall JL, Haynes BJ. Factors affecting consumption of fruits and vegetables by low-income families. *J Am Diet Assoc.* 1994;94:1309-1311.
93. Oliveira V. Cost of food-assistance programs declined slightly in first half of 1996. *Food Review.* 1996;September-December:26-33.

94. Katzev AR, Katzev D. *Evaluation of the 1993-94 Oregon Food Stamp Family Nutrition Education Program*. Public Policy Research Report, 2432 NW Johnson, Portland, OR; 1994.
95. Butkus S. *Mid-year Report of Family Nutrition Education Program*. Puyallup, WA: Washington State University; 1995.
96. Fraker TM. The effects of food stamps on food consumption: A review of the literature. In: *Current Perspective on Food Stamp Program Participation*. Washington, DC: Food and Nutrition Service, US Dept of Agriculture; 1990.
97. Allen J, Gadson K. *Nutrient Consumption Patterns of Low-Income Households*. Washington, DC: Economic Research Service, US Dept of Agriculture; 1983. TB-1685.
98. Morgan KJ, Peterkin BB, Johnson SR, Goungetas B. Food energy and nutrients per dollar's worth of food from available home food supplies. *Home Econ Res J*. 1985;14:241-251.
99. Lin BH, Guthrie J, Blaylock J. *The Diets of America's Children: Influence of Dining Out, Household Characteristics, and Nutrition Knowledge*. Food and Consumer Economics Division, Economic Research Service, US Dept of Agriculture; 1996. Agricultural Economic Report No. 746.
100. Devaney B. *Very Low Birthweight Among Medicaid Newborns in Five States: The Effects of Prenatal WIC Participation*. Washington, DC: Prepared by Mathematica Policy Research, Inc for Food and Nutrition Service, Office of Analysis and Evaluation; US Dept of Agriculture; 1992.
101. Stockbauer JW. WIC prenatal participation and its relation to pregnancy outcomes in Missouri: A second look. *Am J Public Health*. 1987;77:813-818.
102. Owen AL and Owen GM. Twenty years of WIC: A review of some effects of the program. *J Am Diet Assoc*. 1997;97:777-782.
103. Rush D, Sloan NL, Leighton J, Alvir JM, Horvitz DG, Seaver WB, Garbowski GC, Johnson SS, Kulka RA, Holt M, Devore JM, Lynch JT, Woodside MB, Shanklin DS. Longitudinal study of pregnant women. *Am J Clin Nutr*. 1988;48:439-483.
104. Bayder N, McCann M, Williams R, Vesper E. *Final Report: WIC Infant Feeding Practices Study*. Alexandria, VA: Prepared by Battelle Centers for Public Health for the US Dept of Agriculture, Office of Analysis and Evaluation, Food and Consumer Service; 1997.

105. Burghardt J, Gordon A, Chapman N, Gleason P, Fraker T. *The School Nutrition Dietary Assessment: School Food Service, Meals Offered, and Dietary Intakes*. Washington, DC: Prepared by Mathematica Policy Research Inc for the US Dept of Agriculture; 1993.
106. Gordon AR, McKinney P. Sources of nutrients in students' diets. *Am J Clin Nutr*. 1995;61(suppl):232S-240S.
107. Gordon AR, Devaney BL, Burghardt JA. Dietary effects of the National School Lunch Program and the School Breakfast Program. *Am J Clin Nutr*. 1995;61(suppl):221S-231S.
108. St. Pierre RJ, Rezmovic V. An overview of the national Nutrition Education and Training Program evaluation. *J Nutr Educ*. 1982;14:61-66.
109. Rossi PH, Freeman HE. *Evaluation: A Systematic Approach*. Beverly Hills, CA: Sage Publications; 1982:267-297.
110. Government Accounting Office. *Circular No. A-94*. Washington DC: US Office of Management and Budget; 1992.
111. Warner KE, Luce BR. *Cost-Benefit and Cost-Effectiveness Analysis in Health Care*. Health Administration Press. Ann Arbor, MI; 1982.
112. Nas T. *Cost-Benefit Analysis: Theory and Application*. Sage Publications, Inc. Thousand Oaks, CA; 1996.
113. Mishan EJ. *Cost-Benefit Analysis: An Informal Introduction*. Allen & Unwin, Inc. Winchester, MA; 1988.
114. Field K, Thorogood M, Silagy C, Normand C, O'Neill C, Muir J. Strategies for reducing coronary risk factors in primary care: Which is most cost effective? *Br Med J*. 1995;310:1083-1084.
115. Splett PL, Caldwell M. *Costing Nutrition Services: A Workbook*. Chicago, IL: Region V, US Dept of Health and Human Services; 1985.
116. Cost-Sharing or Matching, Subpart G, Chapter XXX, Title 7. In: *Code of Federal Regulations*. Washington, DC: Office of the Federal Register, National Archives and Records Administration; 1992.
117. *What We Eat in America: 1994-1996. Continuing Survey of Food Intakes by Individuals*. Rockville, MD: Prepared by Westat, Inc for Human Nutrition Research Center, Agricultural Research Service, US Dept. Of Agriculture; 1996.

118. Thompson FE, Byers T. Dietary assessment resource manual. *J Nutr.* 1994;124:2245S-2317S.
119. DeWalt KM, D'Angelo S, McFadden M, Danner W, Noland M, Kotchen JM. The use of itemized register tapes for analysis of household food acquisition patterns prompted by children. *J Am Diet Assoc.* 1990;90:559-562.
120. Gerace T. The descriptive sales slip: A dietary assessment tool on the horizon. *J Am Diet Assoc.* 1986; 86:515-516.
121. Manchester A. 1993 food spending picked up. *Food Review.* 1995;8:44.
122. Beaton GH, Milner J, McGuire V, Feather TE, Little JA. Sources of variance in 24-hour dietary recall data: Implications for nutrition study design and interpretation. Carbohydrate sources, vitamins, and minerals. *Am J Clin Nutr.* 1983; 37:986-985.
123. Bowens J, Cox RH, Pratt C, Gaylord C. Development of a food practice checklist for use with low-literacy homemakers in EFNEP. *J Family and Consumer Sciences.* 1995;Summer:35-42.
124. Thorndike R. *Applied Psychometrics.* Boston, MA: Houghton Mifflin; 1982.
125. *Eating Right Is Basic.* Third Version. Lansing, MI: Michigan State University; 1995.
126. Guyatt G, Walter S, Norman G. Measuring change over time: assessing the usefulness of evaluative instruments. *J Chronic Disease.* 1987;40:171-178.
127. Perkin J. Design and use of questionnaires in research. In: Monsen ER, ed. *Research: Successful Approaches.* Chicago, IL: The American Dietetic Association, 1992;111-129.
128. Cronbach L. Coefficient alpha and the internal structure of tests. *Psychometrika.* 1951;16:297-334.
129. Fitz-Gibbon Morris. *How to Design a Program Evaluation.* Los Angeles, CA: Sage Publications; 1987.
130. Campbell DT, Stanley JC. *Experimental and Quasi-Experimental Designs for Research.* Chicago, IL: Rand McNally; 1963.
131. Udvarhelyi S, Colditz GA, Rai A, Epstein AM. Cost-effectiveness and cost-benefit analyses in the medical literature. *Anna Intern Med.* 1992;116:239-244.

132. Kassirer JP, Angell M. The journal's policy on cost-effectiveness analyses. *N Engl J Med.* 1994;331:669-670.
133. Ladewig H. *Performance-based Budgeting and Cooperative Extension.* College Station, TX: Texas Agricultural Extension Service, The Texas A&M University System; 1995.

Part 2

A Cost-Benefit Analysis of the Expanded Food and Nutrition Education Program

INTRODUCTION

Americans spend billions of dollars every year to improve the nutritional welfare of at-risk populations through public and private programs that provide food assistance and education (1). Since resources for health and social services are limited, stakeholders are asking if those resources are spent for programs that have the greatest potential for achieving desired outcomes (2). Future funding will be determined by how well a program achieves outcomes in relation to costs compared to alternative approaches (2).

Economic analysis has been used for years by federal agencies in the decision-making process as a way to choose among alternative approaches (3). Using evaluation procedures based on systematic and careful assessment of options, such as cost-benefit analysis, can help decision makers allocate resources more efficiently. In cost-benefit analysis, potential benefits are expressed in monetary terms so that alternatives can be compared. Decisions about accepting or rejecting a program are based on whether there is a net gain when costs are subtracted from outcomes (3-5).

Although economic analysis has been in existence for years and has been used in education and health, few cost-benefit analyses have been conducted in nutrition (6). Cost-benefit analyses have been conducted for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) using estimated savings in Medicaid expenses for low birth weight infants (7-9) and reduction in Medicaid expenditures for breast-fed infants on WIC (10). A second type of economic analysis, cost-effectiveness analysis, has been used to evaluate prenatal nutrition services (11), to compare the

effectiveness of treatment alternatives for reducing cholesterol (12), and to demonstrate the economic benefits of nutrition counseling for patients with Crohn's disease (13).

The Expanded Food and Nutrition Education Program (EFNEP) is a educational program funded with federal dollars and implemented by state land-grant universities designed to improve the nutritional welfare of low income families. Although cost-effectiveness analyses have been conducted that examined various delivery strategies in EFNEP (14-16), a review of literature reveals no published studies that examined the costs of implementing an ongoing EFNEP program in relation to benefits expressed in monetary terms.

The objectives of EFNEP are to improve behaviors related to food selection and preparation, food resource management, and food safety, leading to the ultimate outcome of good health. To accomplish these objectives, participants enroll for a series of lessons consisting of information on planning nutritious meals and snacks using the Food Guide Pyramid (17), shopping for food, reading food labels, preparing and storing food safely, preparing foods from each food group, reducing dietary sodium and fat, eating during pregnancy, and feeding children. Lessons are delivered by paraprofessionals trained by Extension Family and Consumer Science faculty employed by the state's land-grant university. In Tennessee, the average number of lessons during the 1997-98 reporting period was 11.8 and the average length of time enrolled was from 3 to 6 months (18). After a series of at least six lessons, the participant graduates from EFNEP.

Numerous surveys have suggested that low income families consume too little of some nutrients (19-21) and too much of others (22-23). As a result, they are at risk for

iron-deficiency anemia, poor prenatal outcomes, poor growth, and chronic disease, such as heart disease, cancer and stroke (24-27). These conditions consume a large portion of tax dollars for health care.

The purpose of this study was to apply cost-benefit analysis to determine 1) if participation in EFNEP helps households use their resources wisely, 2) if participation in EFNEP helps households improve their nutrient intake, and 3) what it costs to improve these behaviors. The costs and benefits calculated in this research could be used to help decision-makers choose between spending resources on EFNEP or using resources for alternatives.

METHODS

A detailed description of methods used in this study is in Appendix A.

Subjects

Subjects were individuals from low-income families living in 16 Tennessee counties served by the EFNEP program. All subjects were females 18 years of age or older. Only females were included, since the majority (89%) of EFNEP participants were female in Tennessee in 1997 (18). Subjects under 18 years of age were excluded because parental consent was required for participation. All subjects were eligible to participate in EFNEP, because they received benefits from a public assistance program or had incomes at or below the poverty level established by the Department of Health and Human Services (28).

Paraprofessionals, who deliver nutrition education to participants, and Extension professionals, who supervise county EFNEP programs, recruited participants for the study. Many subjects were referred from agencies that serve low-income audiences. Others were solicited at sites where low-income families frequent (e.g., WIC clinics) and from door-to-door inquiries.

Research Design

The design used in this study was quasi-experimental, described by Campbell and Stanley (29) as the Nonequivalent Control Group Design. This design included three groups: the experimental group A (the group receiving nutrition education from EFNEP

who collected register receipts), the experimental group B (the group receiving nutrition education from EFNEP who estimated food expenditures from recall), and the control group C (a group who qualified for EFNEP, but delayed their participation until subjects in groups A and B completed their EFNEP education). The usual procedure for reporting food expenditures in EFNEP is to ask the participant to estimate how much money, food stamps, and WIC vouchers were spent on food in the month preceding enrollment and the month prior to graduation. Groups B and C followed this procedure, while group A kept cash register receipts for food purchases, or a record of expenditures when a receipt was not available (Appendix B4). Groups A and B received the same nutrition education intervention typically provided by EFNEP paraprofessionals. The only difference between treatment of groups A and B and the usual EFNEP intervention was the use of cash register receipts to determine food expenditures for group A. Group C delayed their nutrition education until subjects in groups A and B graduated so that there was no intervention during the course of the study.

In addition to food expenditures, participants in all three groups were given a pretest, which consisted of a survey of demographic characteristics (Appendix B1), a 24-hour dietary recall (Appendix B2), and a survey of food and nutrition behaviors (Appendix B3). The same records were administered a second time: at graduation for groups A and B and at the time they began receiving lessons for group C.

Subjects were randomly assigned to one of the three groups, i.e., the first person recruited was assigned to group A, the second person recruited was assigned to group B, and the third person recruited was assigned to group C. In the event a subject declined to

participate in the group to which she was randomly assigned, she was enrolled in EFNEP, but not in the study.

Sample Size

A sample size of 384 was determined using guidelines published for simple-random surveys (30-31). The sample size was based on population size, the permissible error and associated confidence level, and the population proportion to be estimated. In 1996-97, the number of females over 18 years of age who graduated from EFNEP within six months was 3,911 (18). A 0.05 confidence level was selected because the research was considered exploratory and a 0.01 level was considered too stringent. According to Wunsch (31), 0.05 is typically used in educational research. Based on percentages of participants who reported improvements in food and nutrition behaviors from data in the 1996-97 EFNEP report (32-33), the researcher was interested in determining if at least 70% of participants in the study improved nutrition and food-related practices. Using these factors, it was determined that a sample size of 341 people would be representative of the population within an acceptable error limit and take attrition into account.

Data Collection

The Pilot Test

Prior to beginning the study, the methodology for collecting outcome data was pilot tested in two counties with 20 participants. As a result of the pilot test, instructions for recruiting subjects for group C were modified. Initially, paraprofessionals were asked

to recruit subjects similar to those in groups A and B by asking them to recommend a friend or neighbor who would agree to be in the control group. Selecting controls from neighborhoods has been used to control for factors such as socioeconomic and ethnic variables (34-35). Participants in the pilot study did not provide names of friends or neighbors. Therefore, paraprofessionals were instructed to employ the usual strategies to recruit subjects, except subjects were to be recruited in sequence. When an individual should be in group C, she was asked if she would delay her EFNEP education for about 3 months.

Following the pilot test, the researcher explained the protocol to each paraprofessional and supervising EFNEP agent in 21 Tennessee counties. In addition to verbal instructions, paraprofessionals and agents were given written instructions (Appendix C). In accordance with The University Office of Research's policy on human subjects, paraprofessionals and agents were instructed to obtain informed consent from each participant. Copies of the consent forms are in Appendix D.

Two kinds of data were collected in this study: cost and outcome. Most cost data were obtained from the University of Tennessee financial data base system. Outcome data were obtained from participants using pre- and posttests.

Collecting Cost Data

The ingredients method described by Levin (4) was used to estimate costs. According to Levin, any intervention has ingredients that have a value or cost. Once the ingredients are identified, their costs are determined, then the costs of all ingredients are

combined to estimate total costs of an intervention. This method also is useful when determining which parts of an intervention have the greatest cost burden. The ingredients identified for EFNEP included: personnel, equipment and materials, facilities, and other inputs. Personnel, equipment and materials were direct costs, while facilities and other inputs were indirect costs.

Expenses associated with this research were collected or estimated using The University of Tennessee's financial data base system. A description of accounting standards is found in the document, "Cost Accounting Standards Board Disclosure Statement for Educational Institutions" (36). This document was submitted by The University of Tennessee to DHHS Office of Inspector General in 1997 to meet the requirements of public law.

Direct costs (i.e., personnel, materials, and equipment) were obtained from a monthly Grant and Contract Budget and Expenditure Report (Appendix E), an official accounting document for grants and contracts. All expenses charged to the adult EFNEP account numbers were collected in these reports. These were obtained from the Agricultural Extension's fiscal officer during the months of May, June, July, August, September, and October of 1997. Monthly expenditures charged to the adult EFNEP accounts during the six-month time horizon are listed in Appendix F. All expenses were multiplied by two to determine total expenses for one year except for three items: 1) group food and lodging, 2) seminar and conference registration, and 3) computer purchases. Expenses associated with group food and lodging, and seminar and conference registration, were for a biennial staff development conference for all faculty

and staff paid with EFNEP funds. Therefore, these expenses were divided by two to estimate costs for 12 months. The costs of computers and purchased during the six-month time frame were divided by five, the expected life of computers and printers (4).

Indirect costs, such as office space, utilities, and other costs, were estimated using a rate of 21.79% of direct costs for expenses on campus and a rate of 10.79% for expenses off campus. The rates were developed for the Agricultural Extension Service by the controller's office of The University of Tennessee and the accountant for the Institute of Agriculture using cost data collected during 1997 and were submitted by The University of Tennessee to the US Department of Health and Human Services (DHHS) for approval. Approval was pending during the time of this research. All expenditures listed on the grant and contract report were used to determine indirect costs, except for equipment expenditures. Indirect costs were not included for equipment because depreciation is included in indirect costs.

Collecting Outcome Data

Outcome data were collected from the Family Record, the Dietary Recall Form, and the EFNEP Survey at entry to and exit from the program. These records are standard for the state program and provided the following information for each participant: 1) demographic characteristics, 2) food intake, 3) money and other resources (e.g., food stamps) spent on food for one month, and 4) information about food and nutrition practices. Each record was administered by a paraprofessional who either conducted an individual interview with the subject, or provided instruction to a group of subjects. Each

paraprofessional was trained by a supervising Family and Consumer Science agent to administer the records following the protocol in the EFNEP Evaluation/Reporting System User's Guide (37).

The Dietary Recall Form was used to record all foods and beverages consumed in a 24-hour period prior to enrollment in EFNEP and 24 hours prior to graduation. Foods obtained from the 24-hour recall were classified into food groups using USDA's Food Guide Pyramid (17) by a computerized dietary analysis program included in the EFNEP national reporting system. Intakes of eight nutrients (protein, fat, carbohydrate, vitamin A, vitamin C, vitamin B₆, iron, and calcium) and energy also were calculated using the computerized dietary analysis program.

In addition to foods consumed, participants in group B were asked how much they spent on food during the month prior to enrollment and during the month before exiting the program. This included money, food stamps, and WIC vouchers. Participants in group A were asked to keep all cash register receipts for food for two weeks out of the month following enrollment and two weeks during the month prior to graduation. These weeks were the middle two weeks of their monthly spending cycle, i.e., the two weeks after they received their food stamps or cash payments. According to Joy (38), the middle two weeks of the monthly spending cycle are a reliable estimate of monthly food expenditures because these two weeks represent average expenditures. Expenditures during the first week following receipt of food stamps and cash payments tend to be very high, while expenditures during the last week of the cycle are very low.

When food receipts were not available, participants were asked to record the amount of money spent on food on a record (Appendix B4). According to Joy (38), participants need a method by which they can keep track of food expenditures that may not be recorded on a cash register receipt, such as meals in fast food restaurants and vending machines. Any non-food items and the sales tax on those items were subtracted from the total on the cash register receipts. Paraprofessionals gathered receipts and/or the record of expenditures from participants and submitted them to a supervising agent, who added the total expenses and multiplied the total by two to represent a month during each of the reporting periods. These amounts were recorded on the Dietary Recall Form.

Food expenditures for groups B and C were obtained by participant recall for the month prior to enrollment and the month prior to leaving the program, which is the usual method for determining food expenditures in EFNEP. The purpose of collecting food receipts in group A was to provide a second method by which food expenditures could be measured. Since this cost-benefit analysis was based on the estimated savings in food expenditures as a result of participation in EFNEP, food expenditure data affected the results of the analysis. Therefore, it was important to consider how more than one method of collecting data affected the final calculation, the net present value (NPV). Using sensitivity analysis, it was possible to examine how differences in the way food expenditures were valued influenced the NPV. Because some variables have a great influence on the final calculation, it is recommended that every CBA model include sensitivity analysis.

The EFNEP Survey was used to collect data on food resource management practices and food selection and preparation practices. The survey consisted of 13 questions related to three areas: food resource management practices, food selection and preparation practices, and food safety practices. Since only two questions measured changes in food safety behaviors, food safety practices were not included as EFNEP outcomes in this study. Ten survey questions required a response to a Likert-type scale and corresponded to a numerical score of 1 to 5 (i.e., 1 = Do not do, 2 = Seldom, 3 = Sometimes, 4 = Most of the Time, 5 = Almost Always). Three questions asked how many times in the past two weeks or in the past month a behavior was practiced and had a possible score of 0 to 31. One question required a yes or no response.

Incentives to participate were provided for subjects in groups A and C, because they were asked to keep register receipts for food or a record of food purchased (group A) or to delay their participation in EFNEP (group C). Normally, EFNEP participants are not asked to keep a record of food expenses and are not asked to delay their participation. Subjects in group A were given colorful three-ring binders for Extension publications, while subjects in group C received one of the following tokens of appreciation: a meat thermometer, vegetable brush and peeler, measuring spoons, measuring cups for dry ingredients, measuring cup for liquid ingredients, or plastic cutting board.

Statistical Analyses

Statistical analyses were conducted using The Statistical Analysis System (SAS) for Windows, Release 6.12 (40). Frequency tables were constructed for each of the three

groups and the total sample for variables with nominal measurements, such as gender, race, residence, participation in public assistance programs, and type of instruction. Frequency tables also were constructed for the total number of persons in a family, number of adults other than the participant in a family, number of children in a family, the ages of children, and the number of lessons received. Descriptive statistics were used for measurements such as age, number of children, total family size, servings from food groups, nutrient intakes, food expenditures, and behaviors from the EFNEP survey.

Food Expenditure Data

The difference between the amount of money or other resources spent on food at program entry and program exit was calculated for each of the three groups. The Analysis of Variance (ANOVA) procedure, a parametric test, was used to compare food expenditures of the groups. Even though data were not normally distributed according to a statistical test for normality, the distribution was symmetrical. According to Schlotzhauer and Littell (41), normality also can be assumed when data on the total population is available and the sample is representative of the total population.

ANOVA was used to determine if differences in sample means for each group were statistically significant. The independent variable group (A, B, or C) was used as the classification variable and the difference in food expenditure as the dependent variable. An alpha-level of 0.05 was chosen as the significance level. Tukey's studentized range test was used to make pairwise comparisons between groups.

A covariate, how often the participant used a shopping list (Q12 on the EFNEP survey), and the interaction of the covariate with the treatment group were measured for each of the three groups in an Analysis of Covariance (ANCOVA). How often a participant used a shopping list was included in the model to determine more precisely the effect of treatment group on food expenditures. When the ANCOVA showed an effect of the interaction of treatment group and how often shopping lists were used, correlation coefficients were computed to measure the strength of the relationship.

Food, Nutrient, and Survey Data

Statistical tests on nutrient intake and survey data were nonparametric because data were not normally distributed. An alpha-level of 0.01 was used for these tests to control the probability of making a type I error by rejecting the null hypothesis that there were no differences between groups. Differences between program entry and exit were used in tests for food and nutrient intakes. Scores for EFNEP Survey questions were analyzed as differences between program entry and exit or as average scores at exit depending on the type of data. Ratio measures were analyzed as differences between entry and exit. Ordinal measures were analyzed as average scores at exit.

Once it was established that there were no statistical differences in food and nutrient intakes between program entry among the three groups, and no differences between the two experimental groups at program exit, they were combined for further analyses. Likewise, experimental groups were combined for survey data, such as planning meals ahead of time. The two experimental groups were combined because they

received the same nutrition education intervention and the intent of the analysis was to establish that differences between subjects who received the intervention, and those who did not, were due to the intervention. The Kruskal-Wallis Test for comparing two groups (i.e., the combined experimental groups and the control group) was used for both food and nutrient intakes and survey data. One question on the survey required a yes or no response; therefore, a chi-square test was used to determine if average responses from groups were significantly different at program exit.

Comparing Costs and Benefits

Once costs and outcomes were identified and quantified, the benefits of implementing EFNEP were compared to the cost. This was accomplished in two ways: 1) using a single measure of effectiveness and 2) using multiple effectiveness measures in an array. With the single measure of effectiveness, the net present value (NPV) was calculated using the amount of money and other resources (e.g., food stamps, WIC vouchers) saved on food expenditures as a result of participation in EFNEP and the cost of implementing EFNEP. NPV was calculated using the formula:

$$NPV = \sum_{t=0}^T \frac{(\text{Benefits} - \text{Costs})}{(1 + r)^t}$$

where

r = discount rate

t = time period

T = time frame

The amount saved on food expenditures was the difference between food expenditures by each family at the beginning of the study (i.e., program entry) and at the

end of the study (i.e., program exit). For this research, sensitivity testing was applied to determine future benefits using three discount rates: 3, 5, and 7%. Discounting is used in economic analyses to adjust the future value of costs and benefits to current value. According to Nas (3), testing more than one discount rate is useful because shadow pricing, the method recommended by Office of Management and Budget (OMB) for determining discount rates (42), is difficult and complicated due to the effect of taxation policies on interest rates. The Public Health Service's Panel on Cost-Effectiveness in Health and Medicine recommends that a 3% discount rate be used in cost-effectiveness analyses of health interventions (43). Five percent is the most common discount rate in health-care literature (44). Seven percent is the rate recommended by the OMB for government projects because it "approximates the marginal pretax rate of return on an average investment in the private sector in recent years" (42, p. 7).

Because there is uncertainty about how long participants practice food resource management behaviors that may lead to savings in food expenditures, two retention periods were tested using sensitivity analysis. The amount saved on food expenditures in one month was multiplied by 3 years and 5 years, based on the assumption that the knowledge gains and behavior changes would be sustained for at least three years as reported by Green et al. (45) and Torisky et al. (46), and for five years as reported by Nierman (47).

Program cost was the average cost per unit of output, which was determined by dividing the total cost of implementing EFNEP for 12 months by the total number of participants that graduated during the same period. Future costs were not discounted

because providing EFNEP education to participants is a one time expense incurred over an average time of three to six months.

Because the difference in food expenditures at program entry and exit was the single measure of effectiveness, two assumptions were tested using sensitivity analysis. The first assumption was that keeping receipts and records of food expenditures was a reliable way to determine family food expenditures. The second assumption was that participant recall of food expenditures without keeping receipts or records, the typical method used in EFNEP, was a reliable way to document family food expenditures. Each method was used to calculate the average savings on food to derive NPVs.

In the array of measures, an array of outcomes was compared to average cost per program family. The advantage of this method is the ability to express diverse outcomes in relation to cost. As several researchers in the field of economic analyses have noted, it is difficult to reduce diverse outcomes to a single measure of effectiveness expressed in dollars (3-5). According to the Office of Management and Budget (42), even though all benefits can not be monetized, it is useful to identify as many benefits as possible and to quantify them using other summary measures. The array of outcome measures consisted of differences in food and nutrient intakes from program entry to program exit and average scores on behaviors related to food resource management practices and food selection and preparation practices at program exit for individuals in program families.

RESULTS

Sample

Four hundred seventy subjects from 16 counties were recruited for the study, 163 in group A, 159 in group B, and 148 in group C. Of the 470 who completed entry records, 444 (94.47%) completed exit records. Sixty-seven (15.09%) of those who completed entry and exit records were excluded, because they failed to keep food receipts, a record of expenditures, or indicated they spent no money or other resources on food. Eight additional subjects were excluded because two were males and four were under 18 years old. Therefore, 371 subjects (78.94%) completed the study. Participation rates by county are shown in Table 2. Overall, participation rates were similar for all three groups.

All subjects were female, 23 (6.20%) were pregnant, and 9 (2.42%) were nursing. The mean age of subjects was 31 years old and ranged from 18 to 72 years old. Mean ages of each group were similar: 32 years in group A, 31 years in group B, and 30 years in group C.

Racial/ethnic characteristics and place of residence of subjects are presented in Table 3. The majority of the sample was either African-American or white, which was similar to the total population of EFNEP participants during the same reporting period, 1997-98 (18). However, 55% of participants were African-American and 43% were white in the sample compared to 59% white and 39% African-American in the total population. Most participants lived in towns of less than 10,000 people and rural

Table 2. Participation rates by county for each group.

County	Group A		Group B		Group C		Total	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Benton	0	0.00	6	66.67	3	42.86	9	34.62
Carroll	17	94.44	18	100.00	17	94.44	52	96.30
Carter	9	100.00	6	100.00	6	100.00	21	100.00
Davidson	0	0.00	20	95.24	17	89.47	38	60.32
Giles	5	71.43	1	12.50	8	61.54	14	50.00
Greene	6	100.00	4	0.67	4	100.00	14	87.50
Hamilton	2	66.67	2	100.00	0	100.00	4	80.00
Hardeman	10	83.33	12	100.00	9	75.00	31	86.11
Haywood	12	100.00	12	100.00	11	91.67	35	97.22
Henry	6	100.00	4	66.67	6	100.00	16	88.89
Johnson	5	100.00	0	0.00	0	0.00	5	62.50
Lincoln	4	100.00	4	66.67	6	100.00	14	87.50
Overton	6	100.00	2	100.00	5	100.00	13	100.00
Putnam	7	58.33	8	66.67	0	0.00	15	48.39
Shelby	30	100.00	30	100.00	29	96.67	89	98.89
Unicoi	3	75.00	0	0.00	0	0.00	3	33.33
Washington	0	0.00	1	33.33	0	0.00	1	20.00
Total	121	74.23	129	81.13	121	81.76	371	78.94

Table 3. Demographic characteristics of the sample: race/ethnicity and residence.

	Group A n=121		Group B n=129		Group C n=121		Total n=371	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
RACE								
African-American	60	49.59	77	59.69	69	57.02	206	55.53
White	59	48.76	50	38.76	50	41.32	159	42.86
American Indian/ Alaskan	1	0.83	1	0.78	0	0.00	2	0.54
Hispanic-American	1	0.83	1	0.78	1	0.83	3	0.81
Asian or Pacific Islander	0	0.00	0	0.00	1	0.83	1	0.27
RESIDENCE								
Towns <10,000 and rural	58	47.93	56	43.41	56	46.28	170	45.82
Central cities over 50,000	38	31.40	57	44.19	49	40.50	144	38.81
Towns & cities 10,000 to 50,000	24	19.83	14	10.85	16	13.22	54	14.56
Farm	1	0.83	2	1.55	0	0.00	3	0.81
Suburbs of cities over 50,000	0	0.00	0	0.00	0	0.00	0	0.00

communities (45.82%) or central cities over 50,000 (38.81%). In the 1998 Adult Participant Profile for EFNEP participants (18), 40% lived in the small towns and rural communities and 42% lived in the large cities.

The composition of subjects' households is shown in Table 4. The average family size was 3.43 persons and was similar for groups A, B and C, respectively. Most families in each of the groups had from one to three children, which was comparable to the average number of children reported for all EFNEP participants in 1997-98 (18). Most of the children (72.75%) reported by subjects in the sample were 10 years old or younger. This was consistent for all three groups. Over half of the participants in the sample were single-female households, while about a third reported a spouse or another adult. Fewer than 10% reported more than one other adult living in the household.

Participation in public assistance programs was similar for groups A, B, and C, as shown in Table 5. Participation also was consistent with that reported by all EFNEP participants in 1997-98 (18). The majority (60.11%) of the sample received food stamps. Over one third participated in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) or the Commodity Supplemental Food Program (CSFP). Almost one third received money from the Temporary Assistance Program to Needy Families (TANF), a cash assistance program. In addition to child nutrition, The Emergency Food Assistance Program (TEFAP), and Head Start, over 20% of subjects received public assistance from other sources, such as public housing and energy assistance.

Table 4. Demographic characteristics of the sample: household composition.

	Group A n=121		Group B n=129		Group C n=121		Total n=371	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
TOTAL NUMBER OF FAMILY MEMBERS								
1	7	5.79	6	4.65	3	2.48	16	4.31
2-4	86	71.07	98	75.97	97	80.17	281	75.74
5-7	20	16.53	24	18.60	17	14.05	61	16.44
8-10	8	6.61	17	14.05	4	3.31	13	3.50
TOTAL NUMBER OF CHILDREN PER FAMILY								
0	14	11.57	19	14.73	13	10.74	46	12.40
1-3	88	72.73	96	74.42	94	77.69	278	74.93
4-6	17	14.05	13	10.08	13	10.74	43	11.59
7-9	2	1.65	1	0.78	1	0.83	4	1.08
AGES OF CHILDREN								
less than 1 year	7	3.18	14	6.01	8	3.73	29	4.34
1-5 years	84	38.18	105	45.06	81	37.67	270	40.42
6-10 years	57	25.92	67	28.76	63	29.30	187	27.99
11-14 years	40	18.18	20	8.58	30	13.95	90	13.47
15-18 years	29	13.18	26	11.16	31	14.42	86	12.88
19 years	3	1.36	1	0.43	2	0.93	6	0.90
Total	220	100.00	233	100.00	215	100.00	668	100.00
TOTAL NUMBER OF OTHER ADULTS								
0	68	56.20	79	61.24	70	57.85	227	58.49
1	42	34.71	36	27.91	41	33.88	119	32.09
2	5	4.13	9	6.98	5	4.13	19	5.12
3	6	4.96	4	3.10	5	4.13	15	4.04
4	0	0.00	1	0.78	0	0.00	1	0.27

Table 5. Participation in public assistance programs.

Type of Assistance	Group A n=121		Group B n=129		Group C n=121		Total n=371	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Food Stamps	73	60.33	83	64.34	67	55.37	223	60.11
WIC/CSFP ¹	40	33.06	50	38.76	43	35.54	133	35.85
TANF ²	42	34.71	44	34.11	36	29.75	122	32.88
Child Nutrition	36	29.75	31	24.03	40	33.06	107	28.84
Other	26	21.49	23	17.83	27	22.31	76	20.49
TEFAP ³	20	16.53	17	13.18	17	14.05	54	14.56
Head Start	10	8.26	12	9.30	12	9.92	34	9.16

¹Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)/Commodity Supplemental Food Program (CSFP)

²Temporary Assistance to Needy Families (TANF)

³The Emergency Food Assistance Program (TEFAP)

Over 96% of participants received six more lessons (Table 6). The average number of lessons received was 13.27 for group A and B (13.13 and 13.40, respectively). This was comparable to the average number of lessons reported for the total Tennessee EFNEP population in 1997-98 (18). Since the first six lessons taught contain basic food and nutrition information, they are considered the minimum number necessary to graduate from EFNEP. Almost 98% (244) of participants received six or more lessons.

The majority (61.16%) of the sample received individual lessons with the program assistant (Table 7). In comparison, only 19% of the total population of EFNEP participants received individual lessons during 1997-98 (18).

Table 6. Number of lessons received by subjects in group A and B.

Number of Lessons	Group A n=121		Group B n=129		Total n=250	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
<6	2	1.65	4	3.10	6	2.40
≥6	119	98.35	125	96.90	244	97.60

Table 7. Type of instruction received by subjects in group A and B.

Type of Instruction	Group A n=121		Group B n=129		Total n=250	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Group	41	33.88	57	44.19	98	39.20
Individual	74	61.16	69	53.49	143	57.20
Group and Individual	6	4.96	3	2.33	9	3.60

Program Costs

Direct costs for May, June, July, August, September, and October of 1997 are listed in Appendix F. When direct costs for personnel, equipment, and materials were summarized for six months and multiplied by two to estimate yearly expenditures, total costs were \$1,337,795.71 (Table 8). The largest portion of total dollars spent was \$1,276,836.11 for the first ingredient, personnel. Personnel costs included \$888,610.94 for professional salaries (state specialists, Extension agents, and program leaders), clerical salaries (secretaries paid monthly), and all paraprofessionals (including paraprofessionals and secretaries classified as paraprofessionals who are paid at an hourly rate).

Expenditures on benefits totaled \$317,116.70 and included longevity, retirement, Social Security, Unemployment Compensation, Workers Compensation, group insurance, and 401K matching. Food and lodging expenditures typically are considered part of travel expenses. However, group food and lodging was charged on one master bill and listed separately. Since group food and lodging expenses were incurred for a biennial staff development conference, expenses were divided by two to estimate yearly expenses.

The cost of equipment and materials, was \$60,959.60. This included the cost of the following: printing, duplication, and binding; computers; maintenance and repairs of equipment; operating supplies; photography; and subscriptions.

Facilities and other program inputs were considered as indirect costs. Total indirect costs for 12 months in 1997-98 were \$176,052. This included \$48,842 for the state portion of the budget and \$127,210 for the county portion of the budget. Indirect costs per month are listed in Appendix F. Total costs to implement EFNEP for 12 months in 1997-98 were \$1,513,847.71. A total of 3,899 families graduated from EFNEP in 12 months (18). Therefore, the program cost for 12 months was \$388.26 per family that graduated.

Program Benefits

Comparison of Experimental Groups and Control Group at Entry

Average entry scores for four questions on food resource management practices and five questions on food selection and preparation practices from the EFNEP Survey

Table 8. Direct costs for 12 months.

Ingredient	Expenditures (dollars)
PERSONNEL	
Salaries	888,610.94
Benefits	317,116.70
Travel	68,391.72
Seminar and Conference Registration	310.50
Group Food and Lodging ¹	2,406.25
Total Personnel	1,276,836.11
EQUIPMENT AND MATERIALS	
Printing, Duplicating, and Binding	17,654.86
Computers	10,200.00
Maintenance and Repairs	16,383.96
Supplies	16,692.36
Photography	8.48
Subscriptions	19.94
Total Equipment and Materials	60,959.60
TOTAL DIRECT COSTS	1,337,795.71

¹Biennial staff development conference (e.g., total cost divided by two years).

are shown in Table 9. Results from the Kruskal-Wallis Test for comparing two groups showed that scores for the combined experimental group and control group were not significantly different for these practices. However, there was a significant difference between the combined experimental group and the control group in how often participants made shopping lists. At program entry individuals in the combined experimental group more often ($P < 0.01$) made shopping lists than did individuals in the control group.

At program entry, 41 subjects (11.20%) reported cutting the size of their children's meals because there was not enough money for food. Percentages were comparable for the experimental and control groups.

Comparison of Experimental Groups and Control Group at Exit

Food expenditures. Subjects in both experimental groups saved money after participation in the program. Subjects in group A saved an average of \$10.36 per month on food expenditures based on receipts and food expenditure records. Those in group B saved an average of \$19.53 based on recall. However, subjects in group C spent \$5.52 more on food at program exit than at program entry based on recall.

The ANOVA procedure showed the differences in food expenditures between program entry and exit for groups A, B, and C were not significantly different. However, because there was a significant difference between the experimental groups and the control group in how often they made shopping lists at program entry, this factor was

Table 9. Average scores for food and nutrition related practices at program entry for the combined experimental group and control group.¹

Question	Group A and B (n=248)	Group C (n=119)
FOOD RESOURCE MANAGEMENT PRACTICES		
Planning meals	2.99 ± 1.17	3.26 ± 1.08
Comparing prices	3.57 ± 1.32	3.62 ± 1.26
Run out of food	2.18 ± 1.28	2.02 ± 1.24
FOOD SELECTION AND PREPARATION PRACTICES		
Healthy food choices	3.48 ± 1.09	3.73 ± 1.10
Adding salt	2.52 ± 1.40	2.40 ± 1.36
Labels with less salt	2.31 ± 1.28	2.07 ± 1.23
Labels with less fat	2.52 ± 1.36	2.33 ± 1.38
Food and nutrition needs	2.85 ± 0.70	2.92 ± 0.64

¹Scores on the EFNEP Survey included: 1=Do Not Do, 2=Seldom, 3=Sometimes, 4=Almost Always, 5=Always

included in the ANOVA as a covariate. When the covariate, how often the subject shopped with a list, and the interaction of the covariate with the treatment group were measured for each of the three groups in the ANCOVA, there was a significant difference between group B and group C ($P < 0.05$). The interaction between how often the subject kept a shopping list and the group they were in did affect food expenditures. Those who more often kept a shopping list and were in group B, saved more on their food expenditures than those who kept a shopping list less often and were in group C. However, keeping a shopping list alone did not significantly affect food expenditures.

Whether or not keeping a shopping list affected food expenditures depended on the group in which the subject participated.

All participants received education from the same competency-based curriculum, “Eating Right is Basic” (48). However, because the number of lessons taught (Table 6) and type of instruction (Table 7) varied, these factors were included in the ANOVA to determine if they affected food expenditures. The number of participants who received less than six lessons was too small to determine if the number of lessons affected food expenditures. ANOVA showed no difference in food expenditures for those who received instruction in groups and those who received education individually.

Food and nutrient intakes. Differences in the average number of meals and the number of servings from each food group consumed at program entry and program exit are shown in Table 10. The combined experimental group consumed significantly more vegetables, fruit, and bread ($P < 0.01$). On average, subjects in this experimental group consumed at exit 1.42 more servings of vegetables per day, 0.82 more servings of fruit per day, and 1.02 more servings of breads per day compared to 0.17 more servings of vegetables, 0.27 more servings of fruit, and 0.04 more servings of bread for the control group.

There also were significant differences between the combined experimental group and the control group when differences in nutrient intakes at program entry and exit were examined (Table 11). Subjects in the experimental groups consumed significantly more carbohydrate, iron, vitamin C, and fiber by program exit than did subjects in the control

Table 10. Comparison of average number of meals and servings from food groups at program entry and program exit for combined experimental group and the control group.

	Group A and Group B (n=248)	Group C (n=121)
Number of Meals	0.38 ± 1.23	0.11 ± 1.06
Meat	0.26 ± 2.19	-0.03 ± 2.11
Dairy	0.60 ± 3.33	0.23 ± 2.85
Vegetables	1.42 ± 6.62**	0.17 ± 9.60**
Bread	1.02 ± 3.71**	0.04 ± 5.98**
Fruit	0.82 ± 3.80**	0.27 ± 1.19**
Other	0.69 ± 16.69	0.12 ± 18.41

**P<0.01

group (P<0.01). Vegetables, fruit, and grains, which are important sources of these nutrients, increased as a result of EFNEP education. Mean vitamin A intake was significantly higher for the control group compared to the experimental groups. The difference between calcium intake from program entry to program exit was slightly greater for the combined experimental group compared to the control group, but not significantly so (P<0.05).

Food selection and preparation practices. Average scores on nine practices are shown in Table 12. At program exit, subjects in the combined experimental group had higher mean scores on most practices than did subjects in the control group. Improvements were reported in resource management practices and food selection and preparation practices. Subjects in the combined experimental group improved their resource management practices by planning meals ahead of time, comparing prices, and

Table 11. Comparison of the difference between average nutrient intakes at program entry and program exit for the combined experimental group and the control group.

Nutrient	Group A and Group B (n=248)	Group C (n=121)
Energy (kcal)	300.68 ± 1164.70	-25.71 ± 1287.25
Protein (g)	16.09 ± 56.72	1.39 ± 49.30
Fat (g)	7.85 ± 59.95	0.18 ± 57.62
Carbohydrate (g)	42.99 ± 145.58**	-7.92 ± 193.70**
Iron (mg)	3.00 ± 10.00**	0.06 ± 10.00**
Calcium (mg)	256.77 ± 1026.52*	55.76 ± 895.76*
Vitamin A (RE)	489.12 ± 2279.22**	701.60 ± 9375.66**
Vitamin C (mg)	37.30 ± 111.44**	4.38 ± 96.88**
Vitamin B ₆	0.39 ± 1.29	-0.02 ± 1.68
Fiber (g)	4.20 ± 18.98**	-2.05 ± 22.35**

*P<0.05, **P<0.01

shopping with a list (P<0.01). In addition, subjects in the combined experimental group reported running out of food before the end of the month less often than did subjects in the control group (P<0.01). There was no difference between groups in whether or not they reported cutting the size of their children's meals because they ran out of food.

Subjects in the experimental groups improved their food selection and preparation practices. Scores on behaviors for the combined experimental group were higher at program exit compared to scores for subjects in the control group. Subjects in the combined experimental group more often thought about healthy food choices, more often read food labels to select foods with less salt or sodium, more often prepared foods

Table 12. Average scores for food selection and preparation practices at program exit for the experimental groups and the control group.¹

Question	Group A and B (n=254)	Group C (n=125)
FOOD RESOURCE MANAGEMENT PRACTICES		
Planning meals	3.96 ± 0.93**	3.41 ± 1.11**
Comparing prices	4.41 ± 0.85**	3.86 ± 1.13**
Shop with a list	1.68 ± 1.05**	1.26 ± 1.28**
Run out of food	1.50 ± 0.82**	1.96 ± 1.24**
FOOD SELECTION AND PREPARATION PRACTICES		
Healthy food choices	4.25 ± 0.91**	3.75 ± 1.04**
Not adding salt	3.02 ± 1.19**	2.67 ± 1.29**
Labels with less salt	3.37 ± 1.15**	2.57 ± 1.30**
Labels with less fat	3.62 ± 1.13**	2.69 ± 1.34**
Food and nutrition needs	3.23 ± 0.55**	2.80 ± 0.63**

¹Scores on the EFNEP Survey included: 1=Do Not Do, 2=Seldom, 3=Sometimes, 4=Almost Always, 5=Always

**P<0.01

without added salt, and more often read food labels to select foods with less fat (P<0.01).

More subjects in the combined experimental group also reported the food and nutrition

needs of their families were being met compared to those in the control group (P<0.01),

which could be indicative of better food resource management practices and food selection

and preparation practices

Net Present Value and Array of Effectiveness Measures

The NPV of EFNEP related to savings in food expenditures was \$600.52 in this study. This value was based on the assumption that benefits were retained for at least 5 years as reported by Nierman (47) at a discount rate of 7% recommended by OMB (40). Participant recall was used to estimate food expenditures rather than register receipts for the following reasons: 1) there was no statistically significant difference between estimated expenditures collected by participant recall and expenditures collected from receipts and records and 2) all paraprofessionals reported difficulties collecting register receipts and/or records of food expenditures (i.e., subjects either forgot to keep receipts and records or provided receipts for purchases made before they were to collect receipts). Those who estimated food expenditures using receipts and records reported lower expenditures than those who estimated expenditures from recall. This information combined with observations reported by paraprofessionals suggested that individuals who estimated expenditures by keeping receipts and records may have underestimated actual expenditures. Sensitivity analyses were conducted on food expenditures to determine how changing the method of estimating expenditures, length of retention of benefits, and discount rate affected the NPV (Table 13). NPV was highest, \$699.10, when participant recall was used to estimate food expenditures at a 3% discount rate, and when food resource management practices were retained for 5 years. NPV was lowest, -\$36.60, when register receipts and records were used to estimate food expenditures at a 7% discount rate, and when food resource management practices were retained for 3 years. If

Table 13. Net Present Value (NPV) from savings in food expenditures as a result of participation in EFNEP.

	Retention of Benefits					
	3 Years			5 Years		
	Discount Rate			Discount Rate		
	3%	5%	7%	3%	5%	7%
Using Food Receipts Kept by Participants (Group A)	-25.29	-31.22	-36.60	192.41	168.47	146.88
Using Participant Recall (Group B)	287.66	270.09	253.75	699.10	647.49	600.52

the discount rate is 7% and practices are retained for 5 years, the NPV of EFNEP would be \$146.88, when food expenditures are estimated from receipts and records, and \$600.52 when food expenditures are estimated from recall. Both of the NPV calculations were positive. Therefore, the value of benefits exceeded the cost of implementing EFNEP using either method of collecting food expenditures. However, the magnitude of benefits was affected by whether participants kept receipts and records to estimate expenditures or used recall.

An array of effectiveness measures for food and nutrient intakes is presented in Table 14. These include improvements in food and nutrient intakes and behaviors that significantly improved for individuals receiving EFNEP education compared to those in the control group. As a result of participation in EFNEP, subjects increased their intake of vegetables, breads, fruit, carbohydrate, iron, vitamin A, vitamin C, and fiber.

Table 15 shows an array of effectiveness measures for food resource management and food selection and preparation practices. EFNEP participants improved resource

Table 14. An array of food and nutrient outcomes for the combined experimental group that improved as a result of participation in EFNEP.

Benefit	Average Change¹
Increased Servings from Food Groups	
Vegetables	1.42
Bread	1.02
Fruit	0.82
Increased Nutrient Intakes	
Carbohydrate(g)	42.99
Iron (mg)	3.00
Vitamin C (mg)	37.30
Fiber (g)	4.20

¹The difference between number of servings or nutrient intake at program entry and exit. choose foods with less salt and fat.

Table 15. An array of food resource management, food selection, and food preparation outcomes for the combined experimental group that improved as a result of participation in EFNEP.

Benefit	Average Score¹
Improvements in Food Resource Management Practices	
Planning meals ahead of time	3.96
Comparing prices before shopping	4.41
Shopping with a list	1.68
Running out of food before end of month less often	1.50
Improvements in Food Selection and Preparation Practices	
Making healthy food choices	4.25
Adding salt less often when cooking	3.02
Reading labels for less salt	3.37
Reading labels for less fat	3.62
Meeting food and nutrition needs	3.23

¹1=Do Not Do, 2=Seldom, 3=Sometimes, 4=Almost Always, 5=Always

management practices by improving meal planning, comparing prices before shopping, and shopping with lists. As a result families ran out of food less often compared to families in the control group. Because of participation in EFNEP, families learned to make healthy food choices, added salt less often when cooking, and read food labels to choose foods with less salt and fat. In general, subjects felt their food and nutrition needs were being met more often than they did before participating in EFNEP.

DISCUSSION

Does participation in EFNEP improve the ability of participants to manage resources wisely? Results from this study showed that participation in EFNEP did help households manage their food resources wisely. Participants who kept food receipts and/or a record of expenditures reported a savings of \$10.36 a month and participants who were asked to recall food expenditures saved \$19.53 a month. In comparison, families that did not receive EFNEP education and estimated food expenditures from recall, reported spending \$5.52 more a month. Individuals who kept a shopping list and estimated food expenditures from recall saved significantly more on their food expenditures ($P<0.05$) than did the individuals who estimated food expenditures from recall and did not receive nutrition education from EFNEP.

In addition, participants who received education from EFNEP improved their food resource management practices. Participants reported they more ($P<0.01$) often planned meals ahead of time, more ($P<0.01$) often compared prices when they shopped, more ($P<0.01$) often felt their food and nutrition needs were being met, and reported less ($P<0.01$) often running out of food than did participants who did not receive EFNEP education.

Does participation in EFNEP improve the nutritional status of families? Participation in EFNEP did improve the nutritional status of families despite spending less resources on food, as shown by improvements in food and nutrient intakes and nutrition behaviors. Families that received nutrition education consumed significantly ($P<0.01$) more servings of vegetables, bread, and fruit than did families in the control group.

Therefore, EFNEP participants consumed greater ($P < 0.01$) amounts of carbohydrate, iron, vitamin A, vitamin C, and fiber and possibly more ($P < 0.05$) calcium than individuals who did not receive nutrition education. In addition to improved food and nutrient intakes, those who received EFNEP education significantly ($P < 0.01$) improved their food selection and preparation practices compared to those who did not receive education. EFNEP participants reported making healthy food choices more often, adding salt to foods less often, and more often reading food labels to choose foods with less salt and fat than individuals who did not receive EFNEP education. In general, they felt their food and nutrition needs were being met more often than did individuals who did not receive education.

How much did it cost to improve food resource management practices? The NPV of EFNEP related to savings in food expenditures by participants was \$600.52. Once future benefits were discounted and costs were subtracted, EFNEP families and society realized a savings of \$600.52 because money saved could be used to buy other goods and services. This was determined based on following assumptions: 1) behaviors practiced as a result of participation in EFNEP would be maintained for at least five years, 2) future benefits would be discounted at a 7% rate, and 3) food expenditures were estimated by participant recall.

One criticism of CBA is that because of the uncertainties involved in identifying and valuing costs and benefits, the same intervention can produce very different results. Therefore, potential users become confused or suspicious that the analyses can be manipulated to support any conclusion (49). Due to the uncertainties, assumptions must

be stated explicitly and sensitivity analyses must be conducted using different data or methods to test the robustness of the results. For this study, three sensitivity analyses were conducted. One analysis was conducted using different methods of estimating food expenditures, a second analysis used three different discount rates, and a third analysis used two periods for retention of benefits.

A very critical assumption made in this study was that the amount participants reported for food expenditures was accurate. Any uncertainty in food expenditures could change the NPV calculation. The two methods used to collect food expenditure data revealed that participants who reported expenditures from recall reported greater savings than did participants who kept food receipts and/or a record of expenses (\$19.52 and \$10.36, respectively). Despite what would appear to be a noticeable difference, the difference was not statistically significant. Average food expenditures for both groups had large standard deviations, which made it difficult to detect a significant difference. However, although the difference was not significant, it did affect the NPV calculation.

In this study, sensitivity analysis showed the NPV ranged from -\$36.60 to \$699.10 depending on the values used in the calculation. When participants estimated food expenditures using recall, the NPV calculation was positive at all three discount rates and when benefits were retained for 3 or 5 years. When participants used register receipts and records to estimate food expenditures, NPV calculations were positive at all three discount rates, if benefits were retained for 5 years. However, when benefits were retained for only 3 years, the NPV calculation was negative at all three discount rates. Therefore, both the

method used to collect food expenditure data and the length of time participants retained behaviors learned as a result of EFNEP education had an important effect on the NPV.

Another criticism of CBA is that often it does not include a control group and, therefore, assumes benefits can be attributed to the intervention. In this research, food expenditure data, food and nutrient intakes, and behavior data were collected for individuals receiving education from EFNEP and for a control group similar in socioeconomic status and other demographic factors. There was a significant ($P < 0.05$) difference in food expenditures between the group reporting from recall only and the control group. Food and nutrient intakes and behaviors significantly ($P < 0.01$) improved for those receiving nutrition education compared to the group that did not receive nutrition education. Therefore, it can be inferred that changes occurred due to EFNEP education.

A third criticism of CBA is that often it fails to account for all the benefits of an intervention and, therefore, may underestimate the value of a program. This cost-benefit analysis used a single effectiveness measure. Ideally, cost-benefit analysis should include the value of all outcomes. However, using a single effectiveness measure is a common approach to cost-benefit analysis in health literature. Cost-benefit analyses of WIC used the savings in Medicaid benefits for infants during the first six months of life as a single measure of effectiveness (7-9). The researchers did not include other measures of effectiveness, such as improvements in iron intake (50) or savings due to increased incidence of breastfeeding (51) that have been documented in WIC evaluations. The practice of using the single measure effectiveness often is used because it is difficult to value all outcomes of an intervention in monetary terms. In a nutrition education program

such as EFNEP, it is more difficult to value the ultimate outcomes (e.g., improved access to nutritious food and improved health) compared to the intermediate outcomes, such as improved food resource management behaviors. The problem is that there are no established methodologies for estimating ultimate benefits in dollars, particularly the intangible benefits, such as reduction in pain and suffering.

In recent years, estimation techniques have been explored that address the problems of valuing outcomes for which market prices do not exist. According to the Centers for Disease Control and Prevention (39), these techniques include the use of expert opinion, past legislative policy decisions, the use of court awards to estimate intangibles such as pain and suffering, the cost-of-illness approach, and the willingness-to-pay approach. Of these five approaches, the cost-of-illness and the willingness-to-pay approaches can be validated more easily than the other techniques. The cost-of-illness approach attempts to determine the economic cost of disease by adding medical and nonmedical costs of disease and productivity losses because of morbidity or premature mortality. The willingness-to-pay approach attempts to measure the value individuals place on reducing the risk of death or illness. The most frequent way this is accomplished is through contingent-valuation studies using surveys of individuals. However, adequate survey instruments, which are required for this approach, are difficult to find in the literature. Methods that have appeared in health care literature have been characterized as poor, which makes it difficult to distinguish between good and bad CBA studies (49).

The problem with using a single measure of effectiveness is the importance placed on one benefit, in this case, the savings in food expenditures. A major limitation of this

study was reliability of the food expenditure data. Despite a carefully explained protocol and periodically checking with paraprofessionals on collecting food expenditures, 15% of the group estimating food expenditures using receipts and records failed to keep receipts and records as instructed. Keeping some expenditures on a record did help participants remember what they spent because they often did not have a receipt.

The process of collecting and summarizing expenditures also was arduous for EFNEP paraprofessionals and the supervising agent. Participants were told what two weeks of the month to collect receipts and records, which could vary by participant. Paraprofessionals had to remember to prompt participants to keep receipts at the designated time. The supervising agent had to determine which items on receipts were food purchases and sales tax had to be determined for food items only. The finding that there was no significant difference between estimates of food expenditures from receipts and records and from participant recall suggested that using participant recall would be as accurate as keeping receipts and records and less burdensome for participants and staff.

The purpose of conducting a cost-benefit analysis is to provide decision makers with information needed to make choices among alternative interventions. Alternative interventions need not have common objectives, as in cost-effectiveness analysis. How does EFNEP compare to other interventions using cost-benefit analysis? The NPV determined for EFNEP in this study, \$600.52 per participant, compared favorably with a cost-benefit analysis of diet counseling for individuals with Crohn's disease (13). Brauer et al. reported a net benefit to society of \$163.90 per patient who received diet counseling.

Despite the growing number of cost-benefit analyses in health care literature, few have used net present value to present findings. If results from this study were expressed as a benefit-cost ratio, the ratio would be 3.03:1. A savings of \$3.03 was realized on food expenditures for every dollar spent to implement EFNEP. Benefit-cost ratios reported for WIC (7-9), which varied from 1.77:1 to 3.13:1, were comparable to the benefit-cost ratio for this study of EFNEP. Benefit-cost ratios for the use of folic acid fortification of grain in preventing neural tube defects were slightly greater. Romano et al. reported a 4.3:1 ratio for low level fortification and a 6.1:1 ratio for high level fortification (53).

APPLICATIONS

This study and numerous others (54-56) provide evidence that EFNEP does accomplish the objectives for which it is intended, i.e., to help low-income families acquire the knowledge, skills, attitudes, and behaviors needed to consume nutritionally sound diets. From the cost-benefit analysis conducted for this research, there also is evidence that the value of the benefits exceed implementation costs. A one time cost per participant could result in hundreds of dollars in savings for society provided that behaviors that improve as a result of EFNEP are sustained. An important assumption made in this study was that the behaviors needed to reduce food expenditures practiced at the time of graduation from EFNEP would be maintained for at least five years.

What this economic analysis of EFNEP means to individuals making policy decisions regarding the benefits of allocating funds to EFNEP is that even with the current state of knowledge about valuing benefits, the monetary value of EFNEP in terms of savings in food expenditures exceed the monetary costs provided the participant retains behaviors learned for five years. As reliable methods of estimating other benefits evolve, this should further increase the monetary value of EFNEP.

Additional cost-benefit analyses of EFNEP and other nutrition education interventions are needed to establish the monetary value of other benefits, such as prevention of chronic disease. To prevent or delay the onset of chronic diseases, recommended food selection and preparation practices must be maintained much longer than five years. To show that EFNEP can save society money by preventing chronic disease, changes in food and nutrition behaviors need to be measured over several years.

To this date, no studies have been published that examine the retention of EFNEP benefits for more than five years. With reliable methods of valuing benefits and documentation of the effectiveness of nutrition education, including both intermediate and long term outcomes, nutrition educators will have the tools necessary to apply economic analyses in a variety of settings.

REFERENCES

1. Oliveira V. Cost of food-assistance programs declined slightly in first half of 1996. *Food Review*. 1996;September-December:26-33.
2. Splett PL. *The Nutrition Practitioner's Guide to Cost Effectiveness Analysis of Nutrition Interventions*. Arlington, VA: National Center for Education in Maternal and Child Health; 1996.
3. Nas T. *Cost-Benefit Analysis: Theory and Application*. Sage Publications, Inc. Thousand Oaks, CA; 1996.
4. Levin HM. *Cost-Effectiveness: A Primer*. Newbury Park, CA: Sage Publications, Inc.; 1983.
5. Warner KE, Luce BR. *Cost-Benefit and Cost-Effectiveness Analysis in Health Care*. Health Administration Press. Ann Arbor, MI; 1982.
6. Splett PL. Phase I: Status report of existing data on the effectiveness, cost, and cost effectiveness of nutrition care services. *J Am Diet Assoc*. 1991;91(suppl):S9-S14.
7. Buescher PA, Larson LC, Nelson MD, Lenithan, AJ. Prenatal WIC participation can reduce low birth weight and newborn medical costs: a cost-benefit analysis of WIC participation in North Carolina. *J Am Diet Assoc*. 1993;93:163-166.
8. *The Savings in Medicaid Costs for Newborns and Their Mothers from Prenatal Participation in the WIC Program*. Washington, DC: Prepared by Mathematica Policy Research Inc for Food and Nutrition Service, Office of Analysis and Evaluation, US Dept of Agriculture; 1991.
9. Schramm WF. WIC prenatal participation and its relationship to newborn Medicaid costs in Missouri: a cost/benefit analysis. *Am J Public Health*. 1985;75:851-857.
10. Montgomery DL, Splett PL. Economic benefit of breast-feeding infants enrolled in WIC. *J Am Diet Assoc*. 1997;97:379-385.
11. Splett PL, Caldwell HM, Holey ES, Alton IR. Prenatal nutrition services: A cost analysis. *J Am Diet Assoc*. 1987;87:204-208.

12. Splett PL. *The Cost-effectiveness of Education for Cholesterol Reduction: A Three State Investigation*. Minneapolis, MN: The University of Minnesota; 1990. Dissertation.
13. Brauer PM, Imes S, Thomson ABR. Economic impact of nutrition counseling in patients with Chrohn's disease in Canada. *J Can Diet Assoc*. 1988;49:236-240.
14. Enyart Y. *Evaluation of Limited One-to-One Nutrition Lessons Plus Mailed Lessons and Follow-up Telephone Contacts*. Columbia, MO: Prepared by The University of Missouri for the Cooperative Extension Service, US Dept of Agriculture; 1984. Cooperative Agreement Number: 12-05-300-550.
15. Jackson RW. *Cost Efficiency and Effectiveness of Two Nutrition Education Methods for Food Stamp Recipients*. Burlington, VT: Prepared by The University of Vermont for the Cooperative Extension Service, US Dept of Agriculture; 1986. Cooperative Agreement Number: 12-05-300-550.
16. Neilan AM. *Evaluating the Effectiveness of Small Group Methods in Nutrition Education for Young Mothers Receiving Public Food Assistance*. Blacksburg, VA: Virginia Polytechnic Institute and State University; 1985.
17. *The Food Guide Pyramid*. Washington, DC: Human Nutrition Information Service, US Dept of Agriculture, 1992. Home and Garden Bulletin. 252.
18. Summary of Adult Participant Profiles. EFNEP Reporting System. Knoxville, TN: The University of Tennessee Agricultural Extension Service; 1998.
19. Cook JT, Martin KS. *Differences in nutrient adequacy among poor and non-poor children*. Medford, MA: Center on Hunger, Poverty and Nutrition Policy, Tufts University; 1995.
20. Food Research and Action Center, Community Childhood Hunger Identification Project. *A Survey of Childhood Hunger in the United States*. Washington, DC: Food Research and Action Center; 1991.
21. Tippet KS, Mickle SJ, Roidt L. Food and nutrient intakes of low-income women and children in metro/nonmetro areas, 1985/86. *Family Econ Rev*. 1990;3:12-15.
22. Kennedy E, Goldberg J. *Review of What American Children Are Eating*. Washington, DC: Center for Nutrition Policy and Promotion, US Dept of Agriculture; 1995.

23. Life Sciences Research Office. *Third Report on Nutrition Monitoring in the United States*. Vol 1. Washington, DC: Life Sciences Research Office, Federation of American Societies for Experimental Biology; 1995.
24. Allen LH. Functional indicators and outcomes of undernutrition. *J Nutr*. 1990;120:924-932.
25. Food and Nutrition Board, Institute of Medicine. *Nutrition During Pregnancy*. Washington, DC: National Academy Press; 1991.
26. Peterson KE, Chen LC. Defining undernutrition for public health purposes in the United States. *J Nutr*. 1990;120:933-942.
27. *The Surgeon General's Report on Nutrition and Health*. Washington, DC: US Dept of Health and Human Services; 1988. DHHS (PHS) publication 88-50210.
28. Department of Health and Human Services. *Poverty Guidelines*. Washington, DC: US Dept of Health and Human Services; 1998.
29. Campbell DT, Stanley JC. *Experimental and Quasi-Experimental Designs for Research*. Chicago, IL: Rand McNally; 1963.
30. Wang, MQ, Fitzhugh E, Westerfield RC. Determining sample size for simple-random surveys. *Health Values*. 1995;19:53-56.
31. Wunsch DR. Survey research: Determining sample size and representative response. *Business Education Forum*. 1986:February:31-34.
32. *Diet Recall Summary Report*. EFNEP Reporting System. Knoxville, TN: The University of Tennessee Agricultural Extension Service; 1997.
33. *Behavior Checklist Summary Report*. EFNEP Reporting System. Knoxville, TN: The University of Tennessee Agricultural Extension Service; 1997.
34. Bell BP, Goldoft M, Griffin PM, Davis MA, Gordon DC, Tarr PI, Bartleson CA, Lewis JH, Barrett TJ, Wells JG, Baron R, Kobayashi J. A multistate outbreak of *Escherichia coli* 0157:H7—associated bloody diarrhea and hemolytic uremic syndrome from hamburgers. *J Am Med Assoc*. 1994;272:1349-1353.
35. Wacholder S, McLaughlin JK, Silverman DT, Mandel JS. Selection of controls in case-control studies. *Am J Epidemiol*. 1992;135:1019-1028.

36. The University of Tennessee. *Cost Accounting Standards Board of Disclosure Statement*. Knoxville, TN: The University of Tennessee; 1997.
37. *EFNEP Evaluation/Reporting System User's Guide, Version 3.0*. Laurel, MD: Cooperative Extension System, US Dept of Agriculture; 1993.
38. Joy AB. Development of a simplified methodology to measure the effect of food purchasing practices on nutrient costs. Presented at: Cooperative State Research, Education and Extension Service Meeting, Nutrition Education for Diverse Audiences. February 10-14, 1997; Houston, TX.
39. Clemmer B, Haddix AC. Cost-benefit analysis. In: Haddix AC, Teutsch SM, Shaffer PA, Duñet D, ed. *Prevention Effectiveness: A Guide to Decision Analysis and Economic Evaluation*. New York: Oxford University Press; 1996:85-102.
40. *Statistical Analysis System*. Release 6.12. Cary, NC: SAS® Institute, Inc; 1996.
41. Schlotzhauer SD, Littell RC. *SAS® System for Elementary Statistical Analysis*. Cary, NC: SAS® Institute, Inc.;1987.
42. Government Accounting Office. *Circular No. A-94*. Washington DC: US Office of Management and Budget; 1992.
43. Shaffer PA, Haddix AC. Time preference. In: Haddix AC, Teutsch SM, Shaffer PA, Duñet D, ed. *Prevention Effectiveness: A Guide to Decision Analysis and Economic Evaluation*. New York: Oxford University Press; 1996;76-84.
44. Krahn M, Gafni A. Discounting in the economic evaluation of health care interventions. *Med Care*. 1993;5:403-418.
45. Green LW, Wang VL, Ephross PH. A 3-year longitudinal study of the impact of nutrition aides on the knowledge, attitudes, and practices of rural poor homemakers. *Am J Public Health*. 1974;64:722-724.
46. Torisky D, Hertzler A, Mifflin B. *Evaluation of the Expanded Food and Nutrition Education Program (EFNEP) in Selected Areas of Virginia: Extent and Retention of Dietary Improvement and Related Family Factors*. Blacksburg VA: Virginia Polytechnic Institute and State University; 1987.
47. Nierman LG. *A Longitudinal Study of the Retention of Foods and Nutrition Knowledge and Practices of Participants from Michigan Expanded Food and Nutrition Education Program*. East Lansing, MI: Michigan State University; 1986.

48. *Eating Right is Basic*. Third Version. Lansing, MI: Michigan Cooperative Extension Service, Michigan State University; 1995.
49. Russell LB, Gold MR, Siegel JE, Daniels N, Weinstein MC. The role of cost-effectiveness analysis in health and medicine. *JAMA*. 1996;276:1171-1177.
50. Rush D, Sloan NL, Leighton J, Alvir JM, Horvitz DG, Seaver WB, Garbowski GC, Johnson SS, Kulka RA, Holt M, Devore JM, Lynch JT, Woodside MB, Shanklin DS. Longitudinal study of pregnant women. *Am J Clin Nutr*. 1988;48:439-483.
51. Bayder N, McCann M, Williams R, Vesper E. *Final Report: WIC Infant Feeding Practices Study*. Alexandria, VA: Prepared by Battelle Centers for Public Health for the US Dept of Agriculture, Office of Analysis and Evaluation, Food and Consumer Service; 1997.
52. O'Brien B, Gafni A. When do the "dollars" make sense? Toward a conceptual framework for contingent valuation studies in health care. *Med Decision Making*. 1996;16: 288-299.
53. Romano PS, Waitzman NJ, Scheffler RM, Randy DP. Folic acid fortification of grain: an economic analysis. *Am J Public Health*. 1995;85:667-676.
54. Del Tredici AM, Omelich CL, Laughlin SG. Evaluation study of the California Expanded Food and Nutrition Education Program: 24-hour food recall data. *J Am Diet Assoc*. 1988;88:185-190.
55. Amstutz MK, Dixon DL. Dietary changes resulting from the Expanded Food and Nutrition Education Program. *J Nutr Educ*. 1986;18:55-60.
56. Cox RH, Gonzales-Viligar MCRV, Novascone MA, Silva-Barbeau I. Impact of a cancer intervention on diet-related cardiovascular disease risks of white and African-American EFNEP clients. *J Nutr Educ*. 1997;28:209-218.

APPENDICES

Appendix A

Extensive Methodology

METHODS

This appendix describes detailed methods used in this study. This research was a cost-benefit analysis of EFNEP, an evaluation of the effectiveness of EFNEP combined with an analysis of costs in a prospective study. The methods used to determine costs, benefits, and calculating the net present value (NPV) are described in this appendix.

The Expanded Food and Nutrition Education Program

Participants in this study were either enrolled in the Expanded Food and Nutrition Education (EFNEP) or would qualify as participants in EFNEP. EFNEP is a nutrition education program for low-income families and youth implemented by the United States Department of Agriculture's Cooperative State Education, Research, Education, and Extension Service (CSREES) with state land-grant universities and county governments. Each of the 50 states and territories receive federal formula funding to implement EFNEP based on the number of low-income residents. Funding began in 1969 and is appropriated by Congress on an annual basis. In 1998, there were 26 counties in Tennessee that provide EFNEP.

Nutrition education is delivered to participants by paraprofessionals supervised and trained by Extension Family and Consumer Science agents. Each participant receives a series of lessons from the curriculum, "Eating Right is Basic" (1). These lessons consist of six basic units in foods and nutrition that include information on meal planning, shopping for food, the Food Guide Pyramid (2), reading food labels, and food safety. In addition to these units, additional lessons are available on each of the food

groups in the Food Guide Pyramid, nutrition during pregnancy, breastfeeding, feeding children, and reducing dietary fat and sodium. Participants receive instruction individually, in groups, or a combination of both.

Type of Research Design

The design used in this research was quasi-experimental, described by Campbell and Stanley (3) as the Nonequivalent Control Group Design (Table 16). This design included three groups: the experimental group A (the group receiving nutrition education from EFNEP who collected register receipts and/or records of food purchases), the experimental group B (the group receiving nutrition education from EFNEP who estimated food expenditures from recall), and the control group C (a group who delayed their participation for 3 to 6 months and estimated food expenditures from recall).

Table 16. The nonequivalent control group design.

Group	Time	
	1 (pretest)	2 (posttest)
Experimental Group A (EFNEP participants with register receipts)	0	x 0
Experimental Group B (EFNEP participants estimating expenditures by recall)	0	x 0
Control Group (Individuals not receiving EFNEP education).	0	0

A pretest consisting of three records, the Family Record (Appendix B1), Dietary Recall Form (Appendix B2), and EFNEP Survey (Appendix B3), administered to all three groups was used to establish the comparability of the experimental groups and control group and to provide baseline data. A posttest, using the same records, was administered to groups A and B at the time the participant graduated. The same posttest was given to group C at about the same time groups A and B graduated so that a similar length of time passed between the pre- and posttests for all three groups.

Participant Selection

Recruitment

Paraprofessionals recruited study participants as they typically would in EFNEP. Participants were recruited in a variety of ways including solicitation at sites where low-income families frequent (e.g., WIC clinics) and referrals from agencies that work with low-income individuals and families. Occasionally, participants were recruited door to door using referrals from other EFNEP participants.

There are two audiences in EFNEP, adult and youth. Only participants who qualify for the adult portion of EFNEP were recruited for this study. According to USDA, adult participants are defined as, “low-income homemakers/individuals living in either rural or urban areas, who are responsible for planning and preparing the family’s food” (4, p. 7). The Federal Poverty Income Guidelines published annually (5) or participation in any public assistance program for low-income individuals are used to determine who is low-income.

Paraprofessionals were instructed to recruit women over 18 years old. Although males do participate in EFNEP, women represent the majority of adult participants. In addition, paraprofessionals were instructed to exclude individuals under 18 years old because of difficulties associated with obtaining parental consent. Participants who were enrolled for less than two months also were excluded so that there was adequate time to collect food expenditure data for one month at entry and one month at exit.

The original proposal for the study described using a neighbor/friend recruiting approach (6-7). Each time a person was enrolled in EFNEP they were asked to identify a neighbor or friend who was similar to them in race/ethnicity, age, income, and family characteristics. None of the paraprofessionals in the pilot study were able to recruit the comparison group using neighbor/friend referrals. Participants they enrolled were not able to provide the names of neighbors and friends who were similar to them who might qualify for EFNEP. Paraprofessionals described the process of matching the control group to the experimental groups as so difficult that they could not concentrate on providing education to their EFNEP participants. Because of the difficulty using the neighbor/friend recruiting approach, the comparison group was obtained by asking individuals who were willing to enroll in EFNEP to delay the start of their lessons. Or, individuals agreed to complete the pre- and posttests but did not choose to participate in EFNEP.

Enrollment

When participants were enrolled in EFNEP, they were randomly assigned to one of the three groups. Each paraprofessional was instructed to recruit 18 participants. Six of the participants were enrolled in group A, six in group B, and six in group C. The first person recruited was assigned to group A, the second to group B, and the third to group C. If subjects refused to participate in the group assigned, they were given the opportunity to participate in EFNEP, but not in the study.

As a token of appreciation for keeping food receipts and/or a record of expenditures, individuals in group A were given a three-ring binder for EFNEP handouts they received from the paraprofessionals. Because they agreed to delay their participation, individuals in group C were given a token of appreciation that included one of the following items: a measuring cup for liquid ingredients, a set of measuring cups for dry ingredients, a vegetable brush and peeler, a set of three spatulas, a meat thermometer, and a plastic cutting board. These individuals were asked to choose one of the items during their first contact with the paraprofessional and were given the item they selected during the second contact when they completed the posttest.

Sample Size

The desired sample size of 341 estimated from guidelines for simple-random surveys (8-9). The sample size was based on population size, the permissible error and associated confidence level, and the population proportion to be estimated. In 1996-97, the number of females over 18 years of age who graduated from EFNEP within six

months was 3,276 (9). A 0.05 confidence level was selected because the research was considered exploratory and a 0.01 level was considered too stringent. Based on percentages of participants who reported improvements in food and nutrition behaviors from data in the 1996-97 EFNEP (9), the researcher was interested in determining if at least 70% of participants in the study improved nutrition and food-related practices.

Using these factors, it was determined that a sample size of 341 would be representative of the population within an acceptable error limit and take attrition into account. Each paraprofessional was assigned the same number of participants to ensure that the sample represented the population of EFNEP participants in Tennessee. Eighteen participants per paraprofessional also was considered a manageable number within the time frame of the study.

At the conclusion of the study, only 470 participants had been recruited and 371 completed the required records. Only 16 of the 21 counties participating in the study recruited participants. The five counties that did not recruit participants stated they could not find individuals willing to participate.

Time Horizon

The time horizon for this investigation was six months based on how much time it takes for most EFNEP participants to complete the program. According to the 1996-97 Summary of Adult Participation Profiles for Tennessee (9), 80% of homemakers who graduated from EFNEP did so in six months or less. Six months allowed adequate time for multiple contacts. The average number of lessons in the 1996-97 Summary of Adult

Participation Profiles was 12. Almost half (49%) of those who completed the program had 14 to 20 educational contacts and 40% had 7 to 13 contacts. Cost data also were collected over the same period as benefits as recommended by Splett (11).

Data Collection

Data for this research were collected for costs and benefits.

Data Collection for Costs

Cost determination was completed in a series of steps that included: defining the service to be costed, defining activities related to implementing the program, specifying how the costs will be measured, gathering the cost data, and quantifying the costs.

Before costs can be determined for any program, it is necessary to define the services. The services costed in this investigation included all nutrition education services provided to participants enrolled in the adult EFNEP program. These services included the lessons provided by paraprofessionals, foods and equipment needed for food demonstrations, publications and printed materials given to participants, audiovisuals used for education, computer dietary analyses and summaries of the EFNEP surveys, and any other materials needed for providing nutrition education.

After defining the services to be costed, the next step was to define all of the ingredients or activities necessary to implement the service so they can be valued in monetary terms. Each activity was listed with personnel and materials needed as shown

in Table 17. Listing all required personnel and materials helped to identify the resources that were to be quantified.

After all costs were identified, they were measured. For this investigation, direct costs were measured in several ways depending on the kind of expense. First, as many direct costs as possible were obtained from a Grant and Contract Budget and Expenditure Report (Appendix E). These included all personnel costs, such as professional and paraprofessional salaries, salaries for support personnel (i.e., secretaries), staff benefits, and travel. The number of volunteer hours were estimated by the agent and paraprofessionals and entered into the EFNEP Reporting System. The market value of volunteers was calculated at the same rate per hour as the salaries of paraprofessionals, \$5.66 per hour.

In addition to personnel costs, equipment, food supplies for demonstrations, office supplies, communication costs (i.e., long distance credit card calls, postage, telecommunications), maintenance and repairs, computer software, and other operating supplies were obtained from the monthly ledger sheets. Monthly printing costs charged to the adult EFNEP program also were listed on the report. However, not all the materials printed were used during the six-month period of investigation. Actual printing costs were estimated from a record of publications and handouts paraprofessionals and supervising Family and Consumer Science agents kept for six months. Cost of equipment used exclusively by EFNEP, such as computers and printers, was recorded from the Grant and Contract Budget and Expenditure Report. The annual cost of computers and printers was determined by dividing actual costs by five, the average number of years computers

Table 17. Activities related to implementation of EFNEP.

Activity	Responsible Person	Material Resources and Equipment Required
Hiring professionals Posting job announcement Interviewing applicants Completing personnel records	Administration (Personnel Assistant, Assist./Assoc. Deans, Section Leader, District Supervisor, county Extension Leader, secretaries, personnel, business office)	Telephone (including e-mail) Office supplies Travel Postage Office equipment (computer, printer, copy machine)
Hiring paraprofessionals Posting job announcement Interviewing applicants Completing personnel records	Extension Home Economist, county Extension Leader, secretaries, Administration (personnel, business office)	Telephone (including e-mail) Office supplies Postage Office equipment (computer, printer, copy machine)
Staff Development for professionals New Worker Orientation Inservice training Professional meetings and training	Extension Specialists, speakers at professional meetings and training, secretaries	Telephone (including e-mail) Office supplies Travel Office equipment (computer, printer, copy machine) Postage Registration fees Educational materials (books, etc.)
Staff Development for paraprofessionals New Worker Orientation Inservice training	Extension Home Economists, Extension Specialists, speakers from other agencies, secretaries	Office supplies Travel Office equipment (computer, printer, copy machine) Postage Educational materials (publications, books, etc.) Food supplies

Table 17. (continued)

Activity	Responsible Person	Material Resources and Equipment Required
Recruiting Families Collaboration with state agencies Collaboration with community agencies Door-to-door solicitation	Extension Specialists (EFNEP Coordinator, EFNEP Nutritionist, Section Leader), county Home Economists, paraprofessionals, administration	Telephone (including e-mail) Office supplies Travel Postage Office equipment (computer, printer, copy machine) Printed materials (pamphlets, etc.)
Dietary Assessments Family Record Food Recall EFNEP Survey	paraprofessionals	Office supplies Printed materials (records, etc.)
Teaching Families	paraprofessionals	Telephone Office supplies Travel Postage Office equipment (computer, printer, copy machine) Food supplies Educational materials (curriculum, handouts, publications, etc.)
Data Entry	secretaries	Office supplies Computer
Interpreting and Summarizing Reports	Extension Specialists (EFNEP Coordinator, EFNEP Nutritionist), Extension Home Economists, paraprofessionals	Office supplies Office equipment (computer and printer) Telephone Postage

are used before they are replaced (12). Annual maintenance costs were added to the cost of computers.

Monthly indirect costs for items, such as office space and utilities, were calculated from a rate determined by the accountant of the Institute of Agriculture and The University of Tennessee's controller's office using cost data collected during 1997. According to Splett and Caldwell (13), indirect expenses can be determined from a standard rate established by the agency. The University of Tennessee Institute of Agriculture proposed a standard rate that was used in this investigation to estimate the cost of buildings and office space, maintenance, heat and lights, administration, accounting, and personnel services. The total direct costs were multiplied by the standard rate for indirect services to determine the total indirect costs. A rate of 21.79% for expenses on campus and a rate of 10.79% for expenses off campus were multiplied by the monthly costs of implementing EFNEP to estimate indirect expenditures. Indirect costs were not calculated for equipment because depreciation was part of the indirect cost. These rates were proposed and submitted to the Department of Health and Human Services (DHHS) for approval during the time of this research.

After monthly costs were measured for the time horizon of six months, they were multiplied by two to represent 12 months. One exception was the annualization of computers and printers. Another exception was the cost of a biennial conference, which was divided by two, the cost of the conference for one year.

Data Collection for Benefits

Prior to actual data collection, a pilot test was conducted to determine if any procedures needed modification. Two counties that did not participate in the study served as pilot counties. Procedures were explained to 4 paraprofessionals who were asked to recruit 20 subjects, 5 subjects per paraprofessional. As a result of the pilot test, the procedure for recruiting the control group was modified as described earlier. Participants in the pilot study did not provide names of friends or neighbors. Because of these difficulties, paraprofessionals were instructed to employ the usual strategies to recruit subjects who would agree to delay their lessons until those in groups A and B completed their instruction. As a result of the pilot test, oral instructions were written as a protocol that EFNEP staff could refer to if they had questions (Appendix C). As part of the protocol, agents were instructed to add the value of foods on WIC vouchers. These values were included in the protocol.

Following the pilot test, all supervising agents and paraprofessionals received training by the researcher to make sure protocol was followed and recalls and other records were as accurate as possible. This training was more in-depth compared to the usual training for paraprofessionals provided by agents. Training consisted of the detailed protocol for administering the records and submitting the required data in Appendix C. In addition, the researcher visited all counties participating in the study during the data collection period to monitor procedures.

Data collection began in March 1997 and continued until January 1998. At the end of the data collection period, all data from outcome measures in the county database

files adult.dbf, cklist.dbf, and recall.dbf. were copied to a diskette. The database structures for these files are described in the manual, *EFNEP Evaluation/Reporting System User's Guide* (14). Each of the database files were imported into the Statistical Analysis System (SAS) (15) for analysis.

Records

All measures of effectiveness came from data collected with three records: the Family Record (Appendix B1), Dietary Recall Form (Appendix B2), and EFNEP Survey (Appendix B3). These records are part of the national EFNEP Reporting System and were developed by a committee of nutritionists and state EFNEP leaders appointed by program leaders at CSREES of USDA. All records were pilot tested before their release in 1993 and 1994. Instructions for completing these records are in the *EFNEP Evaluation/Reporting System User's Guide* (14).

Records were completed by the paraprofessional and/or the participant. For individual instruction, paraprofessionals completed records in a personal interview. When participants were taught in groups, participants completed records with instruction from the paraprofessional. After the record was completed, the paraprofessional checked the record for accuracy and missing information for submission to the supervising agent for entry into a computer in the county Extension office. All computer entry was completed by a secretary trained by the researcher and/or supervising home economist. Instructions for computer data entry are in the *EFNEP Evaluation/Reporting System User's Guide* (14).

The Family Record The purpose of the Family Record was to collect demographic information about the participant, such as age, gender, race and ethnicity, residence, household size, household composition, age of children, type of instruction (individual versus group), and participation in other federal assistance programs. The Family Record was completed on the first visit with the participant and updated as needed when the participant graduated or terminated from EFNEP. At that time, the number of lessons taught was added to the record with an exit date.

The Dietary Recall Dietary Recall Form was used to calculate nutrient intakes in a 24-hour period and the amount of money or other resources spent on food for the past month. Each paraprofessional was instructed to take a detailed 24-hour dietary recall consisting of foods and beverages eaten, amount eaten, and the meal type (i.e., morning, midmorning, afternoon, evening, late evening). After the recall was taken, the paraprofessional coded the foods for computer entry.

Foods and amounts were coded by the paraprofessional using a food dictionary that corresponds with the national EFNEP food database. Foods, serving sizes and identification numbers are listed in the *EFNEP Evaluation/Reporting System User's Guide* (14). Duplicate coding of a random sample of recalls by the researcher was used to determine reliability. In a sample of 64 records, approximately 18% had errors in coding.

Secretaries in EFNEP counties entered the codes into the computer system. Double entry was conducted on a random sample of 64 recalls by the researcher to determine reliability. Approximately 9% of records had errors in data entry.

Foods obtained from the 24-hour recall are analyzed for the six nutrients (protein, fat, vitamin A, vitamin C, iron, and calcium) using a computerized dietary analysis program included in the national reporting system. Specific nutrients to be analyzed in the national EFNEP Reporting System were selected by state EFNEP Coordinators and Extension nutritionists during the development of the reporting system. The reporting system has a food database that consists of nutrient values and servings of food groups for 1373 foods. Nutrient values for most foods were taken from USDA food data banks. Pennington's *Food Values of Portions Commonly Used* (16) and manufacturers were used for foods not listed in the national data banks. Each state also has the ability to add foods commonly eaten in the area.

The amount of money spent on food per month was taken from question eight on the 24-Hour Recall. For group A, paraprofessionals asked each participant to keep register receipts for food expenditures for two weeks out of each month. Collection of register receipts began one week after the family received their food stamps or other income and continued for 14 days. Participants who did not keep receipts or who did not have receipts for places such as fast food restaurants and vending machines were asked to fill in the amount on a record form (Appendix B4). All receipts were given to the supervising agent who added the receipts and the amounts written on the record and multiplied the total by two, the amount estimated spent on food for one month. This method is recommended by Joy (17) who determined that low-income families spend the largest portion of their food dollars during the week immediately following receipt of food stamps or other income and the smallest portion during the week just before

receiving their food stamps or other income. Therefore, the remaining two weeks represent an average weekly amount that can be multiplied by two to estimate total monthly expenditures. The reason this method was used was to reduce the burden of collecting register receipts. According to Joy, this reduces the burden of keeping receipts and increases the reliability of data.

Once the receipts and other food expenditures were totaled and multiplied by two, the dollar value of WIC vouchers received were added to the total. The total amount was added to the 24-Hour Recall Form and entered into the computer by the EFNEP secretary.

For groups B and C, paraprofessionals were instructed to ask the participant to recall what they spent on food in the past month. This amount included food stamps, money, and WIC vouchers. This was reported on the 24-Hour Recall Form and entered into the computer by the EFNEP secretary.

EFNEP Survey. The EFNEP Survey was used to collect data on food resource management practices and food selection and preparation practices. In the EFNEP National Reporting System, questions on the EFNEP Survey are divided and summarized in three clusters: food resource management practices, nutrition practices, and food safety practices. The following questions from the survey were used in the study to measure food resource management practices:

Number 1: How often do you plan meals ahead of time?

Number 2: How often do you compare prices before you buy food?

Number 9: How often do you run out of food before the end of the month?

Number 11: In the past month, how many times have you done major grocery shopping?

Number 12: Of those times (from number 11), how many times did you shop with a list?

Number 13 In the past month, did you ever have to cut the size of your children's meals because there was not enough money to buy food?

Questions 3, 6, 7, 8, and 14 on the survey are considered measures of nutrition behaviors, which reflect practices in food selection and preparation. In addition to the foods on the dietary recall, these questions were used to measure food selection and preparation practices:

Number 3: When deciding what to feed your family, how often do you think about healthy food choices?

Number 6: In the past two weeks, how often have you prepared foods without adding salt?

Number 7: In the past two weeks, how often have you read food labels to select foods with less salt or sodium?

Number 8: In the past two weeks, how often did you read food labels to select foods with less fat?

Number 14: How much do you agree with this statement? "The food and nutrition needs of my family are being met."

Some questions were omitted from the analysis. Questions 4 and 5 were excluded because they relate to food safety practices. Although safe food handling is one objective

of EFNEP, it was difficult to measure food handling practices with two questions only. Question 10 was not included in the analyses because when imported into the SAS data set, most participants' responses appeared as missing data. Question 15, "Most of the other needs of my family are being met," was excluded because the question may not relate to food and nutrition practices.

Expression of Outcome Measures

The outcome measures were expressed in the following ways:

Food resource management practices. Food resource management practices were measured from data on food expenditures and from questions on the survey. Dollars saved on food expenditures was expressed in dollars calculated by subtracting the amount of money and other resources spent per family on food at program exit from program entry. Subjects in group A were instructed to keep register receipts and/or a record of food expenditures during the first month of participation in the EFNEP and in the last month of participation. Subjects in group B were instructed to recall food expenditures during the month prior to EFNEP enrollment and during the month prior to graduation. Subjects in group C also were instructed to recall food expenditures during the month prior to enrolling in EFNEP and the month prior to the time they actually began EFNEP education.

Questions 1, 2, 9, 11, 12, and 13 were measures of food resource management practices. Questions 1, 2, and 9 required one of five responses: do not do, seldom, sometimes, most of the time, and almost always. Therefore, responses were scores from

1 to 5. Questions 11 and 12 required a number from 0 to 14 and, therefore, were scores from 0 to 14. Question 13 was a yes or no response.

Food selection and preparation. Changes in food selection and preparation were measured using the 24-hour food recall and questions related to nutrition practices on the survey. Food intake was expressed as the difference between numbers of servings from the five food groups and the sweets and fat group at program exit from mean servings at program entry taken from the 24-hour dietary recall. Nutrient intakes were expressed as the difference between nutrients consumed at program exit and nutrients consumed at program entry. Nutrition practices were expressed as mean scores from 1 to 5 on question 3, 6, 7, 8, 14 on the survey.

Relating Costs to Outcomes

To conduct a cost-benefit analysis, benefits and costs must be expressed in monetary terms. Food expenditure was the only outcome measured in dollars and, therefore, was the only outcome included in the cost-benefit analysis. All other outcomes were expressed in an array of measures to demonstrate the effectiveness of EFNEP education.

Findings from cost-benefit analyses frequently are presented as benefit-cost ratios. However, expressing findings as net present value (NPV) is the recommended method (18-20). NPV is calculated by subtracting discounted costs from discounted benefits using the following formula:

$$NPV = \sum_{t=0}^T \frac{(\text{Benefits} - \text{Costs})}{(1+r)^t}$$

where

r = discount rate

t = time period

T = time frame

In this study, the benefit was the difference between food expenditures for one month at program entry and program exit. Cost was the amount of money spent per participant to implement EFNEP obtained by dividing the total cost of EFNEP for one year by the number of families who graduated in one year. The discount rate was 7% based on recommendations for federally funded programs by the Office of Management and Budget (20). The time period and time frame was five years, the longest period for which retention of EFNEP benefits has been documented (21).

Data Analysis

Statistical analyses using SAS for Windows, Release 6.12 (15) were conducted in this study to determine if changes in food resource management practices and food selection and preparation practices were the result of participation in EFNEP. Frequency tables were constructed for demographic variables such as gender, race, residence, participation in public assistance programs, total number of persons in the family, number of adults other than the participant in a family, number of children in a family, the ages of children, the number of lessons received, and type of instruction. Descriptive statistics were used for measurements such as age of participant, number of children, total family

size, servings from food groups, nutrient intakes, food expenditures, and behaviors from the survey.

Mean food and nutrient intakes at program entry were compared for each of the three groups to determine if they were comparable. A nonparametric test was used because data were not normally distributed. Once it was determined that the three groups were comparable at program entry and the two experimental groups were similar at exit, the two experimental groups were combined into one group. Thereafter the Kruskal-Wallis Test was used to compare the means of the two groups: the combined experimental group and the control group. An alpha level of 0.01 was used on all tests with food and nutrient data to control the probability of making a type I error by rejecting the null hypothesis that there were no differences between groups.

Average scores for survey questions also were compared for each of the three groups using a nonparametric test to determine if the groups were comparable. Like the food and nutrient data, scores on survey questions were comparable for the groups; therefore, the experimental groups were combined for subsequent tests. The nonparametric test, Kruskal-Wallis, was used to determine if there were differences in average scores for the two groups, i.e., the combined experimental group and the control group. An alpha level of 0.01 also was used for tests on survey data.

Food Expenditure Data

The difference between the amount of money or other resources spent on food at program entry and program exit was calculated for groups A, B, and C. Tests for

normality showed food expenditure data were not normally distributed. However, a histogram showed data were symmetrical. Because of the symmetry of data and because the sample was representative of the total population of EFNEP participants in Tennessee, the parametric test, Analysis of Variance (ANOVA) was used to determine if there were differences among sample means for the three groups (22). The General Linear Model (GLM) was performed using the independent variable (group A, B, and C) as the classification variable and the difference in food expenditures as the dependent variable used in the model. An alpha level of 0.05 was chosen as the significance level. When significant differences among the three groups were detected, the Tukey's Studentized Range Test for more than two groups was used to identify which groups were different.

Analysis of Covariance (ANCOVA) was used to determine if there was an interaction among the dependent variable group and how often a participant used shopping lists when she did major shopping. This particular covariate was tested in the interaction because at program entry the subjects in the combined experimental group more often made a shopping list compared to subjects in the control group.

Sensitivity Analysis

Sensitivity analysis uses mathematical calculations that test the degree of influence different factors have on the outcome of the cost-benefit analysis. Sensitivity analysis was conducted in this study by varying the method by which food expenditures were determined (i.e., participant recall versus collecting register receipts and/or records

of expenditures). A sensitivity analysis was conducted by varying the time frame behaviors learned in EFNEP were retained, either 3 years or 5 years. In a third sensitivity analysis, the discount rate was varied to determine the effect of a 3%, 5%, and 7% rate on the NPV.

REFERENCES

1. *Eating Right is Basic*. Third Version. Lansing, MI: Michigan Cooperative Extension Service, Michigan State University; 1995.
2. *The Food Guide Pyramid*. Washington, DC: Human Nutrition Information Service, US Dept of Agriculture, 1992. Home and Garden Bulletin. 252.
3. Campbell DT, Stanley JC. *Experimental and Quasi-Experimental Designs for Research*. Chicago, IL: Rand McNally; 1963.
4. *Expanded Food and Nutrition Education Program: Guide to Program Management and Supervision*. Washington, DC: Cooperative Extension System, US Dept of Agriculture; 1983.
5. Department of Health and Human Services. *Poverty Guidelines*. Washington, DC: US Dept of Health and Human Services; 1998.
6. Bell BP, Goldoft M, Griffin PM, Davis MA, Gordon DC, Tarr PI, Bartleson CA, Lewis JH, Barrett TJ, Wells JG, Baron R, Kobayashi J. A multistate outbreak of *Escherichia coli* 0157:H7—associated bloody diarrhea and hemolytic uremic syndrome from hamburgers. *J Am Med Assoc*. 1994;272:1349-1353.
7. Wacholder S, McLaughlin JK, Silverman DT, Mandel JS. Selection of controls in case-control studies. *Am J Epidemiol*. 1992;135:1019-1028.
8. Wang, MQ, Fitzugh E, Westerfield RC. Determining sample size for simple-random surveys. *Health Values*. 1995;19:53-56.
9. Wunsch DR. Survey research: Determining sample size and representative response. *Business Education Forum*. 1986:February:31-34.
10. Summary of Adult Participant Profiles. EFNEP Reporting System. Knoxville, TN: The University of Tennessee Agricultural Extension Service; 1997.
11. Splett PL. *The Nutrition Practitioner's Guide to Cost Effectiveness Analysis of Nutrition Interventions*. Arlington, VA: National Center for Education in Maternal and Child Health; 1996.
12. Levin HM. *Cost-Effectiveness: A Primer*. Newbury Park, CA:Sage Publications, Inc.; 1983.

13. Splett PL, Caldwell M. *Costing Nutrition Services: A Workbook*. Chicago, IL: Region V, US Dept of Health and Human Services; 1985.
14. *EFNEP Evaluation/Reporting System User's Guide, Version 3.0*. Laurel, MD: Cooperative Extension System, US Dept of Agriculture; 1993.
15. *Statistical Analysis System*. Release 6.12. SAS® Institute Inc. Cary: NC. 1996.
16. Pennington JAT. *Food Values of Portions Commonly Used*. JB Lippincott Co. Philadelphia, PA; 1994.
17. Joy AB. Development of a simplified methodology to measure the effect of food purchasing practices on nutrient costs. Presented at: Cooperative State Research, Education and Extension Service Meeting, Nutrition Education for Diverse Audiences. February 10-14, 1997; Houston, TX.
18. Nas T. *Cost-Benefit Analysis: Theory and Application*. Sage Publications, Inc. Thousand Oaks, CA; 1996.
19. Clemmer B, Haddix AC. Cost-benefit analysis. In: Haddix AC, Teutsch SM, Shaffer PA, Duñet D, ed. *Prevention Effectiveness: A Guide to Decision Analysis and Economic Evaluation*. New York: Oxford University Press; 1996:85-102.
20. Government Accounting Office. *Circular No. A-94*. Washington DC: US Office of Management and Budget; 1992.
21. Nierman LG. *A Longitudinal Study of the Retention of Foods and Nutrition Knowledge and Practices of Participants from Michigan Expanded Food and Nutrition Education Program*. East Lansing, MI: Michigan State University; 1986.
22. Schlotzhauer SD, Littell RC. *SAS® System for Elementary Statistical Analysis*. Cary, NC: SAS® Institute, Inc.;1987.

APPENDIX B

Participant Records

Expanded Food and Nutrition Education Program Adult Enrollment Form (Family Record)

Fill out for each family at ENTRY and again at EXIT. Keep in family file after it's reviewed by Agent and sent to Secretary for computer entry.

1. PP's Name: _____		ENTRY _____ EXIT _____	
4. Family ID: _____	5. Enrolled in EFNEP before? (circle Y for Yes, N for No) Y N	7. Age: _____	9. Pregnant: Y N
	6. If Yes, did you receive a Certificate of Completion? Y N	8. Sex: F M	10. Breast-Feeding: Y N
a) Name _____ (First) (MI) (Last)		Unit # _____ Sample? Y N	
b) Street _____		Print Report? Y N	
c) City _____ Zip _____		Problem? _____	
d) Phone _____		Date on Computer: _____	
11. Race: Check the category you identify with _____ 1-00 White (non-Hispanic) _____ 2-00 Black (non-Hispanic) _____ 3-00 Am Indian/Alaskan Native _____ 4-00 Hispanic _____ 5-00 Asian or Pacific Islander	12. Place of Residence: circle 1 Farm 2 Towns under 10,000 & rural non-farm 3 Towns & Cities 10,000 to 50,000 4 Suburbs of Cities over 50,000 5 Central Cities over 50,000	13. Total Household Income Last Month: \$ _____	

14. Household Members: Children by Age List First Name of Children (through Age 19)	Age (Years)	15. Number of Other Adults in Household (don't count Homemaker)
1) _____		16. Instruction (Lesson) Type: 1 Group 2 Individual 3 Both 4 Other
2) _____		
3) _____		
4) _____		
5) _____		
6) _____		
7) _____		
		17. Total Number of Lessons: _____

B1.1. Family Record Form (continued on the next page)

18. Entry Date:			Complete Exit information only when leaving EFNEP Program																								
19. Assistance programs that the Family Participates in at ENTRY: (circle)			20. Exit Date:	22. Did your family receive assistance as the result of a referral or suggestion from EFNEP personnel? YN If yes, check all that apply: <input type="checkbox"/> WIC/CSFP <input type="checkbox"/> Food Stamps <input type="checkbox"/> FDPIR <input type="checkbox"/> Commodities <input type="checkbox"/> Head Start <input type="checkbox"/> Child Nutrition <input type="checkbox"/> AFDC <input type="checkbox"/> Other _____																							
<table border="0"> <tr><td>WIC/CSFP</td><td>Y</td><td>N</td></tr> <tr><td>Food Stamps</td><td>Y</td><td>N</td></tr> <tr><td>FDPIR</td><td>Y</td><td>N</td></tr> <tr><td>Commodities</td><td>Y</td><td>N</td></tr> <tr><td>Head Start</td><td>Y</td><td>N</td></tr> <tr><td>Child Nutrition</td><td>Y</td><td>N</td></tr> <tr><td>AFDC</td><td>Y</td><td>N</td></tr> <tr><td>Other</td><td>Y</td><td>N</td></tr> </table> _____ (Specify)			WIC/CSFP		Y	N	Food Stamps	Y	N	FDPIR	Y	N	Commodities	Y	N	Head Start	Y	N	Child Nutrition	Y	N	AFDC	Y	N	Other	Y	N
WIC/CSFP	Y	N																									
Food Stamps	Y	N																									
FDPIR	Y	N																									
Commodities	Y	N																									
Head Start	Y	N																									
Child Nutrition	Y	N																									
AFDC	Y	N																									
Other	Y	N																									
			<table border="0"> <tr><td>1</td><td>Educational Objective Met</td></tr> <tr><td>2</td><td>Returned to School</td></tr> <tr><td>3</td><td>Took Job</td></tr> <tr><td>4</td><td>Family Concerns</td></tr> <tr><td>5</td><td>Staff Vacancy</td></tr> <tr><td>6</td><td>Moved</td></tr> <tr><td>7</td><td>Lost Interest</td></tr> <tr><td>8</td><td>Other</td></tr> </table>	1	Educational Objective Met	2	Returned to School	3	Took Job	4	Family Concerns	5	Staff Vacancy	6	Moved	7	Lost Interest	8	Other								
1	Educational Objective Met																										
2	Returned to School																										
3	Took Job																										
4	Family Concerns																										
5	Staff Vacancy																										
6	Moved																										
7	Lost Interest																										
8	Other																										
Comments:			(Specify)																								

B1.2. Family Record Form (continued)

EFNEP SURVEY

Name	ID#	
Date	Check the box after entry or exit	Entry <input type="checkbox"/> Exit <input type="checkbox"/>

This is a survey about ways you plan and fix foods for your family. As you read each question, think about the recent past. Some questions ask you to think about the past month. Others ask you to think about just the past two weeks.

Please put a check in the box that best answers each question.	Do Not Do	Seldom	Some-times	Most of the Time	Almost Always
(1) How often do you plan meals ahead of time?					
(2) How often do you compare prices before you buy food?					
(3) When deciding what to feed your family, how often do you think about healthy food choices?					
(4) This question is about meat and dairy foods. How often do you let these foods sit out for more than two hours?					
(5) How often do you thaw frozen foods at room temperature?					
(6) In the past <i>two weeks</i> , how often have you prepared foods without adding salt?					
(7) In the past <i>two weeks</i> , how often did you read food labels to select foods with less salt or sodium?					
(8) In the past <i>two weeks</i> , how often did you read food labels to select foods with less fat?					

B3.1. EFNEP Survey Form (Front)

Please put a check in the box that best answers each question.	Do Not Do	Seldom	Some-times	Most of the Time	Almost Always
(9) How often do you run out of food before the end of the month?					
(10) How often in the past two weeks have your children had something to eat in the morning, within 2 hours of waking up?	_____ times				
(11) In the past month, how many times have you done major grocery shopping?	_____ times				
(12) Of those times, how many times did you shop with a list?	_____ times				
(13) In the past month, did you ever have to cut the size of your children's meals because there was not enough money to buy food?	Check one: <input type="checkbox"/> yes <input type="checkbox"/> no				
(14) How much do you agree with this statement? "The food and nutrition needs of my family are being met."	Check one: <input type="checkbox"/> Strongly Disagree <input type="checkbox"/> Disagree <input type="checkbox"/> Agree <input type="checkbox"/> Strongly Agree				

The previous questions asked you about foods and nutrition. Now please think about other aspects of family care (such as health, other money management, parenting, or personal growth.) How much do you agree with this statement:

(15) Most of the other needs of my family are being met.	Check one: <input type="checkbox"/> Strongly Disagree <input type="checkbox"/> Disagree <input type="checkbox"/> Agree <input type="checkbox"/> Strongly Agree
--	---

B3.2. EFNEP Survey Form (Back)

To be filled out by program assistant:
 County: _____
 ID Number: _____

Begin Date: _____
(month, day and year)

End Date: _____
(month, day and year - should be two weeks from begin date)

Directions: Please keep all receipts for food purchased in this envelope. Include receipts from everyone who lives together in your household and eats from your household food supply. If you do not have a receipt, fill in the circle under the name of the type of place you and your household purchased the food and the amount of money spent in the box below. Use a separate line for each purchase.

Supermarket	Convenience Store	Restaurant	Fast Food	Farmer's Market	Vending Machine	Other	Total Purchase Amount
Example <input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	□□□.□□
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	□□□.□□
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	□□□.□□
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	□□□.□□
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	□□□.□□
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	□□□.□□
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	□□□.□□
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	□□□.□□
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	□□□.□□
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	□□□.□□

B4.1. Food Expenditures Record (Front)

APPENDIX C

Instructions for Conducting a Cost-Benefit Analysis

Instructions for Conducting an EFNEP Cost-Benefit Analysis

What is cost-benefit analysis?

What are program outcomes?

How do we measure program outcomes?

Introduction

Cost benefit analysis is a type of program evaluation that examines the amount of money spent to achieve program outcomes.

Program outcomes are what you try to achieve as a result of the program. The major outcomes we try to achieve in EFNEP are:

1. *Improved food resource management practices* - the use of food resources (money, food stamps, WIC vouchers, etc.) to enable families to obtain enough nutritious food.
2. *Improved nutrition practices* - the consumption of foods that meet nutritional needs.
3. *Improved food safety practices* - following the recommendations for safe food handling.

All of these outcomes can lead to improved health for participants, the ultimate outcome of participation in EFNEP.

Program outcomes are measured with the National EFNEP Reporting System using three records: 1) the Family Record, 2) the 24-Hour Food Recall, and 3) the EFNEP Survey. We collect information for all three of the major outcomes.

1. Food resource management practices are measured by:
 - a. question 8 on the 24-Hour Food Recall (“Money spent on food last month.”)
 - b. questions 1, 2, 9, 11, 12, 13, and 14 on the EFNEP Survey

C1.1. Instructions for Conducting a Cost-Benefit Analysis

2. Nutrition practices are measured by:
 - a. the 24-Hour Food Recall
 - b. questions 3, 6, 7, 8, and 10 on the EFNEP Survey
3. Food safety practices are measured by questions 4 and 5 on the EFNEP Survey.

This cost-benefit analysis should show that for every dollar we spend on a participant, the participant saves X number of dollars on food. Since spending less money does not necessarily mean that a person is spending more wisely, we will use improvements in food resource and nutrition practices to show that participants save money and improve their diets.

Who will be included in the cost-benefit analysis?

The following EFNEP participants will be included in the cost-benefit analysis:

1. adults
2. females
3. participants who are enrolled for more than 2 months
4. participants taught in groups and individually

Who will not be included in the cost-benefit analysis?

The following EFNEP participants will not be included in the cost-benefit analysis:

1. participants under 18-years-old
2. males
3. participants enrolled for less than 2 months

3 groups of participants

Participants will be placed in three groups.



Group A



Group B



Group C

C1.2. Instructions for Conducting a Cost-Benefit Analysis (continued)

How many people will be enrolled in the study?

1. Group A - will enroll in EFNEP and receive education as usual, but will be asked to keep food receipts.
2. Group B - will enroll in EFNEP and receive education as usual.
3. Group C - will enroll in EFNEP but will be asked to wait a few weeks to begin lessons.

Each program assistant will be enrolling 18 persons for the study.

6 people to Group A
6 people to Group B
6 people to Group C

Procedures for Data Collection

Enrolling participants

The procedure for enrolling participants will be as follows:

1. Enroll new participant and assign them to Group A
2. Enroll a second participant and assign them to Group B
3. Enroll a third participant and assign them to Group C

It is important that you do not choose which group to assign the participant. They are assigned to a group by chance. If you cannot convince a person to collect the food receipts or a person does not want to delay lessons, then assign them to the next group. For example, if a person does not want to delay their lessons, assign them to Group A and assign the next person to group C. Your goal is to have 6 people in each group.

Incentives for Group C

Because Group C will be asked to delay their education, they will be offered a small token of appreciation. Ask them to select an item from the list you have been provided. Be sure their name, your name, the county, and

C1.3. Instructions for Conducting a Cost-Benefit Analysis (continued)

How will you know when to begin lessons for Group C?

the date are written on the selection form. Make a copy of the selection form and send it to Janie Burney as soon as possible to allow enough time to order the items. They are to be given their selection at the time you begin their lessons.

You begin lessons with Group C when either a Group A or Group B participant completes their last lesson. The Group A or Group B participant should be enrolled at about the same time. You can tell the Group C participant that you will begin lessons at the time you believe the Group A or Group B participant will graduate.

You will be given brightly-colored self-stick notes to attach to the Family Records of the participants in Group A and B that were enrolled at about the same time you enrolled a participant in Group C. Write on the note: "Begin lessons for <name of Group C participant> when this participant graduates." Choose the time either the participant in Group A or the participant in Group B receives her last lesson.

Consent Forms

All 18 people enrolled in this study are required to sign a consent form. This form is to be signed by the participant and sent to the EFNEP agent who will forward them to Knoxville. You have a consent form for each group. Every program assistant and agent should sign the forms and include her address and phone number. Every participant should have a copy of the consent form to keep in case she needs to contact anyone concerning the study. To keep in touch with the participant in Group C during the time you are not visiting them, send them a postcard provided by the state EFNEP office each month. This will serve to remind them that you will be visiting with them again.

Completing the EFNEP records

Participants in Group A, B, and C will complete the Family Record, 24-Hour Recall, and the EFNEP Survey when they are enrolled. These forms will be sent to the EFNEP agent

C1.4. Instructions for Conducting a Cost-Benefit Analysis (continued)

as soon as possible after completion, or, by the next time you are in the office.

The same participants will complete the same records at the time they graduate (for Group A and B), or, when they begin lessons (for Group C). The records taken for Group C at the time they begin lessons will be entered in the computer as their exit records but will be considered their entry records.

Write on the three EFNEP records whether the participant is in Group A, B or C. If a person does not want to be in the group she should be assigned, write this on the Family Record under the "Comment" section. For example, "Did not want to delay lessons. Participant assigned to next available group, Group A."

Entering data in the computer

Records will be entered by EFNEP secretaries as usual except separate directories will be used for each group. All participant records entered during the study will be in the regular directory (example: DATA9697), a directory created for Group A (example: GROUPA), a directory created for Group B (example: GROUPB), or a directory created for Group C (example: GROUPEC). There will be a total of four directories. Three new directories must be created.

How will the food receipts be collected?

Participants in Group A will be asked to keep their food receipts for two weeks out of the month. They will be asked to keep receipts during the first month they are enrolled in EFNEP and for a month after they complete their last lesson.

Which two weeks they collect receipts depends on when they receive their food stamps or other source of income. For example:

1. If they receive their food stamps (or other income) at the first of the month, they begin keeping food receipts

C1.5. Instructions for Conducting a Cost-Benefit Analysis (continued)

at the beginning of the second week and continue through the third week.

2. If they receive their food stamps (or other income) the second week of the month, they should begin keeping receipts one week later for a total of two weeks.
3. If they receive income weekly or twice a month, they should keep food receipts the second and third weeks of the month.

If at the time you enroll a person in Group A, they have received their food stamps or income and it is too late to collect their food receipts for the month, do not include them in the study.

What food receipts will be collected?

Food receipts should be collected for every member of the household. Receipts should be kept for supermarkets, smaller grocery stores, convenience stores, deli's, fast food restaurants, and other restaurants. Ask the participant to identify items on the receipts that are nonfood items.

If a person forgets or is unable to provide a receipt (for vending machines, for example), ask them to write down where they purchased the food and how much they spent on the form provided. This includes food purchases for every person in the household.

Ask them to keep all receipts in the University of Tennessee envelope provided. Send the envelope with receipts and other documentation of money spent to the EFNEP agent.

WIC vouchers

According to the instructions for the National EFNEP Reporting System, the value of the vouchers received from WIC should be part of the total amount spent on food (item 8 on the Family Record). This has not been done consistently, if at all. For the purposes of this study, we will include the value of WIC vouchers for all homemakers who participate in Group A, B, and C. At the beginning

C1.6. Instructions for Conducting a Cost-Benefit Analysis (continued)

of the new reporting year in October, we will need to do this with all of our homemakers.

Ask the homemaker who receives WIC vouchers in the family [pregnant woman, postwoman, infant (birth to 6 mos.), infant (6 to mos. to 1 yr.), child (1 to 5 yrs.)], nursing woman. The value of each vouchers for each person per month is shown below:

<u>Package</u> <u>month</u>	<u>Family Member</u>	<u>Value per</u>
A and A+	Pregnant women	\$52
B	Post-partum women	\$40
C	Infants (birth to 6 mos.)	\$95
D	Infants (6 mos to 1 yr.)	\$106
E and E+	Children (1 to 5 yrs.)	\$54
G and A+	Nursing women	\$63

For this study, write the type of family member receiving WIC on the 24-Hour Food Recall. The agent will add this to the total amount spent on food each month.

This is to be done by the EFNEP agent.

Determining the total amount spent on food

After the participant collects receipts and gives them to the program assistant with the form for purchases without receipts, they should be added together.

Be sure to subtract purchases for nonfood items, such as soap and pet food. Once the nonfood items are subtracted, the tax charged will need to be figured by multiplying the county tax rate by the total amount spent on food.

This is to be done by the EFNEP agent

In addition to the receipts collected, the value of WIC vouchers must be added to the other food expenditures. Part of a cost-benefit study requires that the amount of

C1.7. Instructions for Conducting a Cost-Benefit Analysis (continued)

**Expenses for
publications/handouts**

money spent for programming be documented to determine how much money we spend per person. Most expenses can be obtained from expenditure reports in Knoxville, however, expenses for publications and handouts need to be figured for participants in the study.

For the purposes of this study, the EFNEP agent will keep a log of publications and handouts used with the participants in Group A, B, and C during the study. This would be a list of the publication or handout name and how many were distributed. At the end of the study, they will be forwarded to Janie Burney.

**Setting up data
directories on the
computer**

In order to keep the records for the participants in the cost-benefit study separate from the other EFNEP participants, new directories must be set up on the computers. A directory for each county must be set up for Group A, B, and C. To set-up these directories, follow these steps:

1. Go to **File** on the EFNEP menu bar.
2. Select **3. View/Update Data Directories** under File menu.
3. Press **<enter>**
4. Press **Insert <Ins>** to add a directory
5. Type **GROUPA** by Name
6. Type **C:\EFNEP\GROUPA** by data directory.
7. Press **<enter>**
8. Press **Y** when it tells you **C:\EFNEP\GROUPA** does not exist and asks you if you want to create it.
9. Do not change the name of the Tables Directory.
10. Press **<F10>**

Repeat steps 4 through 10 for Group B and Group C.

For computers with more than one county or subgroup on the computer:

C1.8. Instructions for Conducting a Cost-Benefit Analysis (continued)

Name the new directories according to what county or subgroup they will be in. For example:

•

Benton County might be BGROUPA and Henry might be HGROUPA. These can be up to 8 characters.

C1.9. Instructions for Conducting a Cost-Benefit Analysis (continued)

APPENDIX D

Participant Consent Forms

Group A

Date: _____

Dear _____:

We would like to invite you to participate in a study. The study involves research about the Expanded Food and Nutrition Education Program (EFNEP), a nutrition education program taught by The University of Tennessee Agricultural Extension Service. We want to know if learning about foods and nutrition from EFNEP helps you save money on food, helps you improve the food choices you make, and helps you learn about preparing foods. Your participation is expected to last from three to six months. During that time you will be contacted about 12 times. This is the average number of times an EFNEP participant receives a lesson. The exact number of lessons will depend on how many you would like to receive.

During this time a program assistant, _____, will teach you about foods and nutrition. This can be done individually in your home or in group meetings with other homemakers. We will pick a regular meeting time that is convenient for you. There is no charge for EFNEP.

When you sign up for EFNEP we will be asking you a few questions about yourself and your family, the kinds of foods you eat, and how you shop for food, plan your meals, and prepare your food. Your answers will be written down. This will help the program assistant and you decide on what you would like to learn about foods and nutrition. At this time we also will ask you to keep a record of the amount of money your family spends on food for one month by keeping your grocery receipts and writing down how much you spend on food away from home.

When you finish all the lessons, we will ask you the same questions we asked when you signed up for EFNEP. And, again we will ask you to keep track of how much you spend on food for one month. This will help us learn if you shop, plan meals, or prepare foods any differently than you did when you signed up for EFNEP.

If you agree to participate in this study, you will not be at risk, either physically or mentally. We will do no more than ask you some questions and teach you about foods and nutrition.

Since your name and other information will be written down on our records, we want to assure you that the information will be kept confidential. The records will be locked up in a cabinet or drawer at your county Extension office. No one but the program assistant, the EFNEP Home Economist who supervises EFNEP in your county, the EFNEP secretary who will put the information into a computer, and the researcher (Janie Burney) at the University of Tennessee will know your name. Twelve months after the study your records will be destroyed. This consent form will be kept in the researcher's office for three years after the study is completed.

D1.1. Consent Form for Group A (Front)

We anticipate that you will learn many things about foods and nutrition. By the time you finish your lessons, you may be feeding your family better with less money! As part of the study, we will give you a computer analysis about your diet. You will receive a notebook that you can put all of the handouts (with recipes) that you receive from the program assistant.

Participation in this study is voluntary. You may refuse to participate at any time. It will not affect any assistance you may be receiving from other programs, such as WIC and food stamps.

Should you need to contact anyone about the study, you may contact the researcher (Janie Burney), the program assistant, or your county EFNEP Home Economist. Their addresses and phone numbers are given below.

Sincerely,

Janie Burney
EFNEP Coordinator
119 Morgan Hall
PO Box 1071
Knoxville, TN 37901
1-423-974-7402

EFNEP Program Assistant

EFNEP Home Economist

I have read this consent form and agree to participate.

Signature of Participant

D1.2. Consent Form for Group A (Back)

Group B

Date: _____

Dear _____:

We would like to invite you to participate in a study. The study involves research about the Expanded Food and Nutrition Education Program (EFNEP), a nutrition education program taught by The University of Tennessee Agricultural Extension Service. We want to know if learning about foods and nutrition from EFNEP helps you save money on food, helps you improve the food choices you make, and helps you learn about preparing foods. Your participation in the study is expected to last from three to six months. During that time you will be contacted about 12 times. This is the average number of times an EFNEP participant receives a lesson. The exact number of lessons will depend on how many you would like to receive.

During this time a program assistant, _____, will teach you about foods in nutrition. This can be done individually in your home or in group meetings with other homemakers. We will pick a regular meeting time that is convenient for you. There is no charge for EFNEP.

When you sign up for EFNEP we will be asking you a few questions about yourself and your family, the kinds of foods you eat, and how you shop for food, plan your meals, and prepare your food. Your answers will be written down. This will help the program assistant and you decide on what you would like to learn about foods and nutrition.

When you finish all the lessons, we will ask you the same questions we asked when you signed up for EFNEP. This will help us learn if you shop, plan meals, or prepare foods any differently than you did when you signed up for EFNEP.

If you agree to participate in this study, you will not be at risk, either physically or mentally. We will do no more than ask you some questions and teach you about foods and nutrition.

Since your name and other information will be written down on our records, we want to assure you that the information will be kept confidential. The records will be locked up in a cabinet or drawer at your county Extension office. No one but the program assistant, the EFNEP Home Economist who supervises EFNEP in your county, the EFNEP secretary who will put the information into a computer, and the researcher (Janie Burney) at The University of Tennessee will know your name. Twelve months after the study your records will be destroyed. This consent form will be kept in the researcher's office for three years after the study is completed.

We anticipate that you will learn many things about foods and nutrition. By the time you finish your lessons, you may be feeding your family better with less money! As part of the study, we will give you a computer analysis about your diet.

D2.1. Consent Form for Group B (Front)

Participation in this study is voluntary. You may refuse to participate at any time. It will not affect any assistance you may be receiving from other programs, such as WIC and food stamps.

Should you need to contact anyone about the study, you may contact the researcher (Janie Burney), the program assistant, or your county EFNEP Home Economist. Their addresses and phone numbers are given below.

Sincerely,

Janie Burney
EFNEP Coordinator
119 Morgan Hall
PO Box 1071
Knoxville, TN 37901
1-423-974-7402

EFNEP Program Assistant

EFNEP Home Economist

I have read this consent form and agree to participate.

Signature of Participant

D2.2. Consent Form for Group B (Back)

Group C

Date: _____

Dear _____:

We would like to invite you to participate in a study. The study involves research about the Expanded Food and Nutrition Education Program (EFNEP), a nutrition education program taught by The University of Tennessee Agricultural Extension Service. We want to know if learning about foods and nutrition from EFNEP helps homemakers like you save money on food, improve the food choices they make, and learn to prepare foods. Your participation in the study is expected to last from three to six months. During that time you will be contacted two times. Once when you begin to participate in the study and once when you end your participation in the study.

If you agree to participate, an EFNEP program assistant will ask you a few questions about yourself and your family, the kinds of foods you eat, and how you shop for food, plan your meals, and prepare your food. Your answers will be written down. In about three to six months, the program assistant will visit you again to ask you the same questions she asked the first time. At that time you will be invited to participate in the EFNEP program to learn about feeding your family nutritious foods even on a tight budget. This is free.

If you agree to participate in this study, you will not be at risk, either physically or mentally. We will do no more than ask you some questions.

Since your name and other information will be written down on our records, we want to assure you that the information will be kept confidential. The records will be locked up in a cabinet or drawer at your county Extension office. No one but the program assistant, the EFNEP Home Economist who supervises EFNEP in your county, the EFNEP secretary who will put the information into a computer, and the researcher (Janie Burney) at The University of Tennessee will know your name. Twelve months after the study your records will be destroyed. This consent form will be kept in the researcher's office in Knoxville for three years after the study is completed.

Participation in this study is voluntary. You may refuse to participate at any time. It will not affect any assistance you may be receiving from other programs, such as WIC and food stamps.

You also may choose to sign up for EFNEP before the study is over. But, it would really help us learn more about how we can make EFNEP beneficial to you if you wait to sign up when the study is over.

D3.1. Consent Form for Group C (Front)

Should you need to contact anyone about the study, you may contact the researcher (Janie Burney), the program assistant, or your county EFNEP Home Economist. Their addresses and phone numbers are given below.

Sincerely,

Janie Burney
EFNEP Coordinator
119 Morgan Hall
PO Box 1071
Knoxville, TN 37901
1-423-974-7402

EFNEP Program Assistant

EFNEP Home Economist

I have read this consent form and agree to participate.

Signature of Participant

D3.2. Consent Form for Group C (Back)

APPENDIX E

Grant and Contract Budget and Expenditure Report

APPENDIX F

EFNEP Costs by Month

Table 18. Direct and indirect costs of EFNEP during May, June, and July.

Expense	May		June		July	
	State	County	State	County	State	County
Personnel						
Salaries						
Professional	4971.20	14937.91	4929.50	14598.98	4937.84	14711.32
Clerical	630.09	576.42	630.09	576.42	630.08	576.42
Paraprofessional		49145.87		72819.97		48033.48
Benefits						
Longevity						
Retirement	577.41	5040.01	572.66	6749.09	573.75	4998.96
Social Security	373.64	4255.36	370.44	6015.37	371.18	4141.41
Unemployment Compensation		48.03		54.70	5.42	418.05
Workers Compensation	2.61	202.94	2.61	303.31	2.61	200.88
Group Insurance	235.20	14483.79	235.20	14440.62	235.20	14073.66
401K Matching	3.00	332.54	3.00	330.46	3.00	316.14
Travel						
Travel - In State	937.04	5182.54	279.42	12552.99		388.04
Travel - Out State				291.55		
Printing, Duplicating, and Binding						
Printing	2039.07		583.05			197.81
Publications and Reports						
Communications						
Postage	263.88		73.31			
Freight						
Telephone		189.07	1.47	204.03		
Telecommunication			7.00			

F1. Table of EFNEP Costs for May, June, and July

Table 18. (continued)

Expense	May		June		July	
	State	County	State	County	State	County
Equipment						
Equipment	1600.00	3500.00				
Maintenance and Repairs						
Maintenance and Repairs	366.98	1050.00	305.00	1050.00	305.00	1050.00
Professional Services and Fees						
Subscriptions						
Supplies						
Operating	574.22	646.53	1533.11	2054.07	16.66	
Computer Software						
Contractual and Special Services						
Group Food and Lodging						
Commercial Services			4.24			
Univ Services			1249.00			
Seminar and Conference Registration			621.00			
TOTAL DIRECT COSTS	12574.30	99591.01	11400.1	132041.56	7080.74	89106.17
TOTAL INDIRECT COSTS	2391.31	10079.95	2484.08	13851.16	1542.89	9347.24
TOTAL COSTS	14965.65	109670.96	13884.18	145892.72	8623.63	98453.41

F1.2. Table of EFNEP Costs for May, June, and July

Table 19. Direct and indirect costs of EFNEP during August, September, and October.

Expense	August		September		October		Total
	State	County	State	County	State	County	
Personnel							
Salaries							
Professional	4397.84	14573.25	4937.84	16041.58	4937.84	17790.66	1217.66
Clerical	630.08	576.42	630.08	563.82	127.95	576.42	6724.29
Paraprofessional		49556.53		47886.61	47886.61	48372.96	315815.42
Benefits							
Longevity	400.00	375.00					775.00
Retirement	603.19	5059.53	573.75	5076.38	520.05	5308.99	35653.80
Social Security	401.78	4262.43	371.18	4257.96	332.77	4293.23	29446.80
Unemployment Compensation	8.86	434.46	5.42	416.64	1.10	420.90	1813.58
Workers Compensation	4.27	208.73	2.61	200.24	0.53	202.25	1333.59
Group Insurance	235.20	14504.51	235.20	14204.24	235.20	14722.46	87840.50
401K Matching	3.00	326.16	3.00	358.02	3.00	401.36	2082.68
Travel							
Travel - In State	247.20	1858.58	546.95	3913.90	470.33	7509.32	33886.31
Travel - Out State							291.55
Printing, Duplicating, and Binding							
Printing	662.79		238.64		3508.34		7229.70
Publications and Reports	309.73		39.00				348.73
Communications							
Postage					374.82		712.01
Freight	179.92						179.92
Telephone				474.96	474.96	1.45	870.98
Telecommunication	11.50		19.50		8.50		46.50

F2.1. Table of EFNEP Costs for August, September, and October

Table 19. (continued)

Expense	August		September		October		Total
	State	County	State	County	State	County	
Equipment							
Equipment							5100.00
Maintenance and Repairs							
Maintenance and Repairs	305.00	1050.00	305.00	1050.00	305.00	1050.00	8191.98
Professional Services and Fees							
Subscriptions			9.97				9.97
Supplies							
Operating	1520.23	426.74	355.50	576.02	350.13	217.97	8271.18
Computer Software					75.00		75.00
Contractual and Special Services							
Group Food and Lodging			1046.25		3767.00		4813.25
Commercial Services							4.24
Univ Services							1249.00
Seminar and Conference Registration							621.00
TOTAL DIRECT COSTS	9920.59	93212.34	9319.89	95020.37	63379.13	100867.97	554605
TOTAL INDIRECT COSTS	2161.70	9777.97	2030.80	9967.64	13810.31	10581.05	88026.1
TOTAL COSTS	12082.29	102990.31	11350.69	104988.01	77189.44	111449.02	642630.64

F2.2. Table of EFNEP Costs for August, September, and October

APPENDIX G

Glossary of Terms

Glossary of Terms

benefit-cost ratio - a mathematical comparison of the benefits of an intervention divided by the costs. When the benefit-cost ratio is greater than 1, benefits exceed costs.

contingent valuation studies - the use of surveys to estimate the willingness-to-pay (WTP) values of health outcomes. In the surveys hypothetical market situations are used to elicit consumer valuation of goods and services.

cost analysis - the process of estimating the costs of an intervention.

cost-benefit analysis (CBA) - a type of economic analysis that compares alternative interventions by assigning dollar values to costs and to outcomes. Results are expressed in a benefit-cost ratio or net present value.

cost-effectiveness analysis (CEA) - a type of economic analysis that compares alternative interventions with similar goals by relating costs, expressed in dollars, to outcomes achieved expressed in natural units, such as pounds of weight lost or decreases in blood cholesterol.

cost-feasibility analysis (CFA) - a type of economic analysis that estimates only the cost of an alternative in order to determine whether or not it can be considered.

cost-of-illness (COI) - a method of estimating direct medical and nonmedical costs associated with an illness and indirect costs associated with lost productivity due to morbidity or premature mortality.

cost-utility analysis (CUA) - a type of economic analysis that compares alternative interventions by comparing their costs and the estimated utility or value of their outcomes. A common measure of CUA is the quality-adjusted life year (QUALY) where the quality of life is related to the length of life.

decision analysis - a systematic approach to decision making under conditions of uncertainty using explicit, quantitative methods.

direct costs - the measure of resources spent to implement an intervention or program.

discounting - a way to adjust the value of future costs and benefits to an equivalent present value.

G1.1. Glossary of Terms

discount rate - the rate at which future costs and benefits are discounted to account for changes.

indirect costs - the measure of resources forgone to either participate in an intervention or as the result of a health condition.

intangible costs - costs for which assigning monetary value are difficult, such as the costs of pain and suffering.

net present value (NPV) - the summation of the value of discounted costs from the discounted value of benefits of an intervention.

sensitivity analysis - mathematical calculations that isolate factors that may influence the outcome of an economic analysis.

time horizon - the defined period over which costs and benefits of an intervention are tracked. Time horizon is sometimes called the analytic horizon.

willingness-to-pay (WTP) - the method of estimating the maximum dollar amount an individual would pay in a given risk-reducing situation to reduce the risk of death and illness.

G1.2. Glossary of Terms

VITA

Janie L. Burney was born in Beckley, West Virginia on August 22, 1956. She attended public schools in Titusville, Florida (Brevard County), where she graduated from Astronaut High School in 1974. She majored in Nutrition Science at The University of Tennessee, Knoxville and graduated with a Bachelor of Science in Human Ecology in 1978. Following graduation she was employed by Jennie Stewart Memorial Hospital in Hopkinsville, Kentucky as a nutritionist. In 1981, she entered graduate school at The University of Tennessee, Knoxville and received a Master of Science degree in Nutrition Science with a minor in Food Science. Her major professor was Dr. Jean Skinner and the title of her Master's thesis was, "The Breakfast and Snacking Habits of Eat Tennessee Adolescents." She has been a Registered Dietitian since 1983. In 1983, she was employed as a Nutritionist by the Tennessee Department of Health in the East Tennessee Region.

She currently is employed by The University of Tennessee Agricultural Extension Service as a nutrition specialist. She is Coordinator of the Expanded Food and Nutrition Education Program (EFNEP). Her major job responsibilities include management and supervision of EFNEP. While employed with the Extension Service, she entered the doctoral program with a major in Nutrition at The University of Tennessee, Knoxville. The doctoral degree was received in December, 1998.