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Applying Cost Benefit Analysis to Nutrition Education Programs: Focus on the Virginia Expanded Food and Nutrition Education Program

FINAL REPORT

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

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Applying Cost Benefit Analysis to Nutrition Education Programs: Focus on the Virginia Expanded Food and Nutrition Education Program

FINAL REPORT

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This study was the basis for a Ph.D. dissertation (Rajgopal, 1998) and a Master's thesis (Lewis, 1998). Special recognition, appreciation, and congratulations for a job well done are extended to Dr. Radhika Rajgopal and Edwin Lewis. The results of this study were largely dependent on their dedicated and comprehensive work.

It should be noted that the results in this report do slightly differ from those reported in the above dissertation and thesis. This is because modifications were made to some of the procedures and calculations based on input from a panel of expert reviewers.

Special thanks also go to study co-directors, Dr. Ruby Cox and Dr. Michael Ellerbrock. Their leadership and contributions in their respective areas were greatly appreciated. And a big thank-you to Betty Nunley, Program Support Technician, for developing the web page, managing the myriad of details associated with the project, and generally keeping me in line.

The following panel of experts reviewed a final draft of the report. Their comments and suggestions were greatly appreciated and served to strengthen the final report.

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Michael Lambur

1.0 INTRODUCTION

In attempts to make public programs more cost effective, it is critical to develop and apply new techniques to evaluate Extension programs. Indeed, one of the major challenges facing Extension evaluators is the need to provide concise, meaningful evaluation information to decision-makers. Nutrition education has been a base program of the Cooperative Extension System since its inception. While knowledge gain, and to a more limited extent the behavior changes of participants have been measured, good measures of the cost savings that accrue as a result of participation in these education programs are not available. Procedures that quantitatively compare a program's costs to its benefits are inherently popular and useful. Cost benefit and effectiveness analysis represent economic analysis procedures that can be useful in addressing this need.

The Expanded Food and Nutrition Education Program (EFNEP) is the largest 3(d) funded program conducted by the Cooperative Extension System, at approximately 60 million dollars per year and the only 3(d) program that operates under its own specific statute. EFNEP has been in existence for 30 years, and has been shown to be effective in helping limited resource youth and families with young children acquire the knowledge, skills, attitudes, and changed behavior necessary for nutritionally sound diets and to contribute to their personal development and the improvement of the total family diet and nutritional well-being.

In 1993, an Evaluation/Reporting System (ERS) was implemented nationwide in EFNEP that captures impacts of the program. It does this by comparing dietary intakes of program participants to the Food Guide Pyramid and the Recommended Dietary Allowances for key nutrients, and by measuring changes in behavior related to food resource management, food safety, and improved nutrition practices. This evaluation system helps state EFNEP leaders identify strengths and weaknesses in the operation of their educational programming, and to make adjustments in training of staff, curricula, activities for clients, and allocation of resources. However, effective measures of the benefit of EFNEP in terms of cost savings are not available.

To continue to refine and expand the effectiveness of nutrition programs such as EFNEP, better evaluation procedures are needed to help determine the relative costs and benefits of education versus other intervention programs. Other nutrition education programs conducted by the Cooperative Extension System, other USDA agencies, and the private sector would also benefit from this type of study. In 1996, the Cooperative State Research, Education, and Extension Service, United States Department of Agriculture (CSREES, USDA) issued a national Request for Proposals (RFP) to conduct a cost benefit analysis of nutrition education programs, with emphasis on EFNEP. Virginia Cooperative Extension (VCE) responded to the RFP and was successful in securing the grant to conduct the study.

One of the most widely recognized procedures for examining program efficiency is cost benefit analysis (CBA). CBA is the analytic process where costs and benefits of a program are identified and measured in monetary (dollar) terms. By valuing both costs and benefits in the same monetary terms, they can be directly compared to determine the net economic impact of a program.

CBA has not been widely applied to nutrition education programs, primarily due to the difficulties associated with assigning monetary values to the outcomes achieved. Also, clinicians or nutritionists must have a thorough understanding of economics to conduct a CBA, making it a less popular method of analysis in the nutrition field.

Because CBA uses the common metric of dollars to express program outcomes, it answers the question, "Does a program generate net returns to investments?" This study presents the procedures and results of a cost-benefit analysis of Virginia EFNEP to measure the economic efficiency of the program for the federal sponsors.

1.1 Organization of the report

The remainder of the report is presented in seven sections. Section 2.0 presents the study objectives. Section 3.0 describes the study perspective. Section 4.0 provides a description of Virginia EFNEP. Section 5.0 includes the methods used to conduct the CBA and section 6.0 presents the study results. Section 7.0 includes the results of various sensitivity analyses that were conducted. Finally, in section 8.0 discussion and conclusions are presented. At different points in the study, various decisions and assumptions needed to be made. These are included at the appropriate points in which they were made and are highlighted in *italics* (all decisions and assumptions made in the study are also included in Appendix A).

2.0 STUDY OBJECTIVES

1. Determine the study perspective.
2. Describe EFNEP and identify, through a literature review and review of selected state EFNEP programs (coordinated with the National Program Leader,

EFNEP and appropriate others), a list of benefits and costs associated with EFNEP.
3. Synthesize the identified benefits and costs associated with EFNEP, determine measures for them, share them nationally, and provide opportunity for input. As a result of this input, a set of benefits and costs and their measures will be determined for EFNEP.
4. Determine the analytic measure of the CBA for EFNEP and pilot test in Virginia.
5. Analyze results of the EFNEP CBA in Virginia and make revisions as necessary in the framework. Prepare a report to document process and outcomes.

3.0 STUDY PERSPECTIVE

The primary audiences of this CBA are federal and state decision-makers (i.e., program sponsors) who have responsibilities for weighing the costs of EFNEP to taxpayers against the benefits to program participants and society at large. This program sponsor perspective focuses on the objectives of the funding organization and is most appropriate when choices involve alternative programs under constrained budgets. From this perspective, costs for EFNEP are foregone opportunities to invest in other programs. Benefits are outcomes realized by society at large, for federal decision-makers, or by society within a specific state, for state decision-makers.

4.0 DESCRIPTION OF VIRGINIA EFNEP

A thorough description of the program, including objectives, delivery methods, and other pertinent information needs to be constructed prior to a CBA. In this way, a complete picture of the program and its benefits and the program features relevant to the decision-makers will be provided. The 1996 Virginia EFNEP program was selected for this study. A description of the program was compiled from state documents, including conversations with the Virginia state EFNEP coordinator.

DECISION: In discussions between VCE project staff and the National Program Leader, EFNEP, it was decided that this study would focus on the adult EFNEP because of the consistency in the curriculum and ERS data collected across state programs. While there is a youth EFNEP, behavioral data on the youth program are not routinely collected by all states.

Virginia adult EFNEP operated in 26 counties and cities during 1996. The counties were Amelia, Appomattox, Arlington, Bedford, Charlotte, Dickinson, Lancaster, Lee, Louisa, Mecklenberg, Pittsylvania, Pulaski, Russell, Scott, Smyth, Suffolk, Tazewell, Washington, and Wise. The cities were Chesapeake, Hampton, Newport News, Norfolk, Roanoke, Richmond, and Virginia Beach. Of the 26 EFNEP units, seven are primarily in urban areas and 19 are primarily rural.

4.1 Characteristics of EFNEP participants

EFNEP is primarily targeted to low-income homemakers (i.e., families with incomes at 150% of poverty or below). Investigations of EFNEP enrollees conducted over the past years have indicated that the homemakers were from the poorest sector of society, were of minority or ethnic backgrounds, had limited education, and were considered culturally, socially, and geographically isolated. The food stamp population is also at risk for poor health. Specifically related to nutrition risk factors, this population has a tendency towards poor diet and inadequate nutrition. Food stamp recipients tend to have a low consumption of fruits, vegetables, and milk. They generally have a poor nutrient intake and eat foods high in fat (Cox, 1991).

The demographics of a typical EFNEP target population can be described with the help of the 1996 EFNEP state annual report (Department of Human Nutrition, Foods, and Exercise, 1996). Seventy percent of the families were in the Supplemental Nutrition Program for Women, Infants and Children (WIC) and 53% received food stamps. Almost all homemakers were female (96%). The remaining 4% were male. Forty-six percent were African-Americans, 48% were white, 4% were Hispanic, and 2% were Asian or Pacific Islanders. The average age of the homemakers was 23 years old. Seventeen percent of the homemakers were teenagers (aged 19 years and under). Sixteen percent of the EFNEP homemakers were pregnant or breast-feeding. Of these homemakers, 50% were 20 years old and over; 50% were younger than 20 years old. The above description fits a typical EFNEP population year after year and hence can be used to describe the EFNEP target population in Virginia.

4.2 Program objectives and content

Alleviating hunger as a national priority has gained and lost public and governmental support many times in recent American history. In the late 1960s, much

federal attention was given to the alarming incidence of hunger and malnutrition. The media constantly featured hunger and poverty and in this atmosphere of concern, EFNEP was created. In 1967 and 1968, several national task forces were formed to examine issues of formulation, development, guidelines, and evaluation systems for a national nutrition education program. In November 1968, USDA provided a ten million-dollar grant to the Cooperative Extension System to initiate EFNEP.

The focus of EFNEP is nutrition education. The goal of the program is to assist limited resource audiences in acquiring the knowledge, skills, attitudes, and changed behaviors necessary for nutritionally sound diets, and to contribute to their personal development and the improvement of the total family diet and nutritional well-being (Chipman and Kendall, 1989).

EFNEP is a unique program funded through the USDA, CSREES that is operated by land grant universities in every state, and in American Samoa, Guam, Micronesia, Northern Marinas, Puerto Rico, and the Virgin Islands. The federal appropriation to support EFNEP in fiscal year 1996 was $61,431,000. The federal allocation to the states represents 58% of the total funds supporting EFNEP; the remaining comes from the state and county government funds or other sources. USDA retains only .42% of the federal appropriation for oversight of the program (Ely, 1995).

EFNEP targets two primary audiences: low-income families with young children and low-income youth. EFNEP participants may also be recipients of food stamps or other forms of government food assistance, and may also participate in the WIC program. The original philosophy of EFNEP was based on three concepts: a) that an existing home economics program can be modified to effectively reach low-income audiences, b) professional home economists can teach and supervise paraprofessionals who, in turn, teach low-income homemakers, and c) that a nutrition education program tailored to the needs, interests, competencies, and economic and education levels of low-income families, and delivered by paraprofessionals who are indigenous to the target audience, can convince participants' to change their eating habits. The objectives of EFNEP are as follows:

1) To improve diets and nutritional welfare for the whole family.
2) To increase knowledge of the essentials of human nutrition.
3) To increase the ability to select and buy food that satisfies nutritional needs.
4) To improve practices in food production, storage, preparation, safety, and sanitation.
5) To increase ability to manage food budgets and related resources such as food stamps.

A national food and nutrition education curriculum for youth and adults was developed under a cooperative agreement between Extension Service, USDA and the Michigan Cooperative Extension Service. The "Eating Right is Basic, 3rd edition" (ERIB 3) is the primary curriculum currently being used in Virginia for the adult phase of the program (Coleman, 1995; Cox, 1991). Eating Right is Basic is designed to teach individuals or small groups of individuals with low incomes how to choose and prepare healthy meals. Lessons cover basic nutrition, food resource management, food safety, and food preparation.

The information in the lessons is based on current food recommendations of USDA, the Food and Drug Administration (FDA), and other recognized national organizations. The lessons incorporate the USDA Food Guide Pyramid, Food and Drug Administration and USDA food labeling regulations, and USDA/ Department of Health and Human Services Dietary Guidelines for Americans.

Eating Right is Basic lessons are appropriate for a diverse audience, especially low literacy adults. Most lessons include "Going Further" and "Information for Instructor." "Going Further" information is included after the basic lesson text and provides ideas to expand the basic lesson and/or to meet individual participant needs. For example, in the Food Guide Pyramid lesson, "Going Further" states why smokers need more vitamin C. This information is not necessarily taught to all participants.

The curriculum lessons are available in the form of 16 flip charts and a set of videotapes. The flip chart lessons are typically used with individuals or small groups. For larger groups, the videotapes are recommended.

The first set of lessons in the curriculum, beginning with "Introducing Eating Right is Basic" and continuing through "Keeping Food Safe," provides the core information for the curriculum. The lessons on each of the food groups reinforce and build on these core lessons. The last of the lessons, beginning with "Breakfast—A Healthy Way to Start the Day" and continuing through "Eating Right and Light," may not be necessary for all participants.

The lessons included in the curriculum are as follows:

- Introducing Eating Right is Basic, starting with the Basics—Food, Equipment, and Knowledge
- The Food Guide Pyramid
- Understanding Food Labels
- Planning Makes a Difference
- Making the Most of Your Food Dollars
- Keeping Food Safe

- The Bread, Cereal, Rice, and Pasta Group
- The Vegetable Group
- The Fruit Group
- The Milk, Yogurt, and Cheese Group
- The Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts Group
- Breakfast—A Healthy Way to Start the Day; Choosing Healthy Snacks
- Eating Right for Two
- Feeding Your New Baby (0-4 months)
- Feeding Infants (4-12 months) and Children
- Eating Right and Light

4.3 Program delivery

Face-to-face, one-on-one instruction was the teaching method used almost exclusively during the first 10 years of EFNEP. However, because of the high cost and time of individualized teaching, small group teaching was recommended as an effective alternative and is currently the predominant method used in Virginia.

The delivery of EFNEP subject matter is conducted by paid paraprofessionals (program assistants) and volunteers who typically reside in the communities of the target populations. These staff are trained and supervised by Cooperative Extension professionals. Methods used in delivering the adult component include teaching homemakers of limited resource families on a one-to-one basis or in small neighborhood groups. In Virginia, each family may stay enrolled in the program for a maximum of 12 months, though some states use a shorter enrollment period.

4.4 Assessment of food-related behavior change in EFNEP

Throughout its history, change in food-related behavior has been a focus of impact assessment in EFNEP. Behavior change has been documented through an EFNEP Family Record that includes two assessment instruments: 1) a 24-hour food recall and 2) a food practice checklist (FPC). The 24-hour food recall methodology has remained essentially the same over the years, while the FPC has changed considerably regarding the number of checklist items and the specific behaviors measured by those items. The first national EFNEP FPC, developed in 1974 by Synetics Corporation, assessed 70 behaviors. The items were hand-scored by EFNEP paraprofessionals and a total score was determined for each homemaker at pre and post intervention (Del Tredici, Joy, Omelich, and Laughlin, 1988).

In 1993, a new computerized EFNEP Evaluation/Reporting System (ERS) was implemented nationwide. This system allows for summary results of the behavior changes in participants at the local (county/unit), state, and national levels. The system provides a variety of summary reports that are useful for management purposes and for assessment of individual participant needs. Among other features, this data system has a dietary analysis component for adult participants that provides information on the actual nutrient content of diets and how well the diets meet the national dietary recommendations. The printed reports on assessment of eating habits were designed to be shared with participants and to encourage adoption of recommended practices. Behaviors assessed by the ERS can be placed in the domains of improved nutrition, food selection and preparation methods, food handling practices, resource management, and food safety.

The FPC, administered at program entry and exit, is both efficient and effective. It streamlines the processes of administration, data collection, and data processing, while effectively assessing behaviors and perceptions that go beyond the limits of the 24-hour food recall. Comparing the data from entry to exit shows the changes that occur during the participant's enrollment, thereby strengthening the evidence of EFNEP's impact. An additional benefit of the pre and post method is the built-in assessment of the participant's educational needs.

Documented behavioral changes in the 1996 Annual Report of Virginia EFNEP are a good example of EFNEP impacts. A total of 3,100 people graduated from the program and completed both an entry and exit 24-hour food recall, which assessed intake of the food groups of the Food Guide Pyramid (FGP) and several key nutrients. Regarding improved intake of nutritious foods, the average number of servings consumed increased from entry to exit for all five of the basic food groups (breads/cereals, fruits, vegetables, calcium/dairy, and meat/alternates). About 93% of all homemakers showed some positive change in food intake from entry to exit recall (Department of Human Nutrition, Foods, and Exercise, 1996).

From the Virginia 1996 FPC, the percent of homemakers demonstrating improved behaviors was high. Over 70% of the homemakers made improvements in the 12 basic food-related behaviors taught in EFNEP and assessed by the FPC. As a result of the improvements in nutrition-related behaviors, it could be expected that better health would result and there would be a saving in health care cost in future years (Department of Human Nutrition, Foods, and Exercise, 1996).

4.4.1 Retention of food-related behavior change in EFNEP

Within the past decade, studies have been conducted that address the impact of EFNEP on low-income homemakers six months to five years after program completion (Del Tredici et al., 1988; Brink and Sobal, 1994; Torisky et al., 1989; Nierman, 1986). These studies assessed whether or not the graduates maintained dietary improvement after leaving the program. Overall results showed that dietary regression did not occur when the homemakers were out of the program and that they maintained significantly positive scores in consumption of the basic four food groups as well as positive food related practices (Torisky et al., 1989). The most significant results were noted in Michigan, where Nierman (1986) found that EFNEP graduates posted higher scores on food and nutrition knowledge and practice five years after graduating from EFNEP.

DECISION: In discussions between VCE project staff and the National Program Leader, EFNEP, it was determined that for the purpose of this study, data for the CBA would be limited to that which was collected in the ERS for Virginia in 1996. This would enable us to determine if the ERS provides the data for an appropriate CBA of EFNEP.

5.0 METHODS

5.1 Benefits and costs

A meaningful CBA requires a comprehensive list of program benefits and costs. These lists can be constructed using a number of different sources. Sources of benefits and costs include the program description, professional literature dealing with similar programs and problems, economic theory, introspection, and scenarios developed in the initial phase of the analysis (Sassone and Schaffer, 1978). It is important, however, that the list of program benefits and costs be compiled with the active input of both those who have responsibility for programming and with the aid of the decision-maker for whom the study is being conducted.

Benefits can be defined as all positive outcomes or consequences that result from actions of the program. **Direct benefits** are the primary positive outcomes or consequences of the program that accrue to participants and others directly involved in the program. They are typically derived from program objectives.

Indirect benefits are the secondary outcomes or consequences of the program. They may accrue to program participants, program non-participants, or society in general. Also known as externalities or spillovers, indirect benefits may be positive or negative. In addition, if the target program encourages participation in another publicly offered service, then this effect may be considered a benefit from the perspective of the clientele or program sponsor.

Costs can be defined as the value of the resources that must be used to develop, implement, and operate the program being analyzed. **Direct costs** are the resources budgeted for or assigned to the program. Examples of direct costs include personnel, facilities, equipment and materials, and other costs. Personnel costs include all of the human resources required for the program and encompass such items as salaries and fringe benefits for specialists, managers, clerical and secretarial staff, and paraprofessionals. Facilities refer to the physical space required for the program. Equipment and materials are furnishings, instructional equipment, and materials that are used for the program, whether covered by project expenditures or donated by other entities. Other costs refer to all other items that do not readily fit into the above categories (e.g., travel, cost of training sessions, etc.) (Levin, 1983).

Indirect costs are resources not actually budgeted for or assigned to the program, but nonetheless represent a withdrawal of resources from the economy that allow the program to operate. Examples include time lost from work by recipients while participating in a program, child-care costs, and increased expenditures for foods or medication. Indirect costs are often distinguishable as being borne by the recipient of the program and as such they may represent opportunity costs (i.e., resources that could be expended on other things) to the individual.

There are many ways to measure costs and benefits. Costs are usually straightforward; benefits are more complex. Those that can easily be monetized (valued in dollars) are referred to as **tangible**; those that cannot easily be monetized are referred to as **intangible**. The time horizons over which costs and benefits have occurred or are expected to occur also need to be indicated.

5.1.1 Tangible benefits and costs

Price is a fundamental variable in economics and, when determined by individuals actively trading in a fully competitive market, should represent the value society places on a particular item. In CBA, many direct benefits and costs will have competitive (or near competitive), non-biased market prices by which they can be valued. For example, if a program benefit is a

change in an individual's food purchasing patterns, then that benefit can be valued as the money saved from the new mix of foods purchased. If a cost to the program is the support provided by agency staff, then that cost can be valued as the salary and fringe benefits the sponsor must pay to have them work on the program being studied. In addition, if a comparable good or service is available in the private sector, such as a workshop similar in content to an Extension program, the minimum benefit of the Extension program may be valued as the registration cost (market price) of the private sector program.

5.1.2 Intangible benefits and costs

Direct and indirect costs and benefits that cannot be monetized need to be examined and appropriate measures determined for those that will be included in the study. It is suggested that measures of intangible costs and benefits be included in the analysis. However, comparing these benefits to tangible costs is not advocated. In short, they are included in the results with the expectation that the decision-maker will intuitively place them in their appropriate perspective in relation to the analytic measure selected for the study. Sassone and Schaffer (1978:35) addressed this issue when they stated:

"When decision-makers choose between alternatives, they implicitly value the incommensurables [primarily intangible benefits]; analysts simply face the problem of having no generally accepted procedure for quantitatively integrating these terms into their analyses and of presenting an analysis with marred neatness."

Intangible costs and benefits, especially benefits, can be measured more directly, without the added step of monetizing them. Examples include knowledge gained, attitudes changed, skills acquired, practices adopted, and individual and societal end results.

5.2 Benefits and costs of EFNEP

Scientific evidence suggests that diet plays an important role in the onset of chronic disease and other health conditions, contributing to increased illness, reduced quality of life, and premature death. Although there is still much that scientists do not know about how diets affect health, there is significant agreement on the components of a healthy diet. In particular, diets high in calories, fat, saturated fat, cholesterol, and salt, and low in fiber containing foods (such as fruits, vegetables, and whole grain products) are associated with increased risk for coronary heart disease, certain types of cancers, strokes, and diabetes. Diet also plays a role in other health conditions such as obesity, hypertension, osteoporosis, and problem pregnancy (pre, peri, and postnatal). Taken together, these health conditions cost society an estimated $250 billion each year in medical charges and lost productivity (Frazao, 1996).

The extent to which these costs might be delayed, avoided, or reduced by an improved diet cannot be calculated precisely, but some researchers estimate that proper diet might forestall at least 20% of the annual deaths from heart disease, cancer, stroke, and diabetes (Frazao, 1996). Dietary factors or sedentary life styles are associated with most deaths due to chronic disease. Because of the complexity of the issues and the difficulty of the analyses relating diet and activity patterns to disease outcomes, a conservative approach was adopted in the study. Estimates were often limited by the inadequacy of information regarding disease prevalence and the nature of the relationship to other contributing risk factors for the disease.

A list of benefits and costs associated with EFNEP were prepared by VCE project staff based on information collected from the program description and nutrition related literature (Tables 1, 2, and 3). From a benefit perspective, this list included: 1) direct benefits associated with EFNEP as they related to appropriate nutrition-related diseases that would be affected (i.e., delayed or avoided) through associated behaviors taught and measured in EFNEP, and 2) indirect benefits that would accrue to EFNEP participants through their participation in the program.

Table 1. Direct EFNEP benefits

Disease/ condition	Associated behavior taught/ measured in EFNEP
Heart Disease	• Decreased intake of sodium/salt • Prepare food with less fat, less salt • Decreased fat intake • Increased intake of complex carbohydrates, fiber, fruits, vegetables • Using food labels to select foods • Planning meals around the Food Guide Pyramid (FGP) and Dietary Guidelines (DG) • Reduce/control weight • Increased physical activity
Stroke and Hypertension	• Prepare/serve food with less salt • Using food labels to select food • Meal planning around DG • Reduce/control weight • Increased physical activity
Cancer (primarily orectal)	• Increased intake of fiber, complex carbohydrates, vegetables, and fruits, vitamins A and C, and calcium

Disease/ condition	Associated behavior taught/ measured in EFNEP
	• Decreased fat intake • Meal planning around FGP & DG • Food selection and preparation (to reduce fat and carcinogens such as benzopyrene)
Osteoporosis	• Increased intake of milk products and calcium-rich foods • Food selection around FGP • Increased physical activity
Foodborne illness	• Food safety techniques • Kitchen sanitation • Proper food storage • Use of recommended food preservation methods • Safe thawing practices • Safe cooking and handling of meats and eggs • Safety methods for carried meals (lunch, picnics, etc.)
Anemia	• Increased intake of iron • Adequate intake of vitamin C, A and protein • Adequate food intake in pregnancy, infancy, childhood • Use of recommended infant feeding practices • Breastfeeding
Obesity	• Increased intake of fiber, complex carbohydrate, fruits and vegetables • Decreased fat and calories • Use of sound weight control methods • Increased physical activity • Decreased intake of fats and sweets group • Food preparation to reduce fat and calories • Using food labels to select food
Type 2 diabetes	• Increased intake of fiber, vegetables, and fruits • Decreased intake of fats and sweets group • Weight control • Increased physical activity • Plan foods around FGP and DGs (based on recommendation of physician/dietitian) • Using food labels to select food
Low-birth-weight (LBW) and other aspects of infant health	• Planning meals around FGP and other recommendations in pregnancy • Optimum use of WIC foods • Proper infant feeding/breastfeeding • Following other recommendations in pregnancy and infancy • Appropriate weight gain in pregnancy and infancy
Dental disease and problems	• Decreased intake of fats and sweets group • Providing nutritious snacks • Adequate milk and calcium intake • Planning meals around FGP • Breastfeeding
Reduced food costs (coupled with increased nutrient intake)	• Meal planning • Food buying, food resource management • Food storage and preservation (prevent food loss and spoilage) • Home gardening skills • Reduced eating of fast foods and convenience store items
Food production and preservation	• Gardening skills • Food storage and preservation skills
Job readiness and performance	• Better nutrition leading to better health of adult and dependent children • Reduced absences from work and school • Increased stamina and ability to perform work • Food safety practices leading to reduced illness • Food resource management • Better nutrition and eating breakfast, leads to improved school performance • Improved job performance (improved job security)

Table 2. Indirect EFNEP benefits

Quality of life	• Providing nutritious, appealing meals leading to better health, increased energy and stamina, and less illness • Increased feeling of control over resources, finances, and life • Increased enjoyment in meals and snacks • Improved home environment • Better use of resources or increased resources
Improved self-image	• Improved stamina and feeling of well-being • Improved appearance due to weight control and better nutrition • Friendship and caring of paraprofessional • Reduced loneliness and frustration

continued on next page

	• Increased motivation, knowledge, and skill for getting job, going back to school, or taking other steps • Gaining control over food intake and costs may lead to control over other segments of life

Table 3. Direct EFNEP costs

1. Personnel cost (salaries, wages, benefits)
2. Office space of state and local staff
3. Equipment, office supplies, education materials, demonstration supplies
4. Cost of travel
5. Cost of support staff
• administration
• secretarial
• computer support
6. Training costs
• Training of supervisors and state personnel
• Training of staff

This information was shared nationally by posting the benefits and costs on an Internet web site. An announcement was sent to all state EFNEP coordinators encouraging them to review the web site and to send comments and suggestions to the national study team. All comments received were reviewed and addressed accordingly.

5.3 Monetizing EFNEP benefits

For this study, tangible benefits (i.e., benefits that can be easily monitized) of EFNEP accruing to graduating program participants were characterized in two ways:

1. The benefit of avoiding or delaying the health care costs associated with treating nutrition-related diseases/conditions associated with EFNEP. Treating a disease represents a cost. If that cost can be avoided or delayed, this represents a benefit (i.e., costs that are never incurred; costs that are delayed into the future).

DECISION: In discussions between VCE project staff and the National Program Leader, EFNEP, it was decided that other direct benefits identified, such as reduced food costs, food production and preservation, and job readiness and performance would not be included in the tangible benefit calculations because these data are not consistently or routinely collected across states in the EFNEP ERS.

2. Avoiding or delaying the loss of productivity from morbidity (i.e., earnings foregone from lost workdays) related to nutrition-related diseases/conditions associated with EFNEP. Productivity, or personal earnings, is jeopardized if a person becomes ill and cannot work and therefore cannot earn income. Avoiding or delaying onset of a disease becomes a benefit by increasing the person's productivity/earning potential (called human capital).

For this study, Item 1 above was considered the direct tangible benefit of participation in EFNEP. Item 2 was considered the indirect tangible benefit. Indirect tangible benefits were not included in the initial listing of benefits circulated for national review and were added later.

In addition, there are many intangible benefits (i.e., those that cannot be easily monitized) that accrue to EFNEP participants. These benefits include the avoidance or delay of pain, suffering, discomfort, and grief associated with diet-related diseases and conditions (Disbrow and Bertram, 1984). Other intangible benefits include increased energy, enjoyment of meals, increased self-control, better use of nutrition-related resources, increased quality of life, and increased self-image.

DECISION: In discussions between VCE project staff and the National Program Leader, EFNEP, it was decided that intangible benefits would not be included in the study because they are difficult to monetize and these data are not routinely collected in the EFNEP ERS.

DECISION: The approach taken to monetizing benefits of EFNEP for this study was to characterize the benefits as the health care costs that were either delayed or avoided from practicing appropriate nutritional behaviors as a result of participating in EFNEP. Therefore, the benefits could be valued in dollars by their non-biased market prices (i.e., the cost of medical care associated with the disease or condition either delayed or avoided).

5.3.1 The approach for monetizing tangible benefits

Tangible benefits from EFNEP are equal to the present value of the estimated treatment and morbidity costs saved by avoiding or delaying onset of a disease or condition. The determination of treatment costs to use in the study was based on published results for the most common treatment costs avoided or delayed for each disease/condition. Present value is the value of the benefits over time (in the future) discounted to today's dollars. In short, delaying costs into the future represents a benefit because a dollar is worth more today (or sooner) than at some future time (see Section 5.5.1 for a detailed explanation of discounting). The diseases and conditions were separated into three

categories, or types, for the study.

Type A diseases/conditions (colorectal cancer, heart disease, stroke, hypertension) - Scientific evidence suggests that these diseases/conditions are related to nutrition and can be positively affected through practicing appropriate nutritional behaviors. Because these diseases/conditions are considered to be life threatening, the approach taken to calculating these tangible benefits was to assume that their onset could be delayed through practicing appropriate nutritional behaviors. When delayed, the direct tangible benefit is the present value of delaying the cost of treatment into the future. The total treatment cost used is the average number of years of survival after treatment for the disease/condition. The indirect tangible benefit is the difference in the present value of delaying morbidity costs into the future.[1] For the purpose of this study, the time period selected for delaying each of the Type A diseases/conditions was five years.

Illustration: For direct tangible benefits, if the average onset of the disease/condition is at age 55 and its onset can be delayed for five years until age 60, then the benefit is the difference in the present value of delaying the treatment costs until age 60 rather than at age 55.

For indirect tangible benefits, if the average onset of the disease/condition is at age 55 and its onset can be delayed for five years until age 60, then the benefit is the difference in the present value of delaying earnings foregone from lost work days until age 60 rather than at age 55.

Type B diseases/conditions [osteoporosis, Type 2 diabetes, obesity, commonly occurring infant diseases (i.e., otitis media, respiratory infections, viral infections, gastroenteritis), foodborne illness[2]] - Scientific evidence suggests that these diseases/conditions are also related to nutrition and can be positively affected through practicing appropriate nutritional behaviors. Because these diseases/conditions are not considered to be life threatening, the approach taken to calculating these tangible benefits was to assume that their treatment costs could be avoided through practicing appropriate nutritional behaviors. When avoided, the direct tangible benefit is the present value of the avoided treatment costs from average age of onset of the disease/condition through the average lifespan.[3] The indirect tangible benefit is the present value of morbidity costs avoided from average onset of the disease through the average age of retirement (65 years).

Illustration: For direct tangible benefits, if the average onset of the disease/condition is at age 30, then the benefit is the present value of the treatment costs avoided for the remainder of the participant's lifespan (48 years).

For indirect tangible benefits, if the average onset of the disease/condition is at age 30, the benefit is the present value of earnings foregone resulting from lost workdays from age 30 until 65 (the average age of retirement).

ASSUMPTIONS: There were three critical assumptions that were made in deriving the benefits for Type A and B diseases/conditions:

1) Benefits for Type A diseases/conditions were based upon delaying onset of the disease/condition for a minimum of five years and benefits for Type B diseases/conditions were based upon avoiding the disease/condition for the duration of the participant's natural and working life. These assumptions were made based upon the expert opinion of the project staff.

2) Monetized benefits would only be calculated for EFNEP participants (low-income homemakers) practicing optimal nutritional behaviors (defined below) upon graduating from the program. While we know that benefits would also spillover to the families, there was no way to accurately calculate this from ERS data.

3) Selected EFNEP graduates practicing optimal nutritional behaviors upon graduation would continue to practice the nutritional behaviors acquired in EFNEP for the remainder of their lives. As noted above, studies within the past decade have shown that regression did not occur when EFNEP graduates were out of the program and that they maintained significantly positive behaviors in consumption of the basic four food groups as well as food related behaviors. For the purpose of the study, however, only EFNEP graduates who met very stringent criteria for practicing optimal nutritional behaviors were selected for calculation of benefits (see below).

Type C condition (low-birth-weight (LBW) in-

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1 Because these diseases/conditions are considered life threatening, another approach to monetizing indirect benefits would be to assume that by delaying onset, mortality is delayed. Therefore, the indirect benefit would be the present value of the additional years of earnings accrued after onset of the disease. Lewis (1998) took this approach to monetizing indirect benefits of EFNEP.

2 For obesity and diabetes, the treatment costs attributed to Type A diseases/conditions were factored out of the benefits for these diseases/conditions.

3 Because the majority of EFNEP participants are women, the average lifespan for women was used. According to data from the Centers for Disease Control (1997) this was 78 years.

fants) – This condition differs from Type A and B diseases/conditions because treatment costs are incurred on a one-time basis (when the child is born). The direct benefit is based on avoiding the treatment costs associated with a LBW infant. This benefit is the present value of the treatment costs avoided. It was calculated on the number of EFNEP graduates indicating they are pregnant. It was not discounted because it would have occurred in less than one year of graduating from the program. It should be noted that the benefits of avoiding LBW infants extend beyond the neonatal period (e.g., the avoidance of learning disabilities, attention deficit syndrome, etc). These were not included in the direct benefit calculations.

5.3.2 The formula for monetizing tangible benefits

The following formula was used to derive the direct and indirect tangible benefits from EFNEP per disease/condition:

BENEFIT = ([A] Annual number of graduates in EFNEP x [B] Incidence rate of the disease/condition in the low-income population x [C] Incidence of the disease/condition related to diet x [D] Percent of graduates practicing optimal nutritional behaviors related to avoiding or delaying the disease/condition) x [E] Present value of appropriate benefits for the disease/condition.

Variables A through D are used to derive the number of people who will either avoid or delay onset of the disease/condition.

Example: Disease X

[A] Annual number of graduates in EFNEP: 3,100
(EFNEP participants who complete an entry and exit questionnaire)

[B] Incidence rate of the disease/condition in the low income population: 10% or 310
(There is a probability that 10% of the graduates would get the disease/condition — 310 is 10% of the 3,100 EFNEP graduates)

[C] Incidence of the disease/condition related to diet: 25% or 77
(There is a probability that 25% of the people who get the disease/condition could affect it through controlling specific diet related behaviors — 77 is 25% of the 310 who would get the disease/condition)

[D] Percent of EFNEP graduates practicing optimal nutritional behaviors related to the disease/condition: 5% or 4
(5% of the graduates are practicing optimal nutritional behaviors related to the disease/condition, as measured by entry and exit FPC scores and 24-hour food recall intake, such that they will either avoid or delay onset of the disease/condition – 4 is 5% of the 77 who could affect it through diet related behaviors)

[E] Present value of appropriate benefits for Disease X: $3,000

BENEFIT = 4 x $3,000 = $12,000 for Disease X

The annual number of graduates in EFNEP is the number of participants who complete a pre and post 24-hour food recall and FPC. The incidence rate of the disease/condition in the population is the estimated percent of people who would get the disease/condition regardless of other factors. Where available, incidence rates of low-income populations were used (otherwise incidence rates for the general population were used). The incidence rate of the disease/condition related to diet is the probability (percent) to which the disease/condition could be affected through dietary related behaviors. The percent of EFNEP graduates practicing optimal nutritional behaviors related to the disease/condition are graduates meeting a specified set of criteria generated from ERS data, which included entry and exit FPC scores for certain questions and 24-hour food recall intake data (see below). The present value of the appropriate benefits for the disease is the cost of avoiding or delaying treatment discounted to 1996 dollars.

For Type A diseases/conditions, the calculations for the present value of benefits are:

Direct tangible benefits – (The cost of treatment per patient per year X the average number years of survival after treatment) discounted to 1996 dollars beginning with the average age of onset of the disease/condition - (The cost of treatment per patient per year X the average number years of survival after treatment) discounted to 1996 dollars beginning with the average age of onset of the disease/condition plus five years.

Indirect tangible benefits – (Morbidity costs per disease/condition per year X the average number of years of survival after treatment) discounted to 1996 dollars beginning with the average age of onset of the disease/condition - (Morbidity costs per disease/condition per year X the average number of years of survival after treatment) discounted to 1996 dollars beginning with the average age of onset of the disease/condition plus five years.

For Type B diseases/conditions, the calculations for the present value of benefits are:

Direct tangible benefits – The cost of treatment per patient per year discounted to 1996 dollars from age of onset through age 78.

Indirect tangible benefits – Morbidity costs per disease/condition per year discounted to 1996 dollars

from age of onset through age 65 (average retirement age).

For Type C diseases/conditions (i.e., LBW infants), the present value of the benefit is the non-discounted cost of avoiding this condition.

5.3.3 Monetizing direct tangible benefits

The cost of appropriate disease/condition treatment is documented from relevant scientific literature. Other data from the literature include the incidence of the disease in the U.S. population (in the low-income population, where available), the percentage of the disease attributable to diet, the average age of onset of the disease, and the average years of survival after treatment. Figures from the literature used for this study are provided in the tables and explanations below. All treatment costs of diseases/conditions included in this study have been compiled from Healthy People 2000 (U.S. Department of Health and Human Services, Public Health Service, 1990) unless referenced otherwise.

Type A Dieseases/Conditions (Table 4)

Colorectal cancer: Colorectal cancer is the second leading cause of death due to cancer in the U.S. According to Healthy People 2000, 15% of the population are likely to be affected by colorectal cancer. McGinnis and Foege (1993) established 35% as their best estimate for the proportion of all cancer deaths attributable to diet. The average age of onset for colorectal cancer is 36 (National Research Council, 1989). Even though incidence rates have increased, death rates due to colorectal cancer have decreased, with a current five-year survival period after diagnosis. Treatment costs associated with colorectal cancer are $28,000 per year (adjusted to $33,046 for this study).

Heart disease: According to the National Health Interview Survey (U.S. Bureau of the Census, 1994), the incidence rate of coronary heart disease (CHD) in the low-income population is 31.2%. This incidence rate was derived for the 45-64 age group. This age group was used because the average age of onset of CHD is within the specified age range. Approximately 22-30% of CHD deaths are due to dietary factors, especially increased consumption of cholesterol and saturated fat and a decreased consumption of fiber. For this study the average is utilized (26%). The average age of onset for CHD is 55 (Kris-Etherton and Kummer, 1993). Currently, an average of five years is associated with survival after critical heart attacks (National Research Council, 1989). According to the American Heart Association (1998), treatment costs per year for CHD (not including bypass surgery, which is estimated to cost $30,000) are $3,676 (adjusted to $3,517 for this study).

Stroke: Strokes affect over 600,000 people each year, while more than three million people suffer from stroke-related disabilities. Risk factors include a diet high in saturated fat and cholesterol, as well as obesity, diabetes, and hypertension. The incidence rate of stroke in the population is listed as 1.7%. This was derived by dividing the number of people suffering from stroke-related disabilities in the U.S. (three million) by the average U.S. population between 1990-94 (256 million). Information on the incidence rate of stroke related to diet was not available. The average age of onset for stroke is 45 (National Research Council, 1989). Under proper medical treatment and supervision, a 10-year survival period is the average among stroke victims (National Research Council, 1989). Treatment and rehabilitation due to stroke costs $22,000 per patient per year (adjusted to $23,002 for this study).

Hypertension: According to the National Health Interview Survey (U.S. Bureau of the Census, 1994), the incidence rate of hypertension in the low-income

Table 4. Type A diseases/conditions benefit calculation information

Disease/ Condition	Incidence rate in the population	Incidence rate related to diet	Average age of onset	Number of years onset delayed	Average years of survival after treatment	Cost of treatment per patient per year[4]
Colorectal cancer	15%	35%	36	5	5	$33,046
Heart disease	31.2%	26%	55	5	5	$3,517
Stroke	1.7%	Not available	45	5	10	$23,025
Hypertension	37.4%	45%	30	5	20	$364

4 Adjusted to 1996 dollars. See Appendix B for the procedure used to calculate adjusted costs for all diseases/conditions.

population is 37.4%. This incidence rate was derived for the 45-64 age group. This age group is used because it provides the most accurate probability of contracting hypertension. The incidence rate related to diet is between 29-60%. For this study, the average is utilized (45%). The average age of onset for hypertension is 30 (National Research Council, 1989). Improvements in the detection, treatment, and control of hypertension have contributed to an average of 20 years of survival from fatal conditions, after onset of chronic hypertension (National Research Council, 1989). Annual costs associated with hypertension were $348 per patient (adjusted to $364 for this study) (Frazao, 1996).

Type B Diseases/Conditions (Table 5)

Osteoporosis: Research suggests that among the dietary factors, calcium may play an important role in preventing or delaying the onset of osteoporosis. The incidence rate of osteoporosis in the population is 28%. This was derived by dividing the number of people affected in the U.S. (24 million) by the adult population ages 44 and over in 1995 (85,742,000). Information on the incidence rate of osteoporosis related to diet was not available. The development of osteoporosis is closely associated with bone mineral density and bone mass (Eisman, 1998). There is general agreement among researchers that the most important factors affecting bone mineral density and bone mass are genetics, diet, exercise, alcohol consumption, smoking, and estrogen levels (Eisman, 1998; Murphy, Khaw, May, and Compston, 1994; Wood and Fleet, 1998). Wide discrepancies in results have been reported from studies attempting to quantify the role each factor plays in the development of osteoporosis. Though there is strong agreement that dietary factors (e.g., intake of calcium, vitamin D, milk, caffeine, salt, phosphate, and other minerals) play a major role, researchers have not offered an estimate of the percentage of osteoporosis cases attributed to diet. Osteoporosis and osteoporosis-related fractures are commonly seen in women above 45 years of age (National Research Council, 1989). Medical costs per patient per year are approximately $11, 582 (adjusted to $11,827 for this study) (Barefield, 1996).

Type 2 diabetes: According to the National Health Interview Survey (U.S. Bureau of the Census, 1994), the incidence rate of Type 2 diabetes (also called non-insulin dependent diabetes) in the low-income population was 14.5%. This incidence rate was derived from the 45-64 age group. This age group was used because it provides the most accurate probability of contracting diabetes. Approximately 45% of the diagnosed cases are a result of a poor diet, inactivity, and obesity. Most people with diabetes have Type 2 diabetes that usually appears after the age of 40. The annual cost of Type 2 diabetes is $5,625 per person (adjusted to $6,182 for this study). This figure was derived by dividing the annual direct cost of diabetes in the U.S. in 1995 by the eight million patients treated in 1995 (National Institute of Diabetes and Digestive and Kidney Diseases, 1995).

Obesity: Data from the Third National Health and Examination Survey reveal that the prevalence of obesity in the U.S. populations is increasing, with 37% of low-income women 20 years and older being classified as obese. Although many factors may contribute to obesity (e.g., genetics, hormonal abnormalities, medications, physical activity, and diet), the increased prevalence is generally attributed to a rise in caloric intake coupled with a sedentary lifestyle (Kuczmarski, Flegal, Campbell, and Johnson, 1994). It is generally agreed that successful reduction of obesity requires the combination of a balanced diet (i.e., increased intake of fiber, vegetables and fruits, and decreased intake of fat, refined carbohydrates, and total energy) with increased physical activity and behavior modification (National, Heart, Lung, and Blood Institute, 1998). Weight control lessons commonly taught in EFNEP emphasize both dietary changes and increased physical activity.

Table 5. Type B diseases/conditions benefit calculation information

Disease/condition	Incidence rate in the population	Incidence rate related to diet	Average age of onset	Cost of treatment per patient per year[5]
Osteoporosis	28%	Not available	45	$11,828
Type 2 diabetes	14.5%	45%	40	$6,182
Obesity	37%	50%	23	$625
Foodborne illness	2.8%	100%	23	$1,009
Commonly occurring infant diseases	100%	Not available	0-1	$1,537

5 Adjusted to 1996 dollars. See Appendix B for the procedure used to calculate adjusted costs for all diseases/conditions.

For purposes of this study, it was assumed that dietary factors and low physical activity are the major contributors to obesity and are equally important. Thus, calculations were based on the estimate that 50% of obesity cases were attributed to diet. Regarding cost of obesity, only the cost of weight reduction programs, products, and services were included (e.g., diet foods, appetite suppressants, other weight-loss drugs/aids, and educational or behavioral modification programs). Costs of certain obesity-related chronic diseases were not included as those were already included elsewhere (i.e., with costs of cancer, CHD, hypertension, etc.). The estimated cost of weight-control products, programs, and services was $569 per person (adjusted to $625 for this study). This was derived by dividing the annual cost of weight control products/services ($33 billion) by the 58 million obese adults who may have used these products/services in 1996 (National Institute of Diabetes and Digestive and Kidney Diseases, 1996).

Foodborne illness: The estimated annual costs of foodborne illnesses to society would increase considerably if the total number of episodes experienced by each individual for each foodborne pathogen were available for the study. However, it has been estimated that about 2.8% of the population are affected by foodborne illnesses each year (Buzby, Roberts, Lin, and MacDonald, 1996). This represents only seven out of 40 pathogens. Therefore, this incidence rate is most likely under estimated. The incidence rate was derived by dividing the number of people affected in the U.S. (7,130,767) by the average U.S. population between 1990-94 (256 million). Because foodborne illness is related to diet through food preparation and handling practices and the homemaker is susceptible at any time, the incidence rate used related to diet was 100% (no adjustment was made for meals eaten away from home, e.g., in restaurants). The average age of onset used was 23 (average age of the EFNEP homemaker). Cost per person per year is the total costs for foodborne illness in the U.S. ($6.7 billion) divided by the number of cases in 1993 (7,130,767). This was calculated to be $942 per person per year (adjusted to $1,009 for this study).

Commonly occurring infant diseases: The incidence rate in the population was assumed to be 100% because virtually all infants experience these conditions (i.e., otitis media, gastroenteritis, and viral infections). While breast-feeding has been shown to lower infant mortality as well the incidence of certain frequently occurring childhood diseases/conditions, research to suggest the incidence rate related to diet was not available. Because the benefits accrue within the optimum time of breast-feeding, the average age of onset is in the first year of the infant's life (0-1 year). Kaiser Permanente, in research to determine the benefits of sponsoring an official lactation program, calculated the additional cost of illness among bottle-fed over breast-fed babies in the first year of life as $1,435 (adjusted to $1,537 for this study) (Bailey and Deck, 1993).

For Type C conditions, *LBW infants*, maternal age, high parity, poor reproductive history, low socioeconomic status, and poor maternal nutritional status are among the chief factors responsible for LBW infants. An expectant mother with no prenatal care is three times more likely to have a LBW infant. Studies have proven that adequate nutritional care of high-risk groups, namely adolescents and poor women, is likely to result in the birth of a normal weight baby. The incidence rate of LBW infants in the U.S. is 7.3% (National Center for Health Statistics, 1993). Because of the importance of adequate nutritional care in pregnancy, the incidence rate used for this condition related to diet was 100%. The average onset of this condition is one year (for graduates who were pregnant during their participation in EFNEP). Costs associated with neonatal intensive care for a LBW baby is estimated to be $30,000 (adjusted to $35,406 for this study) (Hori, 1992).

5.3.4 Monetizing indirect tangible benefits

The human capital approach was taken to monetize indirect tangible benefits from EFNEP. The human capital approach views the value of personal health benefits as the economic productivity they permit to take place. That is, by avoiding a fatal or debilitating illness, a program allows individuals to remain productively employed in the labor market. The value of their economic contribution, measured as earnings, constitutes the value of avoiding work loss. In essence, the human being is viewed as a capital investment, the sole purpose of which is economically productive output. This indirect benefit is added to health care resource savings to determine total benefits (Warner and Luce, 1982).

The steps in the human capital approach are straightforward, though not devoid of assumptions and occasional rough estimates. First, analysts take the average age at which people die or are disabled by a certain disease and compute what their expected future income would have been if they had lived and remained productive to a normal term. This future income is discounted, since a dollar received today can be invested and is thus worth more than a dollar received in future years (Rhoads, 1980). The value of work loss (i.e., wages foregone) is a function of age, sex, race, and occupation (Schmid, 1989). Appropriate wage rates, reflecting the value of productivity, are

applied to the hours of work loss in each group and summed. For those groups lacking a market wage, values are imputed from related market data—for example, the wage rates for housecleaners are applied to hours spent by homemakers working in their own homes as full-time homemakers (Warner and Luce, 1982).

Assumptions in the human capital approach include: 1) If participants in the program avoid a certain disease, they will live to average life expectancy and 2) individuals will be in the labor force and productive during their expected lifetime in accordance with the current pattern of the labor force participation for his sex, ethnicity, and educational level. (Rhoads, 1980).

For type A and B diseases/conditions, indirect benefits were calculated based on the earnings foregone due to lost workdays (i.e., morbidity). These diseases/conditions can be delayed or avoided by following the dietary behaviors promoted in EFNEP. When delayed (Type A diseases/conditions), the benefit is the difference in the present value of delaying morbidity costs five years into the future. When avoided (Type B diseases/conditions), the benefit is the net present value of the earnings foregone each year through lost work days from onset of the disease to retirement. The cost of morbidity per disease/condition is a function of the wage rate, average number of lost workdays, and number of hours in the workday. The formula used to calculate the morbidity cost is: wage rate X average numbers of lost workdays X number of hours in the workday.

For the most part, EFNEP graduates are homemakers and are not employed in the job market. This is beginning to change as a result of welfare reform, but many of the jobs available are low paying ones in the service industry. For this study, the wage rate for a household worker was utilized as the appropriate value of their productivity (rather than market wages). According to the Bureau of Labor Statistics (1998), earnings for household workers vary from about $10 per hour or more in large cities to less than minimum wage (i.e., $5.15 per hour) in some rural areas (Bureau of Labor Statistics, 1998). An hourly wage rate of $7.60 was used in this study. This wage rate is the average based on the above information.

An individual's average annual earnings should be increased to reflect gains in labor productivity. Labor productivity is the amount of output generated per unit of labor input. It is an understatement of lifetime earnings to assume that a person 10 years from now will earn the same amount as a person of the same age, sex, ethnicity, and educational level earns today. To adjust for the gain in productivity, an average annual gain can be projected and applied to the annual earnings. This rate of increase may be incorporated into the discounting calculations to obtain a net effective discount rate (Rhoads, 1980).

Almost all CBA's use a gross measure of productivity. In the past, some analysts made arguments for the use of net productivity—gross productivity minus the affected individual's consumption. However, analysts now argue that the individual's own consumption provides them with utility and that, as members of society, their utility should count in an assessment of social welfare (Warner and Luce, 1982).

According to the Bureau of Labor Statistics (1998), the annual average change in productivity between 1986 and 1995 was .93%. However, the calculations in this study did not reflect any increase in labor productivity because the majority of EFNEP graduates were unemployed at the time of this study.

Morbidity figures for Type A and B diseases/conditions are presented in Table 6 below.

Table 6. Morbidity data for Type A and B diseases/conditions

Disease/ condition	Wage rate	Lost work days	Average age of onset
Heart disease	$7.60/hour	58	55
Stroke	$7.60/hour	60	45
Hypertension	$7.60/hour	41	30
Type 2 diabetes	$7.60/hour	0.6	40
Obesity	$7.60/hour	1.83	23
Foodborne illness	$7.60/hour	1.5	23

Heart disease: According to the Bureau of Labor Statistics (1995), the median number of lost work days for people with heart disease was 58 per year.

Stroke: According to the Bureau of Labor Statistics (1995), the median number of lost work days for people with stroke was 60 per year.

Hypertension: According to the Bureau of Labor Statistics (1995), the median number of lost work days for people with hypertension was 41 per year.

Type 2 diabetes: The American Diabetes Association asserts that 15.7 million people in the U.S. have diabetes and one million lost work days were attributable to diabetes in 1992 (American Diabetes Association, 1997). The lost workdays figure used was 0.6. This was calculated by dividing the number of lost workdays (one million) by the number of people with diabetes (15.7 million).

Obesity: According to Wolf and Colditz (1998), the lost work days for obese patients was 1.83 per year.

Foodborne illness: Buzby and Roberts (1997) estimated that most people with foodborne illness miss 1 or 2 days of work. The lost workday figure used was the average or 1.5 days.

Indirect tangible benefits were not calculated for colorectal cancer, osteoporosis, commonly occurring infant diseases, and LBW infants because of the lack of data. However, literature suggests that there are substantial productivity losses resulting from these diseases/conditions. Consequently, the indirect benefits calculations will be understated.

5.3.5 Calculating the number of EFNEP graduates practicing optimal nutritional behaviors

The purpose in deriving and using only the number of EFNEP graduates practicing optimal nutritional behaviors related to a particular disease/condition was to compensate for and minimize the error based on the assumption that graduates would continue to practice the nutritional behaviors acquired in EFNEP for their lifespan and accrue the identified benefits. Consequently, a very conservative approach was taken to calculating the number of graduates practicing optimal nutritional behaviors. Given this, the following method was used. Specific food related behaviors recorded in the FPC, along with RDA nutrient and food group intakes from the 24-hour food recall, were identified that contributed to prevention of each disease/condition.

In 1996, the EFNEP Family Record in Virginia consisted of 14 FPC questions and a 24-hour food recall, along with other demographic data (See Appendix C). All participants completed a FPC and 24-hour food recall upon entry and exit in EFNEP. The FPC questions measure food related behaviors and food handling practices on a scale of 1-5, where 1 = Do not do, 2 = Seldom, 3 = Sometimes, 4 = Most of the time, and 5 = Almost always. For the 24-hour food recall, participants indicate the number of servings they have eaten of all foods in the last 24 hours. Nutrient intakes were compared to the recommended dietary allowances (RDA) and food intake servings were compared to the food guide pyramid (FGP).

To be included in the number of graduates practicing optimal nutritional behaviors, the graduate needed to score a 4 or greater where a positive response was desired, or a 2 or less where a negative response was desired from entry to exit assessment on appropriate questions associated with the disease/condition in the FPC. A procedure was devised to examine ERS FPC data to identify and select only those graduates who reported these appropriate behavior changes from entry to exit (See Appendix D for the procedure). In addition, the graduate's exit 24-hour food recall for disease/condition related nutrients needed to be in accordance with RDA and dietary guidelines (U.S. Department of Agriculture, 1990). Table 7 below presents the criteria for FPC and 24-hour food recall criteria that were used to identify and select EFNEP graduates practicing optimal nutritional behaviors for each disease/condition in the study.

So, for example, to be selected as a graduate practicing optimal nutritional behaviors related to colorectal cancer, the person had to have scored a 3 or less on the entry FPC on questions 3 and 8, and a 4 or more on these same questions on the exit FPC. In addition, their 24-hour food recall data on exit from the program needed to include a fat intake of 65 grams or less, five or more servings of vegetables and fruit, and 20 or more grams of fiber. **Using these stringent criteria, only those graduates reporting improvement of dietary practices from entry to exit into FPC response categories of most of the time (4) to almost always (5) and appropriate 24 hour food exit recall data were selected as those who were practicing optimal nutritional behaviors related to the disease/condition and who would be considered for accruing the appropriate benefits for this study.**

For commonly occurring infant diseases, the criteria for selection was a response of "yes" for whether or not the graduate was breast-feeding. For LBW infants, the criteria was a response of "yes" for whether or not the graduate was pregnant and if their total caloric intake was 2,100 kilocalories or more.

Using this approach with the existing data, nutritional behavior changes can be reasonably attributed, but not causally connected, to EFNEP. Participants who may have already made behavior changes from participating in other programs (e.g., Special Supplemental Nutrition Program for Women Infants and Children Program (WIC)) would not be included in the selection of graduates practicing optimal nutritional behaviors in this study, because they would have exceeded the criteria on the entry assessment and would have been excluded.

Graduates meeting the criteria presented in Table 7 (see page 16) were selected as those practicing optimal nutritional behaviors related to a particular disease/condition. The percent was then calculated by taking the total number of graduates practicing optimal nutritional behaviors in each disease category and dividing it by the total number of EFNEP graduates for 1996.

Using this method, the percent of EFNEP graduates in Virginia for 1996 practicing optimal nutritional behaviors upon exit from the program for each of the diseases are presented in Table 8 (See Appendix E for the number of graduates practicing optimal nutritional behaviors).

Table 8. Percent of participants practicing optimal nutritional behaviors

Disease/condition	Percent Practicing Optimal Nutritional Behaviors
Colorectal cancer	1.9%
Heart disease	1.1%
Stroke	9.4%
Hypertension	9.4%

continued on next page

Disease/condition	Percent Practicing Optimal Nutritional Behaviors
Osteoporosis	28.5%
Type 2 diabetes	1.9%
Obesity	1.9%
Foodborne illness	53.7%
Commonly occurring infant diseases	2.8%
LBW infants	2.7%

5.4 Costs of EFNEP

The direct tangible costs of conducting the entire 1996 adult Virginia EFNEP program for all participants were identified as: salaries and benefits, office space, utilities, equipment, supplies/training, and staff travel. Because the program is delivered primarily in small groups in participants' places of residence and at times convenient to them, indirect costs borne by the participants were considered minimal and not included in the study.

Salaries and benefits. This cost consisted of direct payments of real dollars and in-kind funds to EFNEP professionals, paraprofessionals, and support staff. Salaries and benefits were calculated by multiplying the total number hours expended for program planning, implementing, evaluating, marketing, etc., by the average salary earned per hour, including benefits. The total allocation of funds for this category was derived by summing the salaries and benefits of EFNEP staff from each unit.

Office space. This cost included in-kind values and/or real dollars expended for rent or purchase of office space for staff directly administering or implementing EFNEP. The funding for office space was provided through state and local dollars. The cost of office space was calculated using the following procedure based on methods used by the Office of Management and Budget (OMB, 1997).

a. Each EFNEP unit responded to the following questions: 1) what was the original price of the entire building where Extension is located? (If the exact price was not known, an estimated value was

Table 7. Criteria for optimal nutritional behavior selection

Disease/condition	FPC Question #	FPC Score	24-hour food recall criteria
Colorectal cancer	3 & 8	>= 4	Fat <= 65 gms veg + fruits >= 5 svgs fiber >= 20 gms
Heart disease	6 & 7 & 8	>= 4	Fat <= 65 gms veg + fruits >= 5 svgs fiber >= 20 gms
Stroke & Hypertension	6 & 7	>= 4	Veg + fruits >= 5 svgs Ca >= 800 mgs
Osteoporosis	3	>= 4	Dairy >= 2 svgs Ca >= 800 mgs
Type 2 diabetes	3 & 8	>= 4	Fiber >= 20 gms cal <= 2300 kcals[6] carbohydrate <= 250 gms[7]
Obesity	3 & 8	>= 4	Veg + fruits >= 5 svgs Fiber >= 20 gms cal <= 2300 kcals[8] fat <= 65 gms
Foodborne illness	4 & 5	=< 2	—
Commonly occurring infant diseases	—	—	Yes for nursing
LBW infants	—	—	Yes for pregnant cal >= 2100 kcals

6 Increased from the RDA of 2200 kilocalories to better represent low-income populations.

7 Newer dietary guidelines for those with diabetes (Tinker, Heins, and Holler, 1994) recommend that 80 to 90% of energy be divided between fat and carbohydrates with fat not to exceed 30% kcal. Thus, calories from carbohydrate would range from 50% to 60% kcal. In future CBA calculations, the standard for carbohydrate intake probably should be higher than 250 grams (about 290 grams carbohydrate for a 2300 calorie diet).

8 Increased from the RDA of 2200 kilocalories to better represent low-income populations.

provided based on market values of the government building at that time), and 2) What was the total cost of renovations and improvements made in the building since it was acquired by the government? These values were added together to yield the total value of the building.

b. Each EFNEP unit was then asked to determine what portion or percent of the building was used by Extension (include meeting/conference rooms used frequently by Extension).

c. The values for items a and b were averaged and then multiplied together to yield the average value of the Extension space in the building per EFNEP unit office.

d. Each EFNEP unit was then asked to estimate what portion or percent of Extension space was used in any way to support EFNEP. At a minimum, this should include a portion or percent based on the number of EFNEP faculty/staff using Extension space.

e. The average value for item c was multiplied by the average value for item d. This figure was then multiplied by a 2.0% usage fee established by OMB to reflect the average yearly value of space in an EFNEP unit office.

f. Each EFNEP unit was then asked to determine the yearly cost of janitorial and maintenance service for Extension space in the office.

g. The average value for item f was multiplied by the average value of item d to yield the average value of janitorial and maintenance service in an EFNEP unit office.

h. Values for items e and g were summed and then multiplied by the total number of EFNEP units to yield the total value of EFNEP office space.

Utilities. This cost included real dollars and in-kind funds expended for utilities (e.g., electricity, water, telephone, gas, etc.) used to conduct EFNEP. The cost of utilities for EFNEP was calculated by multiplying the total cost to the Extension unit by the same percentage used in item d in the office space procedure above. The funding for utilities is provided primarily by local dollars. The utility estimates in the Virginia calculation were based on conversations with local Extension staff. The total cost of utilities in a unit was prorated by the number of agents and program assistants housed in the unit.

Equipment. This cost included real dollars expended for the direct purchase of any equipment (e.g., computers, A/V equipment, etc.) that were used by EFNEP staff. Also included was the in-kind value of existing equipment. The total amount expended for equipment was calculated by summing the equipment expenditure from each EFNEP unit. OMB guidelines only allow 6.67% of the total cost of equipment to be used each year as an in kind expense.

Supplies/training. Office and educational supplies consisted of real dollars paid for office supplies, printing, training manuals, and other educational materials. Training costs included real dollars and in-kind funds expended for direct training of professionals and paraprofessionals to specifically carry out EFNEP. This cost included materials for distribution, payment to guest speakers, travel, lodging, and meals. Also included were the costs associated with participating in federal, state, and regional conferences. The total amount expended for supplies and training was calculated by summing these expenditures from each EFNEP unit.

Staff travel. This cost included real dollars and in-kind funds paid to EFNEP staff for travel related to administering or implementing EFNEP. Travel expenditures included mileage in personal cars, meals, and fares for public transportation (e.g., airline, bus, etc.). The total amount expended for staff travel in the state was calculated by summing these expenditures from each EFNEP unit.

Marginal excess burden. When government expenditures are financed by tax collection, distortions are introduced that create losses because not all of the funds collected will re-enter the economy in productive activities that stimulate the gross national product. These losses need to be charged against public expenditures to more accurately reflect the social opportunity costs of public programs (Fox, 1985). A marginal excess burden (MEB) estimate measures the incremental welfare costs of raising extra revenues from an existing distorting tax. Measurements of the costs of public expenditures can be underestimated by failing to account for the MEB of the tax collection system. This bias arises from the assumption that $1.00 of public expenditure has a social opportunity cost of $1.00

Economists contend that the MEB tax in the United States is large. The welfare loss from a 1% increase in all distortionary tax rates is estimated to be 17 to 56 cents per dollar of extra revenue. Consequently, a public program must produce marginal benefits of more than $1.17 per dollar of cost to be welfare improving. This suggests that a program that is normally rejected on the basis of cost benefit ratios exceeding unity could inadvertently be accepted if the MEB is not included in the analysis (Ballard, Shoven, and Whalley, 1985).

Because EFNEP is funded by federal dollars, the MEB was included as a direct cost to ensure that the cost associated with administering EFNEP was not underestimated. The MEB of taxation used for the study was 17%.

5.5 CBA analytic measures

The next CBA step required a decision on the analytic measure that would be generated by the cost benefit analysis. The three most common are the benefit cost ratio, internal rate of return, and net present value. The best analytic measure to use depends on the type of analysis being conducted (i.e., single or multiple programs) and the type of information conveyed to the decision-maker. Before considering the specifics of these analytic measures, however, a topic that is important to all cost benefit applications needs to be understood—the discount rate.

5.5.1 Discount rate

To compute the present value, it is necessary to discount future benefits and costs. All monetized benefits and costs should be discounted. Discounting reflects the time value of money. Benefits and costs are worth more if they are experienced sooner. The higher the discount rate the lower the value of the future cash flows (Office of Economic Policy-Office of Management and Budget, 1992).

There are two concepts that can demonstrate why future dollars are valued less than current dollars. First is the concept of time preference. People prefer current consumption to future consumption, all other things being equal. Having money now gives one the option of spending it or saving it, or doing both. Waiting a year to receive money reduces one's options without offering any compensating advantages (Warner and Luce, 1982).

The second concept asserts that a dollar is worth more today than a dollar at some future date, because the money can be profitably invested in the interval between today and the future. Interest is the premium paid to reflect the fact that any given sum could be put to profitable use over a period of time. It follows then that the value of money which is not currently available, but which will become available (or spent) some years hence must be discounted for the interest that could be earned in the interim. This is why the present value of a dollar to be received in the future is always less than 100 cents (Rhoads, 1980).

A broader definition of discounting is necessary when conducting a cost benefit analysis on programs that have social implications. This discount rate, which is called the social discount rate, can be defined as the discount rate adjusted by society's preferences for certain outcomes. The social discount rate does not have to be restricted to compensating only for the decrease in the value of money. In fact, "society" may desire that returns on a project be realized quickly, in which case the social discount rate will be higher than the decrease in the value of money. If, however, benefits in the distant future are sought, then a low social discount rate would be most appropriate. Although the philosophical arguments for low or high rates are many, in practice the social discount rate is often mandated by the agency or legislative body to which the program is accountable.

Future inflation is highly uncertain. Therefore, analysts should avoid having to make an assumption about the general rate of inflation whenever possible (Office of Economic Policy-Office of Management and Budget, 1992). Many analysts recommend the use of real discount rates for both costs and benefits. The term "real" indicates that no additional adjustment should be made to this discount rate to account for the effect of inflation. When a real discount rate is used, all monetary costs and benefits are reported in real or constant dollars for a specific base year (Haddix, Teutsch, Schaffer, and Dunet, 1996). Constant dollars are used to separate increases in the value of production which are due to inflation from those which are due to actual increases in the quantity of a good or service product.

Several economic analyses in recent years that have focused on disease and injury prevention-effectiveness, health care intervention, and public health services have used a 3% or 5% discount rate. Haddix, Teutsch, Schaffer, and Dunet (1996) recommend using either rate. However, they suggest that most cost-effectiveness studies use 5%. This is a real discount rate.

DECISION: The discount rate that was used for this study was 5%.

5.5.2 Benefit cost ratio

The benefit cost ratio has a long history of use in cost benefit analysis and is the most familiar analytic measure. The benefit cost ratio gives the benefits obtained per dollar of cost. When benefits and/or costs extend over more than one year, they need to be valued in current dollars by reducing them using the social discount rate. In this situation, the benefit cost ratio gives the discounted benefits obtained per dollar of discounted costs (Sassone and Schaffer, 1978).

If the benefit cost ratio is greater than 1, then the benefits produced by the program are greater than the costs; if less than 1, then the costs of the program are greater than the benefits received. If the benefit cost ratio is equal to 1, the program "breaks even" on costs and benefits. Instead of specifying the social discount rate a priori, the benefit to cost ratio can be set to 1 and the break-even rate calculated.

5.5.3 Internal rate of return

A second analytic measure often used in cost benefit analysis is the internal rate of return (IRR). The IRR is defined as the social discount rate that would make costs and benefits equal over the life of the program. In essence, the IRR is the break even social discount rate. Instead of specifying the social discount rate, the IRR method is designed to determine the break-even rate of the project. This value can then be compared with either federally mandated discount rates or compared to the return rates obtained by other projects.

There are two main problems encountered when using the IRR. The first is technical and related to the way in which the social discount rate is calculated. Because of the way in which it is determined, it is possible for a number of IRR's to be calculated. When this occurs, it is usually unclear as to which calculated value is correct. The second problem, at least in some cases, is that the method assumes that the social discount rate is constant over the entire life of the project. In many instances, the evaluator may need to vary the discount rate over the life of the project, especially if it is known that returns will not be immediately evident.

5.5.4 Net present value

The last popular analytic measure is net present value (NPV). NPV discounts all the future yearly net benefits (total benefits minus total costs) and sums them to arrive at a value that reflects all future net benefits in today's dollars. A NPV greater than zero indicates the program is generating returns beyond costs. This measure is highly flexible, because it allows the discount rate to vary over time.

In practice, the evaluator would specify the appropriate social discount rate for each year along with identifying each year's costs and benefits. Because of the potential problem in defining a non-biased social discount rate, it is possible to directly calculate the rate that will yield a NPV of zero (the break even social discount rate). More useful to the evaluator and decision-maker, however, would be to calculate the NPV using a range of social discount rates. This process is part of a broader set of procedures called sensitivity analysis and allows the decision-maker to observe how sensitive the value of a project is to changes in the social discount rate and changes in "society's" view of the desirability of the project benefits.

DECISION: VCE project staff, in conjunction with the National Program Leader, EFNEP and appropriate others determined that the most appropriate analytic measure of analysis of the cost benefit analysis procedure for state EFNEP programs was the benefit cost ratio. In addition, the other two measures would also be reported.

6.0 RESULTS

6.1 Direct tangible benefits of Virginia EFNEP

Given the decisions and assumptions made in this study, the direct tangible benefits of each of the nutrition-related diseases/conditions either avoided or delayed accruing to 1996 adult Virginia EFNEP graduates practicing optimal nutritional behaviors are presented below.[9]

Disease/condition: Colorectal cancer (Type A)

A) Annual number of graduates in EFNEP	3,100
B) Incidence rate of colorectal cancer in the population	15%
C) Incidence rate of colorectal cancer related to diet	35%
D) Percent of graduates practicing optimal nutritional behaviors related to colorectal cancer	1.9%
E) Estimated number of graduates to accrue benefits	3.09225
F) Present value of the benefits related to colorectal cancer	$16,424.75
Total direct benefit of delaying colorectal cancer	**$50,789.43**

Disease/condition: Heart disease (Type A)

A) Annual number of graduates in EFNEP	3,100
B) Incidence rate of heart disease in the population	31.2%
C) Incidence rate of heart disease related to diet	26%
D) Percent of graduates practicing optimal nutritional behaviors related to heart disease	1.1%
E) Estimated number of graduates to accrue benefits	2.7662
F) Present value of the benefits related to heart disease	$691.76
Total direct benefit of delaying heart disease	**$1,913.54**

continued on next page

9 See Appendix F for an example of the calculations.

Disease/condition: Stroke (Type A)

A) Annual number of graduates in EFNEP	3,100
B) Incidence rate of stroke in the population	1.7%
C) Incidence rate of stroke related to diet	—
D) Percent of graduates practicing optimal nutritional behaviors related to stroke	9.4%
E) Estimated number of graduates to accrue benefits	4.9538
F) Present value of the benefits related to stroke	$13,143.81
Total direct benefit of delaying stroke	**$65,111.81**

Disease/condition: Hypertension (Type A)

A) Annual number of graduates in EFNEP	3,100
B) Incidence rate of hypertension in the population	37.4%
C) Incidence rate of hypertension related to diet	45%
D) Percent of graduates practicing optimal nutritional behaviors related to hypertension	9.4%
E) Estimated number of graduates to accrue benefits	49.04262
F) Present value of the benefits related to hypertension	$697.87
Total direct benefit of delaying hypertension	**$34,225.37**

Disease/condition: Osteoporosis (Type B)

A) Annual number of graduates in EFNEP	3,100
B) Incidence rate of osteoporosis in the population	28%
C) Incidence rate of osteoporosis related to diet	—
D) Percent of graduates practicing optimal nutritional behaviors related to osteoporosis	28.5%
E) Estimated number of graduates to accrue benefits	247.38
F) Present value of the benefits related to osteoporosis	$65,468.86
Total direct benefit of avoiding osteoporosis	**$16,195,686.59**

Disease/condition: Type 2 diabetes (Type B)

A) Annual number of graduates in EFNEP	3,100
B) Incidence rate of Type 2 diabetes in the population	14.5%
C) Incidence rate of Type 2 diabetes related to diet	45%
D) Percent of graduates practicing optimal nutritional behaviors related to Type 2 diabetes	1.9%
E) Estimated number of graduates to accrue benefits	3.843225
F) Present value of the benefits related to Type 2 diabetes	$45,898.13
Total direct benefit of avoiding Type 2 diabetes	**$176,396.84**

Disease/condition: Obesity (Type B)

A) Annual number of graduates in EFNEP	3,100
B) Incidence rate of obesity in the population	37%
C) Incidence rate of obesity related to diet	50%
D) Percent of graduates practicing optimal nutritional behaviors related to obesity	1.9%
E) Estimated number of graduates to accrue benefits	10.8965
F) Present value of the benefits related to obesity	$11,686.59
Total direct benefit of avoiding obesity	**$127,342.93**

Disease/condition: Foodborne illness (Type B)

A) Annual number of graduates in EFNEP	3,100
B) Incidence rate of foodborne illness in the population	2.8%
C) Incidence rate of foodborne illness related to diet	100%
D) Percent of graduates practicing optimal nutritional behaviors related to foodborne illness	53.7%
E) Estimated number of graduates to accrue benefits	46.6116
F) Present value of the benefits related to foodborne illness	$18,866.83
Total direct benefit of avoiding foodborne illness	**$879,413.13**

Disease/condition: Commonly occurring infant diseases (Type B)

A) Annual number of graduates in EFNEP	3,100
B) Incidence rate of commonly occurring infant diseases in the population	100%

C) Incidence rate of commonly occurring infant diseases related to diet	—-
D) Percent of graduates practicing optimal nutritional behaviors related to commonly occurring infant diseases	2.8%
E) Estimated number of graduates to accrue benefits	86.8
F) Present value of the benefits related to commonly occurring infant diseases	$1,537.00
Total direct benefit of avoiding commonly occurring infant diseases	**$133,411.60**

Disease/condition: LBW infants (Type C)

A) Annual number of graduates in EFNEP	3,100
B) Incidence rate of LBW infants in the population	7.3%
C) Incidence rate of LBW infants related to diet	100%
D) Percent of graduates practicing optimal nutritional behaviors related to LBW infants	2.7%
E) Estimated number of graduates to accrue benefits	6.1101
F) Present value of the benefits related to LBW infants	$35,406.00
Total direct benefit of avoiding LBW infants	**$216,334.20**

6.2 Indirect tangible benefits of Virginia EFNEP

Given the decisions and assumptions made in this study, the indirect tangible benefits of appropriate diseases/conditions (i.e., heart disease, stroke, hypertension, Type 2 diabetes, obesity, and foodborne illness) accruing to 1996 adult Virginia EFNEP graduates practicing optimal nutritional behaviors are presented below.[10]

Disease: Heart disease (Type A)

A) Average age of onset for heart disease	55
B) Average delayed onset resulting from EFNEP	60
C) Average number of annual lost work days	58
D) Estimated number of graduates to accrue benefits	2.77
E) Present value of lost earnings for heart disease	$693.53
Total indirect benefit of delaying heart disease	**$1,921.08**

Disease: Stroke (Type A)

A) Average age of onset for stroke	45
B) Average delayed onset resulting from EFNEP	50
C) Average number of annual lost work days	60
D) Estimated number of graduates to accrue benefits	4.95
E) Present value of lost earnings for stroke	$2,084.54
Total indirect benefit of delaying stroke	**$10,318.48**

Disease: Hypertension (Type A)

A) Average age of onset for hypertension	30
B) Average delayed onset resulting from EFNEP	35
C) Average number of annual lost work days	41
D) Estimated number of graduates to accrue benefits	49.04
E) Present value of lost earnings for hypertension	$4,779.67
Total indirect benefit of delaying hypertension	**$234,395.01**

Disease: Type 2 diabetes (Type B)

A) Average age of onset for Type 2 diabetes	40
B) Average age of retirement	65
C) Average number of annual lost work days	0.6
D) Estimated number of graduates to accrue benefits	3.84
E) Present value of lost earnings for Type 2 diabetes	$228.80
Total indirect benefit of delaying Type 2 diabetes	**$878.58**

Disease: Obesity (Type B)

A) Average age of onset for obesity	23
B) Average age of retirement	65
C) Average number of annual lost work days	1.83

continued on next page

10 See Appendix F for an example of the calculations.

D) Estimated number of graduates to accrue benefits	10.8965
E) Present value of lost earnings for obesity	$1,952.23
Total indirect benefit of delaying obesity	**$21,272.46**

Disease: Foodborne illness (Type B)

A) Average age of onset for foodborne Illness	23
B) Average age of retirement	65
C) Average number of annual lost work days	1.5
D) Estimated number of graduates to accrue benefits	46.6
E) Present value of lost earnings for foodborne illness	$1,600.19
Total indirect benefit of delaying foodborne illness	**$74,568.85**

6.3 Direct tangible costs of Virginia EFNEP

Given the decisions and assumptions made in this study, the total direct tangible costs of Virginia adult EFNEP for 1996 are presented below.

Cost	Description
Salaries and benefits	The total amount of funds allocated to program assistants, area coordinators, and administratiors for salaries and benefits for 1996 was $1,202,973. This amount was based on information collected for the 26 EFNEP units from the state EFNEP coordinator. *Funding source: federal*
Office space	It was estimated that the value of office space for 1996 was $35,568 for 26 EFNEP unit offices. *Funding sources: state and local*
Utilities	The utility estimates in the Virginia calculation were based on conversations with local EFNEP staff. The total cost of electricity in a unit was prorated by the number of agents and program assistants housed in the unit. a) Electricity: $78,000 ($3,000 per unit X 26 EFNEP units). b) Phone: $12,480 ($480 per unit X 26 EFNEP units). Total Utility - $78,000 + $12,480 = $90,480. *Funding sources: state and local*
Equipment	The total amount of annual funds allocated to EFNEP units for equipment was $2,676. This amount was based on information collected on the 26 EFNEP units from the state EFNEP coordinator. *Funding source: federal*
Supplies/ training	The total amount of funds allocated to EFNEP units for supplies and training was $69,582. This amount was based on information collected on the 26 EFNEP units from the state EFNEP coordinator. *Funding source: federal*
Staff travel	The total amount of funds allocated to EFNEP staff for travel was $62,893. This amount was based on information collected on the 26 EFNEP units from the state EFNEP coordinator. *Funding source: federal*
Marginal excess Burden	The marginal excess burden of taxation was 17% of total direct costs or $248,909.

6.4 Virginia EFNEP CBA analysis

Given the decisions and assumptions made in this study, the outcomes of the three analytic CBA measures (i.e., benefit cost ratio, net present value, and internal rate of return) for 1996 Virginia adult EFNEP graduates practicing optimal nutritional behaviors in relation to total direct program costs are presented in Table 9.

Table 9. Initial EFNEP CBA analysis

Direct Tangible Benefits	Value
Colorectal cancer	$50,789.43
Heart disease	$1,913.54
Stroke	$65,111.81
Hypertension	$34,225.37
Osteoporosis	$16,195,686.59
Type 2 diabetes	$176,396.84
Obesity	$127,342.93
Foodborne illness	$879,413.13
Commonly occurring infant diseases	$133,411.60
LBW infants	$216,334.20
Sub-total direct tangible benefits	**$17,880,625.44**
Indirect Tangible Benefits	
Colorectal cancer	—
Heart disease	$1,921.08
Stroke	$10,318.48

	Value
Hypertension	$234,395.01
Osteoporosis	—
Type 2 diabetes	$878.58
Obesity	$21,272.46
Foodborne illness	$74,568.85
Commonly occurring infant diseases	—
LBW infants	—
Sub-total indirect tangible benefits	**$343,354.46**
Total benefits	**$18,223,979.90**
Direct Costs	
Salaries and benefits	$1,202,973.00
Office space	$35,568.00
Utilities	$90,480.00
Equipment	$2,676.00
Supplies/training	$69,582.00
Travel	$62,893.00
Marginal excess burden	$248,909.00
Total costs	**$1,713,081.00**
Benefit cost ratio	**$10.64/$1.00**
Net present value	**$16,510,898.90**
Internal rate of return	**16.41%**

7.0 SENSITIVITY ANALYSIS

The purpose of sensitivity analysis is to address the presence of uncertainty in the CBA based on the various assumptions made in the analysis (Haddix, Teutsch, Schaffer, and Dunet, 1996). In essence, sensitivity analysis proposes "what if" scenarios by manipulating certain variables to determine minimum and maximum values of the analytic measures (Disbrow and Bertram, 1984). In this way, the CBA becomes more robust concerning any challenges to its original assumptions.

Sensitivity analysis was conducted to address four aspects of the study: 1) the retention rate of dietary behaviors, 2) the incidence rate of osteoporosis related to diet, 3) the incidence rates of the diseases/conditions in the population, and 4) the discount rate (see Lewis, 1998 for a more comprehensive analysis). A fifth sensitivity analysis was conducted to determine the combined effects of items 1 and 3 above.

7.1 Retention rate of dietary behaviors

One critical assumption of the study was that EFNEP graduates practicing optimal nutritional behaviors would continue to practice these behaviors for the duration of their lives. Given the very stringent criteria used to select participants practicing optimal nutritional behaviors and that sustained behavioral change has been documented five years after graduating from EFNEP, the study team felt that this assumption was an appropriate one. However, if this assumption was inappropriate, then the benefits calculated in the study would be overstated. Unfortunately, there are no studies that have documented retention of dietary behaviors beyond five years after exiting EFNEP. In light of this, a sensitivity analysis was performed by decreasing the retention rates of graduates practicing optimal nutritional behaviors by 50% and 75%. Results of these sensitivity analyses are presented in Tables 10 and 11.

Table 10. EFNEP CBA analysis reducing the number of graduates practicing optimal nutritional behaviors by 50%

Direct Tangible Benefits	Value
Colorectal cancer	$25,394.72
Heart disease	$956.77
Stroke	$32,555.90
Hypertension	$17,112.69
Osteoporosis	$8,097,843.29
Type 2 diabetes	$88,198.42
Obesity	$63,671.46
Foodborne illness	$439,706.57
Commonly occurring infant diseases	$66,705.80
LBW infants	$108,167.10
Sub-total direct tangible benefits	**$8,940,312.72**
Indirect Tangible Benefits	
Colorectal cancer	—
Heart disease	$957.07
Stroke	$5,169.66
Hypertension	$117,197.51
Osteoporosis	—
Type 2 diabetes	$439.29
Obesity	$10,636.23
Foodborne illness	$37,284.43
Commonly occurring infant diseases	—
LBW infants	—
Sub-total indirect tangible benefits	**$171,684.19**
Total benefits	**$9,111,996.91**

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Direct Costs	Value
Salaries and benefits	$1,202,973.00
Office space	$35,568.00
Utilities	$90,480.00
Equipment	$2,676.00
Supplies/training	$69,582.00
Travel	$62,893.00
Marginal excess burden	$248,909.00
Total costs	**$1,713,081.00**
Benefit/cost ratio	**$5.32/$1.00**
Net present value	**$7,398,915.91**
Internal rate of return	**11.60%**

Table 11. EFNEP CBA analysis reducing the number of graduates practicing optimal nutritional behaviors by 75%

Direct Tangible Benefits	Value
Colorectal cancer	$12,697.36
Heart disease	$478.39
Stroke	$16,277.95
Hypertension	$8,556.34
Osteoporosis	$4,048,921.65
Type 2 diabetes	$44,099.21
Obesity	$31,835.73
Foodborne illness	$219,853.28
Commonly occurring infant diseases	$33,352.90
LBW infants	$54,083.28
Sub-total direct tangible benefits	**$4,470,156.09**
Indirect Tangible Benefits	
Colorectal cancer	—
Heart disease	$479.92
Stroke	$2,580.66
Hypertension	$58,608.53
Osteoporosis	—
Type 2 diabetes	$219.87
Obesity	$5,318.11
Foodborne illness	$18,647.01
Commonly occurring infant diseases	—
LBW infants	—
Sub-total indirect tangible benefits	**$85,849.10**
Total benefits	**$4,556,005.19**
Direct Costs	
Salaries and benefits	$1,202,973.00
Office space	$35,568.00
Utilities	$90,480.00
Equipment	$2,676.00
Supplies/training	$69,582.00
Travel	$62,893.00
Marginal excess burden	$248,909.00
Total costs	**$1,713,081.00**
Benefit/cost ratio	**$2.66/$1.00**
Net present value	**$2,842,924.19**
Internal rate of return	**8.49%**

7.2 Incidence rate of osteoporosis related to diet

Benefits derived from avoiding osteoporosis represented 89% of the total benefits from EFNEP. Part of the reason this benefit was so high was because there was no available data on the incidence rate of osteoporosis related to diet. To address this situation, a sensitivity analysis was conducted using an estimate of 50% for the incidence rate of osteoporosis related to diet. The results of this analysis are presented in Table 12 below.

Table 12. EFNEP CBA analysis using 50% as the incidence rate of osteoporosis related to diet

Direct Tangible Benefits	Value
Colorectal cancer	$50,789.43
Heart disease	$1,913.54
Stroke	$65,111.81
Hypertension	$34,225.37
Osteoporosis	$8,097,843.29
Type 2 diabetes	$176,396.84
Obesity	$127,342.93
Foodborne illness	$879,413.13
Commonly occurring infant diseases	$133,411.60
LBW infants	$216,334.20
Sub-total direct tangible benefits	**$9,782,782.14**
Indirect Tangible Benefits	
Colorectal cancer	—
Heart disease	$1,921.08
Stroke	$10,318.48
Hypertension	$234,395.01
Osteoporosis	—
Type 2 diabetes	$878.58
Obesity	$21,272.46
Foodborne illness	$74,568.85
Commonly occurring infant diseases	—
LBW infants	—
Sub-total indirect tangible benefits	**$343,354.23**

	Value
Total benefits	**$10,126,136.37**
Direct Costs	
Salaries and benefits	$1,202,973.00
Office space	$35,568.00
Utilities	$90,480.00
Equipment	$2,676.00
Supplies/training	$69,582.00
Travel	$62,893.00
Marginal excess burden	$248,909.00
Total costs	**$1,713,081.00**
Benefit cost ratio	**$5.91/$1.00**
Net present value	**$8,413,055.37**
Internal rate of return	**14.16%**

7.3 Incidence rates of the disease/condition in the population

The incidence rates for heart disease, hypertension, Type 2 diabetes, and obesity in the low-income population were used in the initial calculation of benefits. Because of lack of data, incidence rates used for the remaining diseases/conditions (i.e., colorectal cancer, stroke, osteoporosis, foodborne illness, and LBW infants) were general population figures. The focus of this sensitivity analysis was to adjust the general population incidence rates to be more reflective of low-income populations. The approach taken to do this was to calculate the average difference in the incidence rates between the general population and the low-income population for heart disease, hypertension, Type 2 diabetes, and obesity and then to adjust the incidence rates for all other diseases/conditions by the average difference to be more reflective of low-income populations.

Using this procedure, the average difference was 11 percentage points. The adjusted incidence rates are presented in Table 13 (Top right).

Table 13. Adjusted incidence rates for low-income populations by diseases/conditions

Disease/ condition	Incidence rate in the general population	Known incidence rate in the low-income population	Adjusted incidence rate for the low-income population
Colorectal cancer	15%	—	26%
Heart disease	5.2%	31.2%	—
Stroke	1.7%	—	12.7%
Hypertension	30%	37.4%	—
Osteoporosis	28%	—	39%
Type 2 diabetes	5.9%	14.5%	—
Obesity	35%	37%	—
Foodborne illness	2.8%	—	13.8%
Commonly occurring infant diseases	100%	100%	—
LBW infants	7.3%	—	18.3%

Because the incidence rates are higher in the low-income population, the adjustment served to dramatically increase the monetized benefits (presented in Table 14 below).

Table 14. EFNEP CBA analysis adjusting for low-income diseases/conditions incidence rates

Direct Tangible Benefits	Value
Colorectal cancer	$88,035.02
Heart disease	$1,913.54
Stroke	$486,423.49
Hypertension	$34,225.37
Osteoporosis	$22,558,277.75
Type 2 diabetes	$176,396.84
Obesity	$127,342.93
Foodborne illness	$4,334,250.44
Commonly occurring infant diseases	$133,411.60
LBW infants	$542,317.24
Sub-total direct tangible benefits	**$28,482,594.22**
Indirect Tangible Benefits	
Colorectal cancer	—
Heart disease	$1,921.08
Stroke	$77,144.24
Hypertension	$234,395.01
Osteoporosis	—
Type 2 diabetes	$878.58

	Value
Obesity	$21,272.46
Foodborne illness	$367,608.76
Commonly occurring infant diseases	—
LBW infants	—
Sub-total indirect tangible benefits	**$703,220.14**
Total benefits	**$29,185,814.36**
Direct Costs	
Salaries and benefits	$1,202,973.00
Office space	$35,568.00
Utilities	$90,480.00
Equipment	$2,676.00
Supplies/training	$69,582.00
Travel	$62,893.00
Marginal excess burden	$248,909.00
Total costs	**$1,713,081.00**
Benefit/cost ratio	**$17.04/$1.00**
Net present value	**$27,472,733.36**
Internal rate of return	**37.13%**

7.4 The discount rate

Although it is common for health related studies to use a 5% discount rate (the rate used in this study), there remains some uncertainty about the appropriateness of this rate. Because of the high initial benefit to cost ratio, the discount rate was increased to 10% to determine its effect on the analytic measures. The results of this analysis are presented in Table 15 below.

Table 15. EFNEP CBA analysis adjusting the discount rate to 10%

Direct Tangible Benefits	Value
Colorectal cancer	$42,535.07
Heart disease	$662.14
Stroke	$32,605.12
Hypertension	$29,564.36
Osteoporosis	$3,453,496.54
Type 2 diabetes	$45,863.13
Obesity	$67,775.69
Foodborne illness	$468,049.45
Commonly occurring infant diseases	$133,411.60
LBW infants	$216,334.20
Sub-total direct tangible benefits	**$4,490,297.30**
Indirect Tangible Benefits	
Colorectal cancer	—
Heart disease	$664.74
Stroke	$5,167.07
Hypertension	$202,471.94
Osteoporosis	—
Type 2 diabetes	$253.89
Obesity	$11,922.62
Foodborne illness	$41,807.31
Commonly occurring infant diseases	—
LBW infants	—
Sub-total indirect tangible benefits	**$262,287.57**
Total benefits	**$4,752,584.87**
Direct Costs	
Salaries and benefits	$1,202,973.00
Office space	$35,568.00
Utilities	$90,480.00
Equipment	$2,676.00
Supplies/training	$69,582.00
Travel	$62,893.00
Marginal excess burden	$248,909.00
Total costs	**$1,713,081.00**
Benefit/cost ratio	**$2.77/$1.00**
Net present value	**$3,039,503.87**
Internal rate of return	**16.41%**

7.5 Retention of dietary behaviors and incidence rates of the disease/condition in the population

A final sensitivity analysis was conducted that combined two of the previous sensitivity analyses: reducing the retention rates of graduates practicing optimal nutritional behaviors by 75% and adjusting the incidence rates to reflect the low-income population. The results are presented in Table 16.

Table 16. EFNEP CBA analysis reducing the number of graduates practicing optimal nutritional behaviors by 75% and adjusting for low-income diseases/conditions incidence rates

Direct Tangible Benefits	Value
Colorectal cancer	$22,008.75
Heart disease	$478.39
Stroke	$121,605.87
Hypertension	$8,556.34

	Value
Osteoporosis	$5,639,569.44
Type 2 diabetes	$44,099.21
Obesity	$31,835.73
Foodborne illness	$1,083,562.61
Commonly occurring infant diseases	$33,352.90
LBW infants	$135,579.31
Sub-total direct tangible benefits	**$7,120,648.55**
Indirect Tangible Benefits	
Colorectal cancer	—
Heart disease	$479.92
Stroke	$19,286.06
Hypertension	$58,598.75
Osteoporosis	—
Type 2 diabetes	$219.87
Obesity	$5,318.11
Foodborne illness	$91,902.19
Commonly occurring infant diseases	—
LBW infants	—
Sub-total indirect tangible benefits	**$175,804.90**
Total benefits	**$7,296,453.45**
Direct Costs	
Salaries and benefits	$1,202,973.00
Office space	$35,568.00
Utilities	$90,480.00
Equipment	$2,676.00
Supplies/training	$69,582.00
Travel	$62,893.00
Marginal excess burden	$248,909.00
Total costs	**$1,713,081.00**
Benefit/cost ratio	**$4.26/$1.00**
Net present value	**$5,583,372.45**
Internal rate of return	**11.38%**

8.0 Discussion And Conclusions

A summary of study results for the three analytic measures (i.e., benefit to cost (B/C) ratio, net present value (NPV), and internal rate of return (IRR)) are presented in Table 17.

The initial benefit to cost ratio of $10.64/$1.00 indicated a significant return on investment for Virginia EFNEP. To address the presence of uncertainty in the CBA for the various decisions and assumptions made in the initial analysis, several sensitivity analyses were conducted. These analyses resulted in a range of benefit to cost ratios from $2.66-17.04/$1.00. Given these results, one major conclusion is that the CBA study results suggest that Virginia EFNEP is a program that generates significant net returns on investments. Given the similarities in EFNEP programming across states (i.e., similar target audiences, objectives, curriculum, and delivery methods), it might be appropriate to expect similar results in other states. However, to be sure, further replication of these study methods is needed in other states.

Having concluded this study, the issue that is critically important is to determine the extent to which the methods used in the study present a plausible means for conducting a meaningful CBA of EFNEP and potentially other nutrition education programs. This can best be addressed through thoughtful reflection (presented in the discussion below) and critical and constructive feedback by both nutrition and economic professionals.

8.1 Decisions and assumptions

One important decision in this study was to limit the data used to that already collected in the EFNEP

Table 17. Summary of EFNEP CBA results

Analysis	B/C Ratio	NPV	IRR
Initial analysis	$10.64/$1.00	$16,510,898.90	16.41%
Reducing ONB[11] graduates by 50%	$5.32/$1.00	$7,398,915.91	11.60%
Reducing ONBgraduates by 75 graduates by 75	$2.66/$1.00	$2,842,924.19	8.49%
Using 50% incidence rate for osteoporosis related to diet	$5.91/$1.00	$8,413,055.37	14.16%
Adjusting for low-income diseases/conditions incidence rates	$17.04/$1.00	$27,472,733.36	37.13%
Adjusting the discount rate to 10%	$2.77/$1.00	$3,039,503.87	16.41%
Reducing ONB graduates by 75% and adjusting for low-incomediseases/conditions incidence rates	$4.26/$1.00	$5,583,372.45	11.38%

11 ONB = optimal nutritional behavior

Evaluation Reporting System (ERS). This decision was made to determine if the ERS provides sufficient data for an appropriate CBA of EFNEP. Because the ERS included pre and post program data on participant self-reported dietary practice behaviors and food consumption (24-hour food recall), it seemed reasonable to assume that this would provide an efficient means for providing the appropriate data for the CBA. The study team did consider collecting new data from past participants. However, given the transient nature of the EFNEP population and the limited resources available for the study, this idea was vetoed. This decision did have important implications for the study (discussed below).

The decision to characterize the benefits of EFNEP as the health care costs that were either delayed or avoided from practicing optimal nutritional behaviors as a result of participating in EFNEP was a sound one that the study team felt was very appropriate for the CBA. From a nutrition perspective, research suggests that the outcome of practicing appropriate nutritional behaviors is improved health. Therefore, the avoidance or delay of certain nutrition-related diseases/conditions can be reasonably anticipated from improved nutrition. From an economic perspective, avoiding or delaying certain diseases/conditions can be valued in dollars by their non-biased medical market prices. This made the calculations of benefits fairly straightforward.

Two critical study assumptions were made in deriving the tangible benefits of EFNEP, and these assumptions presented the greatest challenges to the CBA method used in the study. The first was that monetized benefits would only be calculated for EFNEP participants practicing optimal nutritional behaviors attributed to the program. Given that only existing ERS data was used in the study, the idea was to utilize as much of it as possible in linking EFNEP outcomes to the diseases/conditions (and ultimately monetized benefits). This was done by identifying all FPC and 24-hour food recall items that contributed to the delay or prevention of each of the diseases/conditions. Then, only those graduates who indicated practicing all the appropriate FPC items for a particular disease/condition most of the time or almost always (from program entry to exit) and whose appropriate exit 24-hour food recall items were within RDA and FGP guidelines were selected. Participants already practicing these behaviors upon entry into the program were eliminated, as their practices could not be attributed to EFNEP. Hence the term "optimal nutritional behaviors." As noted in Table 8, the percent of graduates practicing optimal nutritional behaviors ranged from 1.1% for heart disease (n=34 graduates) to 53.7% for foodborne illness (n=1,664 graduates). In light of the decision to use only existing ERS data, the study team believed that the process for identifying graduates practicing optimal nutritional behaviors was a sound one.

The second assumption was that selected EFNEP graduates practicing optimal nutritional behaviors would continue to practice them for the remainder of their lives. The rationale supporting this assumption was two-fold. First, the criteria for selecting graduates practicing optimal nutritional behaviors were very conservative and yielded only a small number of people to whom monetized benefits would accrue. Second, follow-up studies of EFNEP graduates indicated that they maintained (and even increased) positive nutritional behaviors for up to five years after graduating from EFNEP. Interestingly enough, in a major review of 80 nutrition education programs for adults, Contento et al. (1995) found that EFNEP was one of the few programs to show improved dietary behaviors after program completion. Given this finding, the study team believed it was appropriate to assume that the selected graduates practicing optimal nutritional behaviors would maintain the nutritional behaviors for the duration of their lives.

The high initial benefit to cost ratio and concerns over these assumptions prompted the sensitivity analyses where numbers of graduates practicing optimal nutritional behaviors were further reduced by 50% and 75%. For the 50% reduction, the benefit to cost ratio was $5.32/$1.00; for the 75% reduction the benefit to cost ratio was $2.66/$1.00. The procedure for determining optimal nutritional behaviors had already reduced the number of graduates who accrued benefits by a significant amount. The reduction in retention conducted in the sensitivity analysis was based on the challenge to the assumption that 100% of the graduates practicing optimal nutritional behaviors would continue them throughout their lives. This challenge was prompted more by the initially high benefit to cost ratio than by supporting nutritional evidence. As Lewis (1998) suggested in his thesis, the lower benefit to cost ratio generated in this sensitivity analysis (75% retention reduction) may be considered by some "a worst case scenario" and by others "a more accurate picture of the EFNEP benefits."

8.2 Sensitivity analysis

Upon examination of all of the analyses, it is quite apparent that the disease/condition accounting for the majority of the tangible benefits from EFNEP was osteoporosis (89%). Consequently, the procedure for determining this benefit should be carefully examined. The incidence rate of osteoporosis in the population was documented (28%). However, as noted previously,

though there is strong agreement that dietary factors play an important role in osteoporosis, researchers have not offered an estimate of the percentage of osteoporosis cases that could be prevented by positive dietary changes. Given this, the tangible benefits from osteoporosis, calculated for this study, may be overstated because there was no adjustment made using the incidence rate related to diet. Hence, the sensitivity analysis using a 50% incidence rate of osteoporosis related to diet. It should be noted, however, that the 50% incidence rate is a very rough estimate. While this adjustment lowers the benefit to cost ratio to $5.91/$1.00, the benefits from osteoporosis still make up 80% of the total benefits.

Osteoporosis is a condition that is not curable, but can be readily treated to slow its progress and can even be avoided through appropriate dietary practices (National Osteoporosis Foundation, 1998). Therefore, it may be reasonable to assume that the potential overestimates of benefits from the lack of available data on the incidence rates of osteoporosis related to diet might be offset by the effectiveness of known treatments through nutrition education programs such as EFNEP.

It would not be appropriate to conclude that because osteoporosis accounts for the majority of the tangible benefit from EFNEP, that in its absence, the CBA would result in a negative benefit to cost ratio. The objective of EFNEP is to bring about change in nutritional practices of its participants. The majority of EFNEP participants are women, where the incidence of osteoporosis is very high. And because the average age of participants is 23 years, the efficacy of ongoing nutritional intervention for this condition is enhanced. So, the avoidance of the cost of treating the outcomes of osteoporosis is just one benefit of the program, albeit a very significant one.

The incidence rates of six of the 10 diseases/conditions used in the initial calculations were not reflective of the low-income population. For this sensitivity analysis, the incidence rates were adjusted to be more reflective of the low-income population. The procedure used resulted in increasing the incidence rates by 11 percentage points for each of the appropriate diseases/conditions. While the adjusted rates are probably closer estimates of the actual incidence rates in the low-income population, they may be overstated. Indeed, in conducting the sensitivity analysis for this one factor, the benefit to cost ratio was dramatically increased to $17.04/$1.00. Because the initial benefit to cost ratio was high, adjusting the incidence rate does not appear to offer very useful information for overall decision making.

The discount rate used in CBA studies often has a degree of uncertainty and is included in the sensitivity analyses. In this study, a discount rate of 5% was used that is common among health care studies. A 10% discount rate was included in the sensitivity analysis to verify that the positive outcome of the EFNEP CBA was not sensitive to the discount rate. However, it should also be noted that a 10% discount rate is high and is unlikely to be used in the CBA of other social programs. The findings of this sensitivity analysis (i.e., a benefit ratio of $2.77/$1.00) indicated that the EFNEP CBA was sensitive to adjusting the discount rate. However, because it did not change the conclusion of the analysis, it was not critical to decision making.

Finally, the sensitivity analysis in which the percent of graduates continuing to practice optimal nutritional behavior was reduced by 75% and the incidence rates of diseases were adjusted to reflect the low-income population showed a benefit to cost ratio of $4.26/$1.00. This analysis addressed two important variables where uncertainty would likely exist in the CBA.

8.3 Additional Research

While much was learned from this study, to improve future cost benefit analyses of EFNEP and nutrition education programs in general, three major areas of additional research need to be addressed.

1. **More long-term studies are needed to document the retention of dietary behaviors from EFNEP and nutrition education programs in general.** Documenting long-term retention of dietary behaviors from a nutrition education program such as EFNEP would address one major issue that challenged the validity of this CBA. The major question that needs to be addressed in these studies is to what extent do participants continue to practice appropriate dietary behaviors after completion of the nutrition education program?
2. **Incidence rates of nutrition related diseases/conditions need to be determined.** The lack of incidence rates for certain nutrition related diseases/conditions in the low-income population was problematic for this CBA of EFNEP. Because this population is a likely target for nutrition education programs, more specific nutrition related disease/condition incidence data is needed. Data on the incidence rate of osteoporosis related to diet is also needed.
3. **More data is needed on the perinatal impacts of EFNEP.** This will provide stronger data for determining more accurate impacts on reductions in LBW infants and commonly occurring infant diseases.

8.4 Conclusion

The CBA of Virginia EFNEP suggests that the monetized benefits exceed costs of the program. ***Given all of the above, the one benefit to cost ratio that best reflects Virginia EFNEP is the initial ratio of $10.64/$1.00.*** However, whether the decision-maker gives more weight to the initial CBA calculation or to any of the other sensitivity analyses, the outcome of this study remains positive. Because Virginia EFNEP generates net gains, taxpayers are receiving positive returns on their invested dollars in this program. Indeed, additional studies of other state EFNEP programs are needed. However, it should be noted that while some variations exist from state to state, there are more similarities than differences in EFNEP across states. While these data and CBA outcomes may not be uniform for all states, they do give a good approximation of the benefits that are likely to occur. Therefore, replication of the study in additional states will strengthen the validity of the CBA.

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Appendix A: Study decisions and assumptions

DECISION: In discussions between VCE project staff and the National Program Leader, EFNEP, it was decided that this study would focus on the adult EFNEP because of the consistency in the curriculum and ERS data collected across state programs. While there is a youth EFNEP, behavioral data on the youth program are not routinely collected by all states.

DECISION: In discussions between VCE project staff and the National Program Leader, EFNEP, it was determined that for the purpose of this study, data for the CBA would be limited to that which was collected in the ERS for Virginia in 1996. This would enable us to determine if the ERS provides the data for an appropriate CBA of EFNEP.

DECISION: In discussions between VCE project staff and the National Program Leader, EFNEP, it was decided that other direct benefits identified, such as reduced food costs, food production and preservation, and job readiness and performance would not be included in the tangible benefit calculations because these data are not consistently or routinely collected across states in the EFNEP ERS.

DECISION: In discussions between VCE project staff and the National Program Leader, EFNEP, it was decided that intangible benefits would not be included in the study because they are difficult to monetize and these data are not routinely collected in the EFNEP ERS.

DECISION: The approach taken to monetizing benefits of EFNEP for this study was to characterize the benefits as the health care costs that were either delayed or avoided from practicing appropriate nutritional behaviors as a result of participating in EFNEP. Therefore, the benefits could be valued in dollars by their non-biased market prices (i.e., the cost of medical care associated with the disease or condition either delayed or avoided).

ASSUMPTIONS: There were three critical assumptions that were made in deriving the benefits for Type A and B diseases/conditions:

1) *Benefits for Type A diseases/conditions were based upon delaying onset of the disease/condition for a minimum of five years and benefits for Type B diseases/conditions were based upon avoiding the disease/condition for the duration of the participant's natural and working life. These assumptions were made based upon the expert opinion of the project staff.*
2) *Monetized benefits would only be calculated for EFNEP participants (low-income homemakers) practicing optimal nutritional behaviors upon graduating from the program. While we know that benefits would also spillover to the families, there was no way to accurately calculate this from ERS data.*
3) *Selected EFNEP graduates practicing optimal nutritional behaviors upon graduation would continue to practice the nutritional behaviors acquired in EFNEP for the remainder of their lives. As noted above, studies within the past decade have shown that regression did not occur when EFNEP graduates were out of the program and that they maintained significantly positive behaviors in consumption of the basic four food groups as well as food related behaviors. For the purpose of the study, however, only EFNEP graduates who met very stringent criteria for practicing optimal nutritional behaviors were selected for which benefits were calculated.*

DECISION: The discount rate that was used for this study was 5%.

DECISION: VCE project staff, in conjunction with the National Program Leader, EFNEP and appropriate others, determined that the most appropriate analytic measure of analysis of the cost benefit analysis procedure for state EFNEP programs was the benefit cost ratio. In addition, the other two measures would also be reported.

Appendix B: Procedure used to adjust treatment costs for diseases/conditions

When an economic analysis is done, data are often collected from years besides the base year of the study. To ensure that all figures are comparable and that figures can be weighed against figures that occur in the same time period, it is necessary to standardize the figures to one time unit. There are several methods that have been used to adjust figures for inflation. The approach taken in this study is based on the Gross Domestic Product deflator index provided by the federal government.

To adjust the treatment cost of a disease in this study reported for a year before the base year (i.e., 1996), the procedure used was to divide the index value for the base year by the index value for the year in which the treatment cost was reported. Then multiply the results by the unadjusted value of the treatment cost for the disease. The table below contains the calculations for the treatment cost for each disease.

Disease/ Condition	Base year index (1996)	Year cost reported – associated index	Unadjusted cost	Adjusted cost
Colorectal cancer	1.0990	1990 - 0.9312	$28,000	$33,046
Heart disease	1.0990	1998 – 1.1488	$3,676	$3,517
Stroke	1.0990	1994 - 1.0511	$22,000	$23,002
Hypertension	1.0990	1994 - 1.0511	$348	$364
Osteoporosis	1.0990	1995 - 1.0762	$11,582	$11,827
Type 2 diabetes	1.0990	1992 - 1.000	$5,625	$6,182
Obesity	1.0990	1992 - 1.000	$569	$625
Foodborne illness	1.0990	1993 - 1.0263	$942	$1,009
Commonly occurring infant diseases	1.0990	1993 - 1.0263	$1,435	$1,537
LBW infants	1.0990	1990 - 0.9312	$30,000	$35,406

Appendix C: Virginia EFNEP Family Record/Food Practice Checklist

Beginning on next page.

Virginia Cooperative Extension
EFNEP

EFNEP FAMILY RECORD

Virginia Expanded Food & Nutrition Education Program

REPRINTED 1997 **PUBLICATION 360-090**

*Complete on each family at ENTRY into EFNEP and again at EXIT. Technician should fill in **shaded** items.*

1. Technician's Name & ID#:

2. Check: ENTRY_____ EXIT_____

3. Unit ID: _____

4. Homemaker's ID: _____

5. Enrolled in EFNEP before? (circle Yes OR No) Yes No

6. If Yes, did you receive a Certificate of Completion? Yes No

7. Age: ____

8. Sex: Female___ Male___

9. Pregnant (circle) Yes No

10. Breastfeeding: Yes No

Homemaker (First) (MI) (Last)

a) Name _____

b) Street _____

c) City _____ Zip _____

d) Phone _____

Additional concerns/problems affecting family:

Grade of school completed by homemaker: _____

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 number

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

Date put on Computer: _____

13. Total Household Income Last Month: $_____

14. Household Members: Children by Age List First Name of Children (through Age 19)	Age (Years)
1.	
2.	
3.	
4.	
5.	
6.	
7.	

15. Number of Other Adults in Household ____
(don't count Homemaker)

16. Lesson type (Check one):

1 __ Group
2 __ Individual
3 __ Both
4 __ Other _____

17. Number of Lessons since last record:

18. Entry Date:

19. Programs/agencies from which Family received assistance at ENTRY:
(Circle YES or NO)

WIC/CSFP	Yes	No
Food Stamps	Yes	No
FDPIR (Food Distribution	Yes	No
Prog. on Indian Res.)	Yes	No
Commodities	Yes	No
Head Start	Yes	No
Child Nutrition	Yes	No
AFDC	Yes	No
Other _____	Yes	No

(Give name of program or agency)

20. Exit Date:

21. Exit Reason: (circle)

1 Educational Objective Met
2 Returned to School
3 Took Job
4 Family Concerns
5 Staff Vacancy
6 Moved
7 Lost Interest
8 Other

22. Did your family get help from one or more of programs below, due to referral or suggestion by EFNEP Technician?
Yes___ No___

If YES, check all that apply:

___ WIC/CSFP
___ Food Stamps
___ FDPIR (Food Distribution Prog. on Indian Res.)
___ Commodities
___ Head Start
___ Child Nutrition
___ AFDC
___ Other _____
(Give name of program or agency)

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

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VIRGINIA STATE UNIVERSITY

FOOD PRACTICE CHECKLIST

Date Taken:	Check if answers were written in by Technician ❑	**Check One**	Entry ❑	Exit ❑
			Other ❑	No. ___

The questions below ask about ways you plan and fix foods for your family. As you answer 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 for several days before buying groceries?					
(2) How often do you compare prices of different brands 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 of the refrigerator for more than two hours?					
(5) How often do you *thaw frozen food* by leaving it out on the counter or table (at room temperature)?					
(6) In the past **two weeks**, how often did you prepare or eat foods *without adding salt?*					
(7) In the past **two weeks**, how often did you read food labels to select foods with *less salt or sodium?*					

Please put a check [ ] in the box that best answers each question.	**Do Not Do**	**Seldom**	**Some Times**	**Most of the time**	**Almost Always**
(8) In the past **two weeks**, how often did you read food labels to select foods with **less fat**?					
(9) How often do you *run out of food*, or money to buy food, before the end of the month?					
(10) How often in the past **two weeks** did you or your children have something to eat within 2 hours of getting out of bed?	____times				
(11) In the past **month**, how many times did you do *major grocery shopping*?	____times				
(12) When doing major grocery shopping (in 11 above), how many times did you shop with a *grocery list*?	____times				
(13) In the past **month**, did you have to reduce the amount of food you, or your children, had to eat because there was not enough food, or money to buy food?	Check one: ❑ yes ❑ no				
(14) How much do you agree with this statement? "The *food and nutrition needs* of my family are being met."	Check one: ❑ Strongly Disagree ❑ Disagree ❑ Agree ❑ Strongly Agree				

The previous questions asked about foods and nutrition. Now think about other needs of your family (such as health, money management, parenting, relationships with family and friends, and personal growth.)

How much do you agree with the statement below?

(15) Most of the *other needs* of my family are being met.	Check one: ❑ Strongly Disagree ❑ Disagree ❑ Agree ❑ Strongly Agree

HOMEMAKER'S 24-HOUR FOOD RECALL

1. Homemaker's ID #:	2. Date Taken:
3. Pregnant ❑ Yes ❑ No 4. Nursing ❑ Yes ❑ No	5. Takes Nutritional Supplements ❑ Yes ❑ No If "Yes" List Type:
6. Money Spent on Food Last Month: $__________	

Meal Type Morning = 1 Afternoon = 4 MidMorning = 2 Evening = 5 Noon = 3 Late Evening = 6	**Serving Abbreviations** TBSP = tablespoon c = cup tsp = teaspoon lb = pound oz = ounce sl = slice	9. Check Which Food Record: ❑ ENTRY ❑ EXIT ❑ Other: Number_____

10. What did homemaker eat and drink in the last 24 hours?
(To be filled out by Technician OR Homemaker)

11. To Be Coded By EFNEP Technician.

Food Items and Description (List all foods and beverages. List main ingredients in mixed foods, on separate lines.)	Amount Eaten	Meal Type	Food ID Number	Amount Code
				•
				•
				•
				•
				•
				•
				•
				•
				•
				•
				•
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				•
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				•
				•
				•
				•
				•
				•

12. Number of Lessons Taught Since Last Record:
Individual______ Group______ Other______

When a pregnant homemaker has a baby, enter delivery date, birthweight, and general health of baby:
____

Appendix D: Procedure for calculating the number of EFNEP graduates practicing optimal nutritional behaviors from FPC data

EFNEP participants complete a food practice checklist (FPC) and a 24-hour food recall on entry and exit from the program. The data on each were treated as pre (entry) and post (exit) program scores. Data were entered into the ERS system and stored as database (dbf) files. The dbf files were analyzed to determine graduates practicing optimal nutritional behaviors using the personal computer version of the Statistical Package for the Social Sciences (SPSS-PC).

To be included in the number of graduates practicing optimal nutritional behaviors, the graduate needed to score a 4 or greater where a positive response was desired, or a 2 or less where a negative response was desired from entry to exit assessment on appropriate questions associated with the disease/condition in the FPC. In addition, the graduate needed to have reported 24-hour food recall behaviors in the identified ranges for the appropriate diseases/conditions. After converting the dbf files to SPSS-PC files, the pre and post scores were examined using the following procedure.

1) The appropriate criteria were applied to pre and post data independently. Only those graduates satisfying the criteria were selected (saved as two files).
2) The files were then merged.
3) If, after merging the files, both pre and post records existed for a graduate, then the graduate was rejected, because it was evident that they were already practicing optimal nutrition behaviors and hence EFNEP did not influence their practices.
4) If, after merging the files, only post records existed for a graduate, then the graduate was selected as one who had benefited from EFNEP and was practicing optimal nutritional behaviors related to the disease/condition.

This procedure was applied to each data set for the 26 counties in Virginia EFNEP.

SPSS-PC procedure for selecting numbers of EFNEP graduates practicing optimal nutritional behaviors from each VCE unit for the CBA study

1. Go to File - Open (Files of type: All Files)
2. Open recall.dbf file
3. Go to Data - Sort Cases
4. Sort cases by the variable "id" in ascending order
5. Go to Data - Select Cases
6. Select - If condition is satisfied
7. Select if variable "isexit" = 'T' (unselected cases are deleted)
8. Save this file to the A drive (name = recall)
9. Repeat steps 1-8 for the cklist.dbf file on the disk
10. After saving the cklist file to the A drive (name = cklist), leave it open and go to Data - Merge Files - Add Variables
11. At the Add Variables: Read File box, double click on the previously saved recall file (saved in step 8)
12. At the Add Variables from: A:\ recall.sav box:
    a. Check (click) the small box to turn on the option "Match cases on key variables in sorted files" (lower left)
    b. Click once on id (+) in the Excluded Variables box to highlight it (upper left)
    c. Click on the > box to add the id (+) variable to the Key Variables box (lower right)
    d. Click the OK box (upper right)
    e. Click the OK box on the warning message
    f. Do not save contents to cklist.sav to data editor (if this box appears)
13. The data from the two files will be merged into one file by id (can you believe it!)
14. Go to Data - Select Cases
15. Select - If condition is satisfied
16. Enter select criteria from the FBC and Food Recall criteria (unselected cases are deleted)
17. The results are the number of graduates practicing optimal nutritional behaviors for the disease/condition for that unit (with all data on the disk – may include 93 and 94 data)
18. Save the file (name = optim)
19. Print a copy of this file and then cross out all cases with a date before October 1995 (these are what we will use in the CBA)
20. Repeat above steps for the other units
21. Repeat steps 1-13 (in step 7 select, "is exit" = F)
22. In step 14, save the file as pre-merged
23. To select the participants, who satisfy optimal nutrition behaviors for avoidance of disease, the following steps are applied to the pre-merged file
24. Repeat steps 14-18 for each disease
25. Repeat steps 1-18 for each county
26. To create the exit data, the exact procedure is applied to the chklst.dbf and the recall. dbf.files. In Step 7, select "is exit" = T
27. Continue through step 18
28. Using hard copies of the entry and exit data, delete those participants who:
    a) appear on both entry and exit data
    b) have exited from the program before October 1st 1995

The resulting exit data contain only those participants who satisfied the optimal nutrition behaviors on entry to the program, and who have exited after October 1st 1995 from the program.

Appendix E: Number of 1996 Virginia EFNEP graduates practicing optimal nutritional behaviors

County/City	Heart Disease	Stroke and Hypertension	Cancer, Obesity, Diabetes	Osteoporosis	Commonly Avoided Infant Diseases	Foodborne Illness	LBW infants
Amelia	0	0	1	4	0	13	3
Appomattox	0	0	0	3	0	7	0
Arlington	1	1	3	16	5	54	0
Bedford	0	0	0	3	3	4	6
Charlotte	1	6	1	16	0	47	1
Chesapeake	7	38	10	135	4	271	1
Dickenson	0	0	0	0	0	4	0
Hampton	0	4	5	140	27	155	3
Lancaster	0	7	0	22	3	65	0
Lee	0	2	0	6	1	29	0
Louisa	0	2	0	12	1	33	0
Mecklenberg	0	2	0	11	0	49	8
Newport News	0	11	1	29	0	124	3
Norfolk	2	25	6	75	3	173	6
Pittsylvania	1	25	1	20	2	30	7
Pulaski	1	4	1	7	17	9	1
Richmond	7	30	7	36	1	91	3
Roanoke City	11	92	18	139	3	167	14
Russel	0	0	1	8	0	19	0
Scott	0	0	0	3	0	5	0
Smyth	1	2	2	17	0	27	3
Suffolk	0	5	1	48	0	77	5
Tazewell	0	1	0	15	1	35	0
Virginia Beach	1	21	1	97	6	121	1
Washington	0	1	0	4	0	11	0
Wise	1	10	1	19	10	44	8
Total (Percent)[12]	34 (1.1%)	290 (9.4%)	60 (1.9%)	885 (28.5%)	87 (2.8%)	1664 (53.7%)	84 (2.7%)

12 Total number of graduates = 3,100

Appendix F: Example benefit calculations

Example benefit calculations for the initial analysis of each of the four categories of tangible benefits (i.e., direct and indirect tangible benefits for Type A and B diseases/conditions) are presented below. All present value benefit calculations (i.e., the value of the benefit in the future adjusted to the value of the benefit in 1996) were conducted using the Microsoft Excel Spreadsheet program. The discount rate used for all present value calculations was 5%.

Direct tangible benefits for type A diseases/conditions — colorectal cancer

Average age of participant = 23
Average age of onset of colorectal cancer = 36
Average years of survival of colorectal cancer after onset = 5
Average number of years onset of colorectal cancer delayed = 5
Annual 1996 adjusted treatment cost of colorectal cancer after onset = $33,046.00
Estimated number of graduates practicing optimal nutritional behaviors to accrue benefits = 3.09225

Present value of colorectal cancer treatment costs for five years if incurred at average age of onset (from age 36-40) = $75, 874.08 (calculation illustrated below)

Age	Present Value Colorectal Cancer Treatment Costs
23-35	$0.00
36	$16,690.48
37	$15,895.69
38	$15,138.75
39	$14,417.86
40	$13,731.30
Total present value	**$75,874.08**

Present value of colorectal cancer treatment costs for five years if delayed for five years (from age 41-45) = $59,449.32 (calculation illustrated below)

Age	Present Value Colorectal Cancer Treatment Costs
23-40	$0.00
41	$13,077.42
42	$12,454.69
43	$11,861.61
44	$11,296.77
45	$10,758.83
Total present value	**$59,449.32**

The direct benefit for colorectal cancer is the difference in the above two present values multiplied by the estimated number of graduates practicing optimal nutritional behaviors for colorectal cancer. The calculation is presented below.

($75,847.08 - $59,449.32) X 3.09225 = $50,789.43

Direct tangible benefits for type B diseases/conditions — Type 2 diabetes

Average age of participant = 23
Average age of onset of Type 2 diabetes = 40
Average lifespan = 78
Annual 1996 adjusted treatment cost of Type 2 diabetes after onset = $6,182.00
Estimated number of graduates practicing optimal nutritional behaviors to accrue benefits = 3.843225

Present value of Type 2 diabetes treatment costs avoided for 39 years if not incurred at age 40 = $45,898.13 (calculation illustrated below)

Age	Present Value of Type 2 Diabetes Treatment Cost
23-39	$0.00
40	$2,568.75
41	$2,446.43
42	$2,329.93
43	$2,218.98
44	$2,113.32
45	$2,012.68
46	$1,916.84
47	$1,825.56
48	$1,738.63
49	$1,655.84
50	$1,576.99
51	$1,501.89
52	$1,430.38
53	$1,362.26
54	$1,297.39
55	$1,235.61
56	$1,176.77
57	$1,120.74
58	$1,067.37
59	$1,016.54
60	$968.13
61	$922.03
62	$878.13
63	$836.31
64	$796.49
65	$758.56
66	$722.44
67	$688.04
68	$655.27
69	$624.07
70	$594.35
71	$566.05

continued on next page

Age	Present Value of Type 2 Diabetes Treatment Cost
72	$539.09
73	$513.42
74	$488.97
75	$465.69
76	$443.51
77	$422.39
78	$402.29
Total Present Value	**$45,898.13**

The direct benefit for Type 2 diabetes is the present value of the avoided treatment costs multiplied by the estimated number of graduates practicing optimal nutritional behaviors for Type 2 diabetes. The calculation is presented below.

$45,898.13 X 3.84 = $176,396.84

Indirect tangible benefits for type A diseases/ conditions — heart disease

Average age of participant = 23
Average age of onset of heart disease = 55
Average years of survival of heart disease after onset = 5
Average number of years onset of heart disease delayed = 5
Annual cost of lost work days for heart disease = $3,526.40
Total cost of lost work days for heart disease in 1996 dollars for five years = $17,632.00
Estimated number of graduates practicing optimal nutritional behaviors to accrue benefits = 2.77

Present value of lost work days from heart disease for five years if incurred at average age of onset (from age 55-59) = $3,203.76 (calculation illustrated below)

Age	Present Value of Lost Work Days from Heart Disease
23-54	$0.00
55	$704.75
56	$671.19
57	$639.23
58	$608.79
59	$579.80
Total present value	**$3,203.76**

Present value of lost work days from heart disease for five years if delayed for five years (from age 60-64) = $2,510.23 (calculation illustrated below)

Age	Present Value of Lost Work Days from Heart Disease
23-59	$0.00
60	$552.19
61	$525.90
62	$500.85
63	$477.00
64	$454.29
Total present value	**$2,510.23**

The indirect benefit for heart disease is the difference in the above two present values multiplied by the estimated number of graduates practicing optimal nutritional behaviors for heart disease. The calculation is presented below.

($3,203.76 - $2,510.23) X 2.77 = $1,921.08

Indirect tangible benefits for type B diseases/ conditions — Type 2 diabetes

Average age of participant = 23
Average age of onset of Type 2 diabetes = 40
Average age of retirement = 65
Annual 1996 cost of lost work days for Type 2 diabetes = $36.48
Estimated number of graduates practicing optimal nutritional behaviors to accrue benefits = 3.84

Present value of lost work days from Type 2 diabetes avoided for 26 years if not incurred at age 40 = $228.80 (calculation illustrated below)

Age	Present Value of Lost Work Days from Type 2 Diabetes
23-39	$0.00
40	$15.16
41	$14.44
42	$13.75
43	$13.09
44	$12.47
45	$11.88
46	$11.31
47	$10.77
48	$10.26
49	$9.77
50	$9.31
51	$8.86
52	$8.44
53	$8.04
54	$7.66
55	$7.29
56	$6.94
57	$6.61
58	$6.30
59	$6.00
60	$5.71
61	$5.44
62	$5.18
63	$4.94

Age	Present Value of Lost Work Days from Type 2 Diabetes
64	$4.70
65	$4.48
Total Present Value	**$228.80**

The indirect benefit for Type 2 diabetes is the present value of the lost work days avoided multiplied by the estimated number of graduates practicing optimal nutritional behaviors for Type 2 diabetes. The calculation is presented below.

$228.80 X 3.84 = 878.58

EXECUTIVE SUMMARY

INTRODUCTION

The Expanded Food and Nutrition Education Program (EFNEP) is the largest 3(d) funded program conducted by the Cooperative Extension System, at approximately 60 million dollars per year, and the only 3(d) program that operates under its own specific statute. EFNEP has been in existence for 30 years, and has been shown to be effective in helping limited resource youth and families with young children acquire the knowledge, skills, attitudes, and changed behavior necessary for nutritionally sound diets and to contribute to their personal development and the improvement of the total family diet and nutritional well-being.

To continue to refine and expand the effectiveness of nutrition programs such as EFNEP, better evaluation procedures are needed to help determine the relative costs and benefits of education versus other intervention programs. Other nutrition education programs conducted by the Cooperative Extension System, other USDA agencies and the private sector would also benefit from this study as well. In 1996, the Cooperative State Research, Education, and Extension Service, United States Department of Agriculture (CSREES, USDA) issued a national Request for Proposals (RFP) to conduct a cost benefit analysis of nutrition education programs, with emphasis on EFNEP. Virginia Cooperative Extension (VCE) responded to the RFP and was successful in securing the grant to conduct the study.

One of the most widely recognized procedures for examining program efficiency is cost benefit analysis (CBA). CBA is the analytic process where costs and benefits of a program are identified and measured in monetary (dollar) terms. By valuing both costs and benefits in the same monetary terms, they can be directly compared to determine the net economic impact of a program. Because CBA uses the common metric of dollars to express program outcomes, it answers the question; "Does a program generate net returns to investments?" This study presents the procedures and results of a cost-benefit analysis of Virginia EFNEP to measure the economic efficiency of the program for its federal sponsors.

STUDY OBJECTIVES

1. Determine the study perspective.
2. Describe EFNEP and identify, through a literature review and review of selected state EFNEP programs (coordinated with the National Program Leader, EFNEP and appropriate others), a list of benefits and costs associated with EFNEP.
3. Synthesize the identified benefits and costs associated with EFNEP, determine measures for them, share them nationally, and provide opportunity for input. As a result of this input, a set of benefits and costs and their measures will be determined for EFNEP.
4. Determine the analytic measure of the CBA for EFNEP and pilot test in Virginia.
5. Analyze results of the EFNEP CBA in Virginia and make revisions as necessary in the framework. Prepare a report to document process and outcomes.

STUDY PERSPECTIVE

The primary audiences of this CBA are federal and state decision-makers (i.e., program sponsors) who have responsibilities for weighing the costs of EFNEP to taxpayers against the benefits to program participants and society at large. This program sponsor perspective focuses on the objectives of the funding organization and is most appropriate when choices involve alternative programs under constrained budgets. From this perspective, costs for EFNEP are foregone opportunities to invest in other programs. Benefits are outcomes realized by society at large, for federal decision-makers, or by society within a specific state, for state decision-makers.

DESCRIPTION OF VIRGINIA EFNEP

The 1996 Virginia adult EFNEP program was selected for this study. A description of the program was compiled from state documents, including conversations with the Virginia state EFNEP coordinator. Virginia adult EFNEP operated in 26 counties and cities during 1996. The counties were Amelia, Appomattox, Arlington, Bedford, Charlotte, Dickinson, Lancaster, Lee, Louisa, Mecklenberg, Pittsylvania, Pulaski, Russell, Scott, Smyth, Suffolk, Tazewell, Washington, and Wise. The cities were Chesapeake, Hampton, Newport News, Norfolk, Roanoke, Richmond, and Virginia Beach. Of the 26 EFNEP units, seven are primarily in urban areas and 19 are primarily rural.

EFNEP is primarily targeted to low-income homemakers (i.e., families with incomes at 150% of poverty or below). It is designed to assist limited resource audiences in acquiring the knowledge, skills, attitudes, and changed behaviors necessary for nutritionally sound diets, and to contribute to their personal development and the improvement of the total family diet and nutritional well being. EFNEP participants may

also be recipients of food stamps or other forms of government food assistance, and may participate in the WIC program. The original philosophy of EFNEP was based on three concepts: a) that an existing home economics program can be modified to effectively reach low-income audiences, b) that professional home economists can teach and supervise paraprofessionals who, in turn, teach low-income homemakers, and c) that a nutrition education program tailored to the needs, interests, competencies, and economic and education levels of low-income families, and delivered by paraprofessionals who are indigenous to the target audience, can convince participants to change their eating habits. The objectives of EFNEP are as follows:

1) To improve diets and nutritional welfare for the whole family.
2) To increase knowledge of the essentials of human nutrition.
3) To increase the ability to select and buy food that satisfies nutritional needs.
4) To improve practices in food production, storage, preparation, safety, and sanitation.
5) To increase ability to manage food budgets and related resources such as food stamps.

A national food and nutrition education curriculum for youth and adults was developed under a cooperative agreement between Extension Service, USDA and the Michigan Cooperative Extension Service. The "Eating Right is Basic, 3rd edition" (ERIB 3) is the primary curriculum currently being used in Virginia for the adult phase of the program. Eating Right is Basic is designed to teach individuals or small groups of individuals with low incomes how to choose and prepare healthy meals. Lessons cover basic nutrition, food resource management, food safety, and food preparation.

The delivery of EFNEP subject matter is conducted by paid paraprofessionals (program assistants) and volunteers who typically reside in the communities of the target populations. These staff are trained and supervised by Cooperative Extension professionals. Methods used in delivering the adult component include teaching homemakers of limited resource families on a one-to-one basis or in small neighborhood groups. In Virginia, each family may stay enrolled in the program for a maximum of 12 months, though some states use a shorter enrollment period.

In 1993, a new computerized EFNEP Evaluation and Reporting system (ERS) was implemented nationwide. This system allows for summary results of the behavior changes in participants at the local (county/unit), state, and national levels. The system provides a variety of summary reports that are useful for management purposes and for assessment of individual participant needs. Among other features, this data system has a dietary analysis component for adult participants that provides information on the actual nutrient content of diets and how well the diets meet the national dietary recommendations. The printed reports on assessment of eating habits were designed to be shared with participants and to encourage adoption of recommended practices. Behaviors assessed by the ERS can be placed in the domains of improved nutrition, food selection and preparation methods, food handling practices, resource management, and food safety.

Within the past decade, studies have been conducted that address the impact of EFNEP on low-income homemakers six months to five years after program completion. These studies assessed whether or not the graduates maintained dietary improvement after leaving the program. Overall results showed that dietary regression did not occur when the homemakers were out of the program and that they maintained significantly positive scores in consumption of the basic four food groups as well as positive food related practices. The most significant results were noted in Michigan, where it was found that EFNEP graduates posted higher scores on food and nutrition knowledge and practice five years after graduating from EFNEP. For the purpose of this study, data for the CBA were limited to that collected in the ERS for Virginia in 1996. This enabled study personnel to determine if the ERS provides the data for an appropriate CBA of EFNEP.

METHODS

A meaningful CBA requires a comprehensive list of program benefits and costs. **Benefits** can be defined as all positive outcomes or consequences that result from actions of the program. **Direct benefits** are the primary positive outcomes or consequences of the program that accrue to participants and others directly involved in the program. **Indirect benefits** are the secondary outcomes or consequences of the program. They may accrue to program participants, program nonparticipants, or society in general. Also known as externalities or spillovers, indirect benefits may be positive or negative.

Costs can be defined as the value of the resources that must be used to develop, implement, and operate the program being analyzed. **Direct costs** are the resources budgeted for or assigned to the program. Examples of direct costs include personnel, facilities, equipment and materials, and other costs. **Indirect costs** are resources not actually budgeted for or assigned to the program, but nonetheless represent a withdrawal of resources from the economy that allow the program to operate. There are many ways to

measure costs and benefits. Those that can easily be monetized (valued in dollars) are referred to as **tangible**; those that cannot easily be monetized are referred to as **intangible**. The time horizons over which costs and benefits have or are expected to occur also need to be indicated.

Scientific evidence suggests that diet plays an important role in the onset of chronic disease and other health conditions, contributing to increased illness, reduced quality of life, and premature death. Although there is still much that scientists do not know about how diets affect health, there is significant agreement on the components of a healthy diet. In particular, diets high in calories, fat, saturated fat, cholesterol, and salt and low in fiber containing foods are associated with increased risk for coronary heart disease, certain types of cancers, strokes, and diabetes. Diet also plays a role in other health conditions such as obesity, hypertension, osteoporosis, and problem pregnancy (pre, peri, and postnatal). Taken together, these health conditions cost society an estimated $250 billion each year in medical charges and lost productivity.

A list of benefits and costs associated with EFNEP was prepared by VCE project staff based on information collected from the program description and nutrition related literature. For benefits, this list included: 1) direct benefits associated with EFNEP as they related to appropriate nutrition-related diseases that would be affected (i.e., delayed or avoided) through associated behaviors taught and measured through EFNEP, and 2) indirect benefits that would accrue to EFNEP participants through their participation in the program. This information was shared nationally by posting the benefits and costs on an Internet web site. An announcement was sent to all state EFNEP coordinators encouraging them to review the web site and to send comments and suggestions to the national study team. All comments received were reviewed and addressed accordingly.

Tangible benefits (i.e., benefits that can be easily monitized) of EFNEP accruing to graduating program participants were characterized in two ways:

1. The benefit of avoiding or delaying the health care costs associated with treating nutrition-related diseases/conditions associated with EFNEP. Treating a disease represents a cost. If that cost can be avoided or delayed, this represents a benefit (i.e., costs that are never incurred; costs that are delayed into the future). Other direct benefits identified, such as reduced food costs, food production and preservation, and job readiness and performance were not included in the tangible benefit calculations because these data are not consistently or routinely collected across states in the EFNEP ERS.
2. Avoiding or delaying the loss of productivity from morbidity (i.e., earnings foregone from lost workdays) related to nutrition-related diseases/conditions associated with EFNEP. Productivity, or personal earnings, is jeopardized if a person becomes ill and cannot work and therefore cannot earn income. Avoiding or delaying onset of a disease becomes a benefit by increasing the person's productivity/earning potential (called human capital).

Item 1 above was considered the direct tangible benefit of participation in EFNEP. Item 2 was considered the indirect tangible benefit. It was decided that intangible benefits would not be included in the study because they are difficult to monetize and these data are not routinely collected in the EFNEP ERS.

Tangible benefits from EFNEP were equal to the present value of the estimated treatment and morbidity costs saved by avoiding or delaying onset of a disease or condition. The determination of treatment costs to use in the study was based on published results for the most common treatment costs avoided or delayed for each disease/condition. Present value is the value of the benefits over time (in the future) discounted to current dollars. In short, delaying costs into the future represents a benefit because a dollar is worth more today (or sooner) than at some future time. The diseases and conditions were separated into three categories, or types, for the study.

Type A diseases/conditions (colorectal cancer, heart disease, stroke, hypertension) - Because these diseases/conditions are considered to be life threatening, the approach taken to calculating these tangible benefits was to assume that their onset could be delayed through practicing appropriate nutritional behaviors. When delayed, the direct tangible benefit is the present value of delaying the cost of treatment into the future. The total treatment cost used was the average number of years of survival after treatment for the disease/condition. The indirect tangible benefit is the difference in the present value of delaying morbidity costs into the future. For the purpose of this study, the time period selected for delaying each of the Type A diseases/conditions was five years.

Type B diseases/conditions (osteoporosis, Type 2 diabetes, obesity, commonly occurring infant diseases (i.e., otitis media, respiratory infections, viral infections, gastroenteritis), foodborne illness) - Because these diseases/conditions are not considered to be life threatening, the approach taken to calculating these tangible benefits was to assume that their treatment costs could be avoided through practicing appropriate nutritional behaviors. When avoided, the direct tangible benefit is the present value of the avoided treatment costs from average age of onset of the disease/

condition through the average lifespan. The indirect tangible benefit is the present value of morbidity costs avoided from average onset of the disease through the average age of retirement (65 years).

Type C condition (low-birth-weight (LBW) infants) – This condition differs from Type A and B diseases/conditions because treatment costs are incurred on a one-time basis (when the child is born). The direct benefit is based on avoiding the treatment costs associated with a LBW infant. This benefit is the present value of the treatment costs avoided.

The following formula was used to derive the direct and indirect tangible benefits from EFNEP per disease/condition:

BENEFIT = ([A] Annual number of graduates in EFNEP x [B] Incidence rate of the disease/condition in the low income population x [C] Incidence of the disease/condition related to diet x [D] Percent of graduates practicing optimal nutritional behaviors related to avoiding or delaying the disease/condition) x [E] Present value of appropriate benefits for the disease/condition.

The cost of appropriate disease/condition treatment was documented from relevant scientific literature. Other data from the literature included the incidence of the disease in the U.S. population (in the low-income population, where available), the percentage of the disease attributable to diet, the average age of onset of the disease, and the average years of survival after treatment.

For type A and B diseases/conditions, indirect benefits were calculated based on the earnings foregone due to lost workdays (i.e., morbidity). These diseases/conditions can be delayed or avoided by following the dietary behaviors promoted in EFNEP. When delayed (Type A diseases/conditions), the benefit is the difference in the present value of delaying morbidity costs five years into the future. When avoided (Type B diseases/conditions), the benefit is the net present value of the earnings foregone each year through lost work days from onset of the disease to the average lifespan or retirement.

A very conservative approach was taken to calculating the number of graduates practicing optimal nutritional behaviors. A procedure was devised to examine ERS FPC data to identify and select only those graduates who reported appropriate behavior changes from entry to exit. In addition, the graduate's exit 24-hour food recall for disease/condition related nutrients needed to be in accordance with RDA and dietary guidelines. Participants who may have already made behavior changes from participating in other programs (e.g., Special Supplemental Nutrition Program for Women Infants and Children Program (WIC)) were not included in the selection of graduates practicing optimal nutritional behaviors in this study, because they would have exceeded the criteria on the entry assessment and would have been excluded.

Using this method, a small percent of EFNEP graduates in Virginia for 1996 were selected as those practicing optimal nutritional behaviors upon exit from the program for each of the diseases/conditions.

The direct tangible costs of conducting the entire 1996 adult Virginia EFNEP program for all participants were identified as: salaries and benefits, office space, utilities, equipment, supplies/training, and staff travel. Because the program is delivered primarily in small groups in participants' places of residence and at times convenient to them, indirect costs borne by the participants were considered minimal and not included in the study.

The next CBA step required a decision on the analytic measure that would be generated by the cost benefit analysis. The three most common are the benefit cost ratio, internal rate of return, and net present value. The benefit cost ratio gives the benefits obtained per dollar of cost. If the benefit cost ratio is greater than 1, then the benefits produced by the program are greater than the costs; if less than 1, then the costs of the program are greater than the benefits received. If the benefit cost ratio is equal to 1, the program "breaks even" on costs and benefits. The internal rate of return (IRR) is the social discount rate that would make costs and benefits equal over the life of the program. Net present value (NPV) discounts all the future yearly net benefits (total benefits minus total costs) and sums them to arrive at a value that reflects all future net benefits in today's dollars. A NPV greater than zero indicates the program is generating returns beyond costs. This measure is highly flexible, because it allows the discount rate to vary over time. The social discount rate used in the study for each of the analytic measures was 5%.

RESULTS

The initial outcomes of the three analytic CBA measures (i.e., benefit cost ratio, net present value, and internal rate of return) for 1996 Virginia adult EFNEP graduates practicing optimal nutritional behaviors in relation to total direct program costs are presented below. Also presented are the results of various sensitivity analyses. The purpose of sensitivity analysis is to address the presence of uncertainty in the CBA based on the various assumptions made in the analysis. Sensitivity analysis proposes "what if" scenarios by manipulating certain variables to determine minimum and maximum values of the analytic measures. In this

way, the CBA becomes more robust concerning any challenges to its original assumptions.

Sensitivity analysis was conducted to address four aspects of the study: 1) the retention rate of dietary behaviors, 2) the incidence rate of osteoporosis related to diet, 3) the incidence rates of the diseases/conditions in the population, and 4) the discount rate (see Lewis, 1998 for a more comprehensive analysis). A fifth sensitivity analysis was conducted to determine the combined effects of items 1 and 3 above.

Summary of Virginia EFNEP CBA Results (Table 1)

The initial benefit to cost ratio of $10.64/$1.00 indicated a significant return on investment for Virginia EFNEP. To address the presence of uncertainty in the CBA for the various decisions and assumptions made in the initial analysis, several sensitivity analyses were conducted. These analyses resulted in a range of benefit to cost ratios from $2.66-17.04/$1.00.

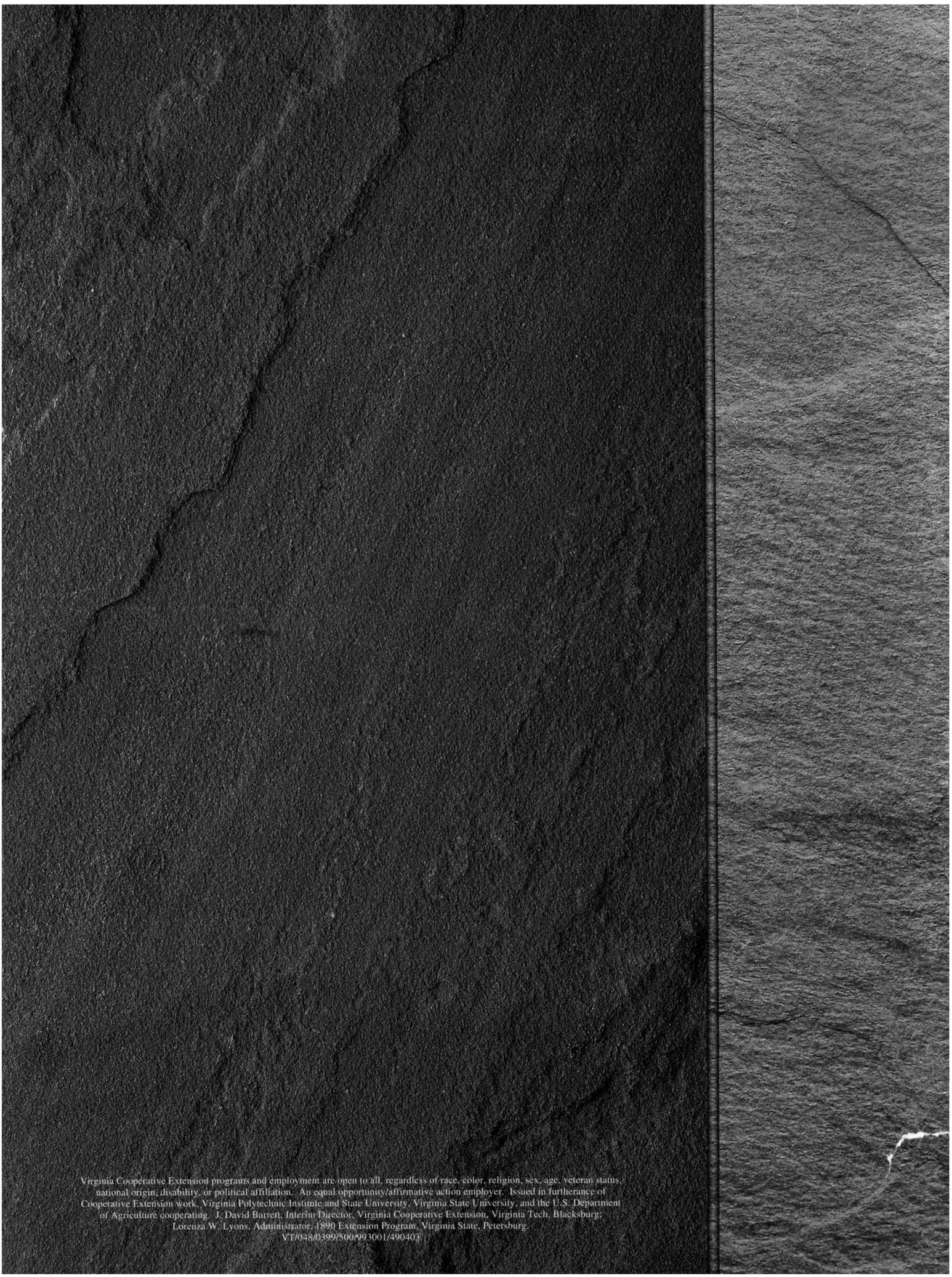
CONCLUSION

The CBA of Virginia EFNEP suggests that the monetized benefits exceed costs of the program. Given all of the above, the one benefit to cost ratio that best reflects Virginia EFNEP is the initial ratio of $10.64/$1.00. However, whether the decision-maker gives more weight to the initial CBA calculation or to any of the other sensitivity analyses, the outcome of this study remains positive. Because Virginia EFNEP generates net gains, taxpayers are receiving positive returns on their invested dollars in this program. Indeed, additional studies of other state EFNEP programs are needed. However, it should be noted that while some variations exist from state to state, there are more similarities than differences in EFNEP across states. While these data and CBA outcomes may not be uniform for all states, they do give a good approximation of the benefits that are likely to occur. Therefore, replication of the study in additional states will strengthen the validity of the CBA.

Table 1. Summary of Virginia EFNEP CBA results

Analysis	B/C Ratio	NPV	IRR
Initial analysis	$10.64/$1.00	$16,510,898.90	16.41%
Reducing ONB[1] graduates by 50%	$5.32/$1.00	$7,398,915.91	11.60%
Reducing ONB graduates by 75%	$2.66/$1.00	$2,842,924.19	8.49%
Using 50% incidence rate for osteoporosis related to diet	$5.91/$1.00	$8,413,055.37	14.16%
Adjusting for low-income diseases/ conditions incidence rates	$17.04/$1.00	$27,472,733.36	37.13%
Adjusting the discount rate to 10%	$2.77/$1.00	$3,039,503.87	16.41%
Reducing ONB graduates by 75% and adjusting for low-income diseases/conditions incidence rates	$4.26/$1.00	$5,583,372.45	11.38%

1 ONB = optimal nutritional behavior



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