Cost Benefit Analysis of Virginia EFNEP: Calculating Indirect Benefits and Sensitivity Analysis

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(ABSTRACT)

The Cooperative Extension System has focused on nutrition education for low-income families for approximately 29 years via the Expanded Food and Nutrition Education Program (EFNEP). In response to the need for a comprehensive economic evaluation of EFNEP, Virginia Cooperative Extension (VCE) was awarded a grant from the Cooperative State Research, Education and Extension Services, United States Department of Agriculture (CSREES, USDA) to conduct a cost benefit analysis (CBA) of nutrition education programs, with emphasis on EFNEP. Virginia EFNEP served as the pilot program to test the evaluation procedure.

This study is a part of the CBA of Virginia EFNEP. The purpose is to calculate the indirect tangible benefits derived from participation in EFNEP. The indirect tangible benefits are classified as 1) delaying productivity loss due to mortality and 2) avoiding productivity loss due to morbidity. This study also uses sensitivity analysis to evaluate the effects of two critical assumptions pertaining to retention of dietary behaviors and to incidence rate of diseases in the low-income population. Finally, the discount rate is analyzed via sensitivity calculations.

There were two major conclusions drawn from this study. First, the indirect benefits accounted for more than $1 million of the total benefit generate by EFNEP. Second, the sensitivity analyses support the positive outcome (i. e., positive return on every dollar invested) derived from the CBA of Virginia EFNEP.

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DEDICATION

This thesis is dedicated to my parents, Edgar and Anna Lewis. They have been tremendously supportive of my endeavors. Without their love, encouragement, and assistance, it would have been impossible for more me to successfully complete this Master's program.

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CHAPTER 1.0 RESEARCH PROPOSAL

1.1 Introduction

Several recent studies point to the need for effective nutrition intervention programs for low-income families in America today. For example, The Report of the Task Force on Minority Health released in 1985 and 1986 emphasized the need for special attention to be paid to chronic health problems among racial minorities, whose average annual income is lower than that of white Americans (Singleton).

Historically, the pervasive problems of hunger and malnutrition in the United States have affected both whites and blacks, in urban and rural areas. In 1968, it was reported that approximately five and one-half million families were living in poverty (Sc. & Educ. Admin.). Poverty is one of the many factors that place families at risk for engaging in poor health and nutrition behaviors. It is associated with an increased risk of developing cardiovascular disease, obesity, and diabetes. For families with limited incomes or social patterns that predispose them to such high-risk health behaviors, the struggle to cope with life's everyday problems takes precedence over health promotion and disease prevention (Singleton). Estimates of the magnitude of this problem in the 1960's differed, but two general conclusions were certain:

- Several million Americans were living at or below the poverty level.
- Children and adults in low-income families were suffering inadequate nutrition, sometime severe malnutrition.

In an effort to address the problem, hundreds of federal, state, and local programs sought to focus their resources appropriately. During this period of searching for solutions, the Expanded Food and Nutrition Education Program (EFNEP) was born. This program was developed by and administered through the Extension Service, the educational arm of the U.S. Department of Agriculture (USDA). The EFNEP program was expected to produce improved diets and health for program participants and their families. This goal would be accomplished via the participants' increased knowledge of the essentials of nutrition, as well as from increased skills in food selection, purchasing, preparation, production, storage, safety and sanitation. The program would also enhance the ability of participants to manage resources relating to food,

including participation in the Food Stamp and the Commodity Distribution Program (Sc.& Educ. Admin.).

In an era of accountability, the ability to measure the benefits of nutrition intervention efforts has become important in conducting more comprehensive economic evaluations and may determine which nutrition programs are continued and which are not (Himburg & Keane). EFNEP evaluators have measured knowledge gain and, to a more limited extent, the behavior changes of participants, but there are no published measures of direct benefits (i.e., cost savings) accrued as a result of participation in the program (Lambur, Cox, & Ellerbrock).

In 1996, the Cooperative State Research, Education and Extension Service, United States Department of Agriculture (CSREES, USDA) responded to this need for a comprehensive economic evaluation of nutrition education programs. They awarded Virginia Cooperative Extension (VCE) a grant to conduct a cost benefit analysis (CBA) of nutrition education programs, with emphasis on EFNEP.

Why is VCE using CBA to evaluate the economic impact of nutrition education programs? First, this is the approach requested by CSREES, USDA. Second, there are major advantages to using CBA. The most attractive advantage is that CBA uses the common measurement of dollars to identify, measure and compare the cost and benefits of a program. Therefore, this technique answers one question that others such as cost-effectiveness analysis and cost-utility analysis cannot, i.e., "does a project generate net savings"(Haddix, Teutsch, Shaffer & Dunet).

1.2 Problem Statement

Studies using CBA in health related programs are quite rare. One possible reason for this is that the evaluation issues in which health care professionals are interested generally involve benefits that cannot be easily monetized. Another explanation might be that the analytical details required in a typical CBA demand familiarity with economic concepts and a foundation in welfare economics, and understandably such preparation is generally lacking among clinicians (Nas).

VCE uses the classical CBA framework to perform the cost-benefit analysis. However,

because of limited research related to evaluating nutrition education programs, VCE makes several critical assumptions in its approach to monetizing the benefits of EFNEP. These assumptions could possibly effect the outcome of the study. As a part of the VCE EFNEP study, this project examines the effects of the assumptions on the calculated derived benefits of EFNEP through sensitivity analysis. The assumptions analyzed are:

- *The parameters included in the study characterizing EFNEP participants, such as incidence rate of diseases, are indicative of the low-income population.* The target population of EFNEP is low-income homemakers. Therefore, the use of statistics that are representative of the general U.S. population could create a sample bias problem. The VCE EFNEP study uses the incidence rates for the low-income population where available. However, because of limited data, this information has only been identified for diabetes, hypertension, and heart disease.

- *EFNEP graduates who are practicing optimal nutritional behaviors upon exiting the program will continue to practice these behaviors for the duration of their lives.* Several studies have been conducted that address the impact of EFNEP on low-income homemakers up to five years after program completion. These studies assessed whether or not the graduates maintained the dietary improvements 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 (Lambur, Rajgopal, Lewis, Cox, Ellerbrock). The VCE EFNEP study calculates the benefits derived from avoiding or delaying several diseases/conditions under the assumption that graduates practicing optimal nutritional behaviors maintain dietary improvement for the ***duration of their lives***. However, there are no long-term studies to substantiate this assumption.

The discount rate is also evaluated in the sensitivity analysis section. A five percent discount rate is used for this CBA of EFNEP. Although this discount rate is common in health related studies, there is some degree of uncertainty when selecting the appropriate rate.

Some economists do not consider a CBA complete unless all benefits are monetized and included in the calculations. Additionally, nutrition education program administrators are better served when all benefits are included in the benefit-cost comparison. As part of the VCE EFNEP study, this study attempts to add to the direct benefit calculations by monetizing the major indirect

benefit of nutrition education programs and examining it's effect on the final CBA outcome. The indirect benefit is defined as delaying or avoiding the loss of productivity from morbidity or mortality related to a specific disease.

While there is a youth component to EFNEP, the adult program is the focus of the VCE EFNEP study. Virginia Adult EFNEP operated in 26 counties and cities in 1996. During that year, 6,375 homemakers participated in the program and 3,100 were graduated. Also, the federal appropriation to Virginia EFNEP in 1996 was $1,260,734. Approximately 80% of the funds were allocated to the adult program. The federal appropriation only represents 58% of the total funds supporting EFNEP; the remaining 42% comes from state and county government funds and other sources (Cox 1997).

The VCE EFNEP study provides useful information to those responsible for funding EFNEP. It also furnishes other nutrition education programs with a more user-friendly procedure for conducting an economic analysis of their programs. This study is a part of the VCE EFNEP study. It provides those administering the program and other decision makers with worst and best case scenarios via sensitivity analysis of key assumptions. Also, other program evaluators are presented with some of the limitations of applying CBA to nutrition education programs.

1.3 Objectives

The primary objective of this study is to examine the approach to monetizing benefits used in the economic evaluation of EFNEP. The specific objectives are to:

1. explore the effects of including the major indirect benefit of EFNEP on the CBA outcome and
2. conduct a sensitivity analysis on two key assumptions and the discount rate used in the EFNEP evaluation.

1.4 Hypotheses

1.4.1 Maintained hypothesis (Assumptions):

Market prices for health care are not biased. (This hypothesis allows us to avoid the use of shadow prices.)

1.4.2 Research hypothesis

H_o: conducting a sensitivity analysis of key assumptions will not change the hypothesized positive outcome of the EFNEP CBA.

1.5 Conceptual Framework

1.5.1 Benefits

Identifying the benefits of a nutrition education program can be as challenging as valuing those benefits. Thus, it is imperative to understand the concept of benefits in the context of economic evaluation. Benefits can be defined as all positive outcomes or consequences of the program that accrue to program participants and others directly involved in the program or indirectly affected by the program or its participants (Lambur, Cox, & Ellerbrock). More specifically, in the evaluation of nutrition education programs, benefits are defined as all the costs that would be avoided by participating in (or graduating from) the program (Disbrow & Bertram). Benefits are often classified as *direct, indirect and intangible*. These benefits will be discussed in chapter three.

1.5.2 Costs

For one to comprehend the specific problem addressed in this study, it is important to

understand the various costs associated with administering a nutrition education program. The costs are the value of the resources that must be withdrawn from the economy to operate the program. Costs generally fall into two categories: *direct and indirect.* These costs will be addressed in chapter three.

1.5.3 Cost-benefit analysis

Cost-benefit analysis (CBA) is a technique that allows program evaluators to determine whether benefits exceed costs for a given program (Himburg & Keane). With CBA, both program costs and benefits are assigned monetary values. The results are expressed as discounted net benefits (program benefits minus program costs), as a ratio of benefits to costs, or as a rate of return. The difference between benefits and costs indicates whether a specific program results in a net gain or net loss. This information can assist decision makers in selecting among various programs or different strategies within a program (Haddix, Teutsch, Shaffer & Dunet).

Like other analytical methods, the application of CBA is controversial. A major difficulty associated with cost-benefit analysis for public health prevention programs is converting all benefits to monetary values. Valuing human life and assigning monetary values to health outcomes such as averting suffering and pain are difficult and controversial tasks. However, as our ability to quantify these intangible benefits improve, CBA is becoming a more comprehensive and a more complete measure of the change in societal welfare (Haddix, Teutsch, Shaffer & Dunet). CBA and other evaluation technique will be discussed in greater detail in chapter three.

1.5.4 Alternative Approaches

In the current literature on conducting economic evaluations of public health programs two methods, besides CBA, are often considered: cost-effectiveness analysis (CEA) and cost-utility analysis (CUA).

Cost-effectiveness analysis

Cost-effectiveness analyses are the most commonly performed economic analyses in the health arena. Effectiveness data on outcomes are more generally available and more easily understood than outcome measures for either CBA or CUA. In CEA, no attempt is made to assign a monetary value to health benefits. Instead of dollars, another measure of outcomes is chosen that is relevant to the question being studied (Haddix, Teutsch, Shaffer & Dunet). For example, a unit of measure might be the number of lives saved per dollar of expenditure.

Cost-effectiveness analysis is most useful when the goal is to identify the most cost effective strategy from a set of alternate interventions that produces a common effect (Haddix, Teutsch, Shaffer & Dunet). The obvious disadvantage of the CEA is that the judgement about the value of the outcomes (i.e., benefits) of a program must be made implicitly by the user of the study results.

Cost-utility analysis

Cost-utility analysis (CUA) is a variant of the cost-effectiveness analysis. Unlike the CEA, CUA allows prevention strategies for more than one disease or health problem to be compared. In CUA, net benefits are expressed as the number of life years saved, with a quality-of-life-adjustment. Therefore, the measure for CUA is quality-adjusted life years.

The advantage of quality-adjusted life years is that rather than relying on implicit judgements about the value and quality of life, CUA makes these values explicit in the calculations. On the other hand, the disadvantages are that the quality-adjusted life years have subjective determination, are difficult to measure, and not universally accepted (Haddix, Teutsch, Shaffer & Dunet).

1.6 Technique

1.6.1 Measuring indirect benefits

The ***human capital approach*** is often used to measure indirect benefits. This approach is

simply a valuation of life that views humans as productive assets, who when healthy will generate earnings over time (Rhoads). These benefits are measured by the added earnings from longer life expectancies and/or reduced disability days (Disbrow & Bertram).

1.6.2 Sensitivity analysis

The usefulness of CBA depends largely on addressing the presence of uncertainty in the analysis. Analyses that directly address uncertainty and report a range of estimates in sensitivity analyses are most useful, because they provide comprehensive information for further analysis and interpretation by decision makers (Haddix, Teutsch, Shaffer & Dunet). A sensitivity analysis can establish the minimum and maximum value a variable has to have for a program to appear worthwhile (Disbrow & Bertram). For the VCE study, the sensitivity analysis will be conducted on two of the principal assumptions and the discount rate used in the EFNEP evaluation.

1.7 Organization of Thesis

Chapter two provides a description of EFNEP. More specifically, there is a discussion on the program structure, delivery modes, and objectives. This chapter also includes a review of the VCE EFNEP study. In chapter three, the economic theory associated with CBA is addressed in greater detail. Also, the methods used to meet the objectives of this study are delineated in chapter three. Chapter four contains the results of the study. Finally, chapter five includes conclusions and implications.

CHAPTER 2.0 BACKGROUND OF VCE STUDY

To understand the contribution that this study makes to the VCE EFNEP study via calculations of indirect benefits and sensitivity analysis, it is necessary to understand the background of the VCE EFNEP study.

2.1 Description of EFNEP

The Expanded Food and Nutrition Education Program is the largest funded program conducted by the Cooperative Extension System, at approximately $60 million each year. It is funded through the USDA Cooperative State Research, Education, and Extension Service and is operated by land-grant universities. EFNEP currently operates in all 50 states, and in American Samoa, Guam, Micronesia, Northern Marinas, Puerto Rico, and the Virgin Islands (Rajgopal).

In Virginia, EFNEP has a youth and adult component, however, the adult program is the focus of the VCE study. 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, Richmond, Roanoke, and Virginia Beach. Of the 26 EFNEP units, seven are primarily in urban areas and 19 are primarily in rural (Rajgopal).

2.1.1 Characteristics of adult EFNEP audiences

EFNEP targets two primary audiences: low-income youth and families with young children. EFNEP participants may be recipients of food stamps or some other form of government food assistance, and may also participate in the Women, Infant, and Children (WIC) program. Investigations of adult EFNEP enrollees conducted over the past years have indicated that the target population (i.e., 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. This population has a tendency towards poor diet and inadequate nutrition. Food stamp recipients tend to have a low consumption of fruit, vegetables, and milk. They generally have poor nutrient intake and eat foods high in fat (Cox 1997).

The demographics of typical EFNEP homemakers are described in the EFNEP state annual report of 1996. Seventy percent of the participants were WIC recipients, and 57% received food stamps. Forty-six percent were black, 48% were white, 4% were Hispanic, 2% were Asians. Seventeen percent of the homemakers were teenagers (aged 19 and under). Eight percent of these homemakers were pregnant. Of the homemakers aged 20 years and over, 8% percent were pregnant or breast-feeding. The above description fits a typical EFNEP population year after year and hence can be used to describe the EFNEP target population (Cox 1997).

2.1.2 Program objectives and content

EFNEP is designed to assist limited resource audiences in acquiring the knowledge, skills, attitudes, and change 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). The original philosophy of EFNEP was based on three conditions: 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 educational 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:

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

The 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 curriculum currently being used in Virginia for the adult component of EFNEP (Coleman; 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 organizations. The lessons incorporate the USDA Food Guide Pyramid, FDA and USDA food labeling regulations, and USDA Dietary Guidelines for Americans (Lambur, Rajgopal, Lewis, Cox, Ellerbrock).

2.1.3 Food related behavior change in EFNEP

Documented behavioral changes in the 1996 Annual Report of Virginia EFNEP are a good example of EFNEP impacts. Of the 6,375 homemakers who participated in the program, 3,100 met the program objectives and completed both entry and exit questionnaires, which assessed intake of the food groups of the Food Guide Pyramid and several key nutrients. ***All benefit calculations are based on 3,100 EFNEP graduates.*** About 93% of the homemakers showed a positive change in food intake from entry to exit of the program (Cox 1997). The specific details of the procedure used in assessing food-related behavior change in EFNEP are delineated in Radhika Rajgopal's dissertation, "Cost-Benefit Analysis of Virginia EFNEP".

2.2 Direct Benefits of EFNEP

Scientific evidence suggests that diet plays an important role in the onset of chronic diseases and other health conditions, contributing to increased illness, reduced quality of life, and premature death. Diets high in calories, fat, saturated fat, cholesterol, and salt and low in fiber containing foods (e.g., fruits, vegetables, and whole grain products) are associated with increased risk for coronary heart disease, certain types of cancers, strokes, and noninsulin-dependent (NID)

diabetes. Diets also play 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).

2.2.1 Calculating direct tangible benefits

The direct tangible benefit associated with EFNEP is characterized by the dollars saved by avoiding or delaying the onset of diet related diseases/conditions. These benefits are equal to the present value of the estimated dollars saved per disease/condition multiplied by the number of EFNEP graduates who are calculated to avoid or delay the onset of specified diseases/conditions by following the recommended dietary behaviors (Lambur, Rajgopal, Lewis, Cox, Ellerbrock).

The following formula was used to derive the direct tangible benefits of EFNEP per disease/condition.

BENEFITS *=([A] Annual number of graduates in EFNEP* **x** *[B] Incidence rate of disease in the population* **x** *[C] incidence of disease related to diet* **x** *[D] Percent of graduates practicing appropriate nutritional behaviors related to avoiding or delaying the disease)* **x** *[E] Present value of the cost avoided or delayed per person for treating a specified disease.*

The derivation of the last variable (E) in this formula involves a detailed procedure that warrants an explanation. Some of the cost figures used in this project were reported for years other than the base year (the base year for the EFNEP evaluation is 1996). These figures were adjusted to the base year using the procedure described in section 3.2.3 (*Adjusting for Inflation*). The direct benefits are accrued from average age of onset of diseases/conditions until the average survival after onset (for type A diseases) or average lifespan (for type B diseases/conditions). To ensure that benefits can be compared to costs, the benefits (i.e., cost avoided or delayed) accrued in the future are discounted (discounting is explained in chapter 3) to the present value for the base year.

2.2.2 Diseases/conditions

There are ten diseases/conditions that are considered in the evaluation of EFNEP. As stated above, these diseases/conditions can potentially be avoided or delayed by complying with the dietary behaviors promoted in EFNEP. The diseases/conditions are divided into three categories (A, B, and C). The tables below list the diseases/conditions and the relative information required for calculating the benefits.

The base year for the CBA of EFNEP is 1996. Therefore, all cost and benefit figures are based on 1996 dollars.

Table 2.1 Type A Disease

Disease/ Condition	Incidence rate of disease in the population	Incidence rate of disease related to diet	Average Age of onset of the Disease	Average years of survival after onset	Average delayed onset of disease	Cost of treatment Per patient per year
Colorectal cancer	15%	35%	36	5	5	$33,406
Heart disease	31.2%	26%	55	5	5	$35,406
Stroke	1.7%	Not available	45	10	5	$23,025
Hypertension	37.4%	45%	30	20	5	$364

According to health related studies (see Rajgopal's dissertation), the onset of type A diseases can be delayed by practicing the appropriate nutritional behaviors. Therefore, the approach taken to calculate these benefits is to delay onset of the disease. When delayed, the direct benefit is the difference between the present value of treating the disease at average onset and the present value of treating the disease at the delayed onset of the disease. For the purpose

of the EFNEP CBA, the time period selected for delaying each of the type A diseases was five years.

Implicit in the "average years of survival after onset" is there are a number of people who die as a result of these diseases. However, this study does not contend that every person with a type A disease will die prematurely or as a result of the specified disease. The average survival figure provides an average number of years over which the cost for treating a disease is incurred (i.e., the period over which the benefits are accrued).

Table 2.2 Type B disease/conditions

Disease/ Condition	Incidence rate of disease in the population	Incidence rate of disease related to diet	Average Age of onset of the Disease	Cost of treatment per patient per year
Osteoporosis	28%	N/A	45	$11,828
NID Diabetes[1]	14.5%	45%	40	$6,182
Obesity[1]	12.5%	0.11%	23	$625
Foodborne illness	2.8%	100%	23	$1,009
Commonly occurring infant diseases[2]	100%	N/A	0-1	$1,537

[1] The incidence rates for obesity and diabetes have been adjusted to exclude that percent of these conditions that are related to more severe diseases and are likely captured in the type A diseases.

[2] Commonly occurring infant diseases consist of otitis media, respiratory infection, viral infection and gastroenteritis.

Type B diseases/conditions result in treatment costs that would be incurred from average age of onset throughout the participant's life. The calculations for this category are based on avoiding these diseases/conditions. When avoided, the direct benefit is the present value of avoiding the disease/condition from average onset through the average lifespan[3].

Type C condition

Low birth weight infants is the only disease in this category. The incidence of the condition in the population is 7.3% and the cost of treatment per patient per year is $16,024 per low birth weight infant (Rajgopal).

See the VCE EFNEP report for references and details on the derivation of incidence rates, cost of diseases, age of onset, and average survival for all diseases/conditions.

Assumptions

In addition to the assumptions stated in the first chapter, there are two critical assumptions introduced in this section. These assumptions were made when deriving the benefits for type A and B diseases/conditions:

1) Benefits associated with type A diseases are based upon delaying the onset of the disease for five years and the benefits associated with type B diseases/conditions are based upon avoiding the diseases/conditions for the duration of the graduate's natural or working life. These assumptions are based on the expert opinion of the VCE study team.
2) Monetized benefits will only be calculated for EFNEP participants practicing optimal nutritional behaviors (discussed below) upon graduating from the program. While we know that some level of benefits will accrue to graduates not practicing optimal nutritional behaviors as well as to family member, there is no way to accurately calculate this from ERS data (Lambur, Rajgopal, Lewis, Cox, Ellerbrock).

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[3] The EFNEP evaluation used age 78, the average lifespan for women, because women are the primary participants in EFNEP (Lambur, Rajgopal, Lewis, Cox, Ellerbrock).

2.2.3 Percent of EFNEP graduates practicing optimal nutritional behaviors

The diet related behaviors necessary for accruing direct benefits vary for each disease/condition. At the entry and exit of the program, specific dietary behaviors of EFNEP graduates were compared to the required behaviors for avoiding or delaying a disease/condition. If a positive change was documented upon exiting the program, the graduate was considered to be a beneficiary regarding the specified disease/condition. A detailed description of this procedure is available in Rajopal's dissertation. The percentages of graduates practicing optimal nutritional behavior for each disease/condition are listed in table 2.3. The number of graduates is available in the direct benefit calculations located in Appendix A.

Table 2.3 Percent of EFNEP graduates 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
Osteoporosis	28.5%
NID Diabetes	1.9%
Obesity	1.9%
Foodborne illness	53.7%
Commonly occurring Infant diseases	3%
Low birth weight infants	3%

2.3 Cost of EFNEP

2.3.1 Direct costs

The direct costs of conducting EFNEP are defined in table 2.4. The figures included in the table are the administrative costs incurred in the 1996 fiscal year.

Table 2.4 Annual Cost of Administering Virginia EFNEP

Costs	Description
Salaries & Benefits	The total amount of funds allocated to Program Assistants, area coordinators, and administrators for salaries and benefits is **$1,363,204.** This amount is based on information collected from the 26 EFNEP unit offices. *Funding sources: federal*
Office Space	It has been estimated that the value office space is **$35,568** for 26 EFNEP unit offices. *Funding sources: state and local*
Utilities	The utility estimates in the Virginia calculation are based on conversation with local EFNEP staff. The total cost of electricity in a unit is prorated by the number of agents and Program Assistants housed in the unit. a) Electricity, water and gas - $3000 for each of the 26 EFNEP units per year (i.e. $3000 * 26 = $78,000). b) Phone - $40 per month or $480 per unit (i.e. $480 * 26= $12,480). ***Total Utility = $78,000 + $12,480 = $90,480*** *Funding sources: state and local*
Equipment	The total amount of funds allocated to EFNEP units for equipment is **$3,588.** This amount is based on information collected from the 26 EFNEP unit offices. *Funding sources: federal*
Supplies/Training Cost	The total amount of funds allocated to EFNEP units for supplies and training is **$78,269.** This amount is based on information collected from the 26 EFNEP unit offices. *Funding sources: federal*

Staff Travel	The total amount of funds allocated to EFNEP staff for travel is **$71,800.** This amount is based on information collected from the 26 EFNEP unit offices. *Funding sources: federal*
Marginal Excess Burden	**$279,295**
Total Direct Cost	**$1,922,204**

2.3.2 Marginal excess burden

When government expenditures are financed by tax collection, distortions are introduced in the factor and product markets that create deadweight losses because not all of the funds collected will re-enter the economy in productive activities that stimulate the GNP. These losses can be as large as a share of tax revenues collected, and need to be charged against public expenditures to more accurately reflect the time social opportunity costs of public programs (Fox). An 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 biased downward 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 percent increase in all distortionary tax rates is in the range of 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 project 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).

EFNEP is funded by federal dollars. The marginal excess burden of taxation was included in the EFNEP CBA to ensure that the cost associated with administering EFNEP is not biased downward. The EFNEP analysis used a 17% (or $279,295) MEB of taxation, the percent commonly used in the United States.

2.4 CBA Results - Excluding Indirect Benefits

The CBA calculation for EFNEP, not including indirect benefits, yields a total benefit of $17,770,727 and a total direct cost of $1,922,204 (direct administrative cost + MEB of taxation). Based on those figures, the NPV is $15,848,525 and the benefit-cost ratio is 9.24/1.00. Again, the calculations of direct benefits are located in Appendix A.

This section includes concepts that have not been discussed thus far such as discounting and decision making criteria (i.e., NPV, benefit-cost ratio, and internal rate of return). These concepts are addressed in greater detail in chapter three.

CHAPTER 3.0 DATA/CONCEPTUAL FRAMEWORK/METHODS

3.1 Data/Resources

Calculating the economic benefits of nutrition education programs requires the acquisition of several types of data that may be found in various resources. The Evaluation Reporting System (ERS) for EFNEP was used to determine which graduates of EFNEP have adopted the dietary behaviors necessary to avoid or delay the onset of diet related diseases or other medical conditions. The ERS data comprise pre- and post survey responses to questions related to nutritional practices and dietary recall information. One of the goals of the VCE study was to conduct the CBA using only existing ERS data. No primary data was collected.

Several nutrition journal articles provided the costs associated with treating certain diseases/conditions. They were also used to determine the correlation between specific dietary practices and diet related diseases/conditions. Some of the journals referenced in this paper include Food Review, Society for Nutrition Education, and World Health Statistics Quarterly.

The Virginia EFNEP Annual Report 1996 and EFNEP studies from other states provided historical, demographic, program objective and content information. EFNEP studies on continuing dietary behaviors were used to justify the dietary retention assumption made in the VCE study.

The internet was an extremely useful resource. Many facts, statistics, and other figures used in the VCE study were located on various websites. The major websites used in the EFNEP evaluation were American Diabetes Association, Bureau of Labor, and Office of Management and Budget.

Finally, economists have published several resources that discuss the procedure for conducting a CBA. Some of the resources specifically delineate procedures for conducting economic evaluations of public health programs. Two examples of those valuable resources are *Benefit-Cost Analysis: A Political Economy Approach,* by Allen Schmid and *Prevention Effectiveness: A Guide to Decision Analysis and Economic Evaluation,* by Haddix, Teutsch, Schaffer, and Dunet.

3.2 Theory

3.2.1 Benefits

Direct tangible benefits are the primary positive outcomes or consequences of the program that accrue to participants and others directly involved in the program (Lambur, Cox, & Ellerbrock). In a nutrition education program, the direct benefits are the *health costs* avoided or delayed as a result of the program. For example, if the number of patients treated for heart attacks due to poor diet are reduced as a result of a nutrition education program, resources are saved. Further, the avoidance of any direct costs can be considered a direct benefit.

Indirect tangible benefits are the secondary outcomes or consequences of the program. These benefits accrue to program participants, program non-participants, employers, or society in general. The indirect benefits of a nutrition education program are defined as the increased productivity of the program recipients, as well as indirect costs averted (Disbrow & Bertram). Productivity, or personal earnings, is jeopardized if a person becomes ill or dies and cannot work and therefore cannot earn income. Avoiding or delaying onset of a disease/condition becomes a benefit by increasing the person's productivity/earning potential. Additionally, if illnesses are eliminated or delayed via program participation, society becomes an indirect beneficiary because of the increased ability of people to work.

The final class of benefits is the ***intangible benefits.*** These benefits include the pain, suffering, discomfort, and grief that are avoided through the achievement of the program's goal. This cost of the illness is borne by the participant, the participant's family and friends, and ultimately society when it's not avoided (Disbrow & Bertram). Other intangible benefits realized as a result of consuming healthy, cost-effective meals are increased energy, enjoyment of meals, feeling of control over finances, better use of resources, and improved self-image. This class is often ignored because it includes benefits for which monetary values are not easily assigned.

3.2.2 Costs

Direct costs are the expenditures for resources involved in the nutrition program, such as salaries of personnel, purchase or rental expenses for space, operating cost of equipment, and the cost of materials and supplies (Disbrow & Bertram).

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 while participating in the program, child care cost, and increased expenditures for foods and medication. These costs are often borne to the participants and as such they may represent opportunity costs to the individuals (Lambur, Cox, & Ellerbrock).

3.2.3 Cost-benefit analysis

Several factors must be taken into consideration if one hopes to conduct a comprehensive economic analysis of a program. Several of these factors are discussed in this section.

Perspective

CBA is an attempt to assess social costs and benefits. The identification of costs and benefits depends on who is included in society, or the study perspective. Three such perspectives are possible (Lambur, Rajgopal, Lewis, Cox, Ellerbrock).

<u>Societal perspective</u>

Economic analyses typically take a societal perspective--analyzing all benefits of a program (no matter who receives them) and all costs of a program (no matter who pays for them). For most public health studies, the societal perspective is appropriate because the goal of research is to analyze the allocation of societal resources among competing activities (Haddix, Teutsch, Shaffer & Dunet).

Individual perspective

The individual, group, or organization that receives the program perspective often produces the highest benefit-to-cost assessment (because individual program participants benefit most intensely from social programs) but may be of limited use to decision makers due to differences in objectives (Lambur, Rajgopal, Lewis, Cox, Ellerbrock).

Sponsor perspective

The program sponsor perspective focuses on the objectives of the funding organization and is most appropriate when choices involve alternative programs under constrained budgets. From the sponsor's focus, benefits are usually costs that, as a result of the program, will no longer be required (e.g., saving money, reducing suffering, etc.) (Lambur, Rajgopal, Lewis, Cox, Ellerbrock).

Time Frame and Analytical Horizons

The *time frame* of an analysis is the specified period in which the nutrition education program actually occurs. The *analytic horizon* is the period over which the costs and benefits of health outcomes occur that result from nutrition intervention. Hence, the analytical horizon is often longer than the time frame because the benefits of an intervention may continue after the intervention is completed (Haddix, Teutsch, Shaffer & Dunet).

Analysts suggest that the analytic horizon of an economic analysis for a nutrition education program should extend over that portion of an individual's lifetime, during which time the costs of the program are incurred and the benefits are received. An analytic horizon that does not include this period may not capture all of the benefits associated with the program (Haddix, Teutsch, Shaffer & Dunet).

Discount Rate

Rationale for discounting

To compute the net present value, it is necessary to discount future benefits and costs. All benefits and costs, monetized and nonmonetized, should be discounted. Robert Banks and Arnold

Kotz state that *"a given sum is normally worth more today than an equal sum 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 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 which could be earned in the interim, which is why the present value of a dollar to be received in the future is always less than 100 cents (Rhoads)."*

Another acceptable reason for discounting is 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 some of both. Waiting a year to receive money reduces one's options without offering any compensating advantages other than security (Warner & Luce).

Private vs social rates of discount

Selecting the appropriate discount rate depends largely upon the decision maker. As a general rule, the appropriate discount rate for decisions is the intertemporal rate of trade-off that reflects the value that the decision maker places on the effects being considered. For private decisions, the appropriate reference point is the private decision maker's rate of trade-off and his/her relative valuation of future effects (Sloan). For example, a rate of 10% would mean that an individual would give up $1.00 in consumption in this time period if he/she were compensated with a minimum of $1.10 of consumption in the next time period (Sassone & Schaffer).

The discount rate for studies that take the societal perspective is called a social discount rate. In the case of social decisions, one would want to use the social rate of time preference, although many economists suggest that the private opportunity cost of capital provides the most reliable guideline for the social rate of discount (Sloan). A social rate reflects an individual's judgement as to the correct growth path for real per capital consumption in the economy. For example, an individual who places more weight on the present will have a high social discount rate (Sassone & Schaffer). An individual with more concern for their distant future and future generations will have low social discount rates (Schmid).

Several economic analyses in recent years in areas of prevention-effectiveness (focusing on preventing disease and injury), health-care intervention, and public health service have used a 3 or 5 percent discount rate. The authors of Preventive-Effectiveness, Haddix, Shaffer, Teutsch, and Dunet, recommend using either percentage. However, they suggest that most cost-effectiveness studies use 5 percent. Sensitivity analyses using discount rates ranging from 1 percent to 7 percent would be of assistance in identifying the degree to which the discount rate estimate must be refined within that range (Sloan).

Future inflation is highly uncertain. Therefore, analysts should avoid having to make an assumption about the general rate of inflation whenever possible (OEP-OMB). Many analysts recommend the use of *real* discount rates for both costs and benefits--monetary and nonmonetary. The term "real" indicates that no additional adjustment should be made to this discount rate to account for the affect 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, Shaffer, & Dunet). 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.

Adjusting for Inflation

When an economic analysis is done, data on costs are often collected from years besides the base years of the evaluation. To ensure that all costs are comparable and that costs can be weighed against benefits that occur in the same time period, it is necessary to standardize the costs to one time unit. Cost data reported for previous years can be adjusted for a specified base year by using either the Consumer Price Index (CPI) or other inflation adjusters. The CPI is an explicit price index that directly measures movements in the weighted average of prices of goods and services in a fixed "market basket" of goods and services purchased by households over time (Haddix, Teutsch, Shaffer & Dunet).

To adjust the cost of an item reported for a year before the base year, divide the index value for the base year by the index value for the year in which the cost was reported. Then multiply the result by the unadjusted value of the item. The formula for this calculation is

$$Y_B = Y_P [\frac{D_B}{D_P}]$$

where

Y_B = base year value D_B = index value of base year

Y_P = past year value D_P = index value of past year

For example, if data are available for the 1990 cost of a visit to a clinician but are needed for a study using 1992 costs, the cost of the visit to the clinician can be inflated to 1992 dollars, using the physician-services component of the CPI. The ratio of the 1992 to 1990 index values (181.2/160.8 = 1.127) is multiplied by the cost of a 1990 visit to a clinician ($45), and the result is the cost of a visit to a clinician in 1992 dollars ($51) (Haddix, Teutsch, Shaffer & Dunet).

$$51 = 45x\frac{181}{160}$$

Evaluation Criteria

There are a variety of decision rules at the analyst's disposal. The three most popular rules will be used to interpret the finding of the VCE EFFNEP study. These are (a) net present value, (b) benefit-cost ratio, and (c) internal rate of return.

Net Present Value

The NPV method reduces future streams of costs and benefits to a single number in which the costs and benefits are discounted to present terms. An NPV greater than zero indicates the program will generate returns beyond costs (Sassone & Schaffer). The formula is

$$NPV = \frac{B_0 - C_0}{(1+d)^0} + \frac{B_1 - C_1}{(1+d)^1} + \ldots + \frac{B_t - C_t}{(1+d)^t} + \frac{B_n - C_n}{(1+d)^n}$$

where

C_t is the dollar value of costs incurred at time *t*,

B_t is the dollar value of benefits incurred at time *t*,

d is the discount rate, and

n is the life of the project, in years.

Of the three rules, net present value (NPV) is the generally preferred decision criterion. The Office of Management and Budget (OMB) recommends NPV as the standard criteria for project selection (Nas). When analyzing the benefits derived from two or more programs, the NPV allows one to compare the magnitude (in dollars) of the programs (see example below).

However, the NPV can be misleading when the budget is limited. The NPV method does not indicate the investment cost associated with a program. This limitation is inconvenient when comparing projects that requires different initial investments.

Benefit-Cost Ratio

The benefit-cost ratio method is closely related to the NPV rule. A benefit-cost ratio is used to determine the feasibility of a project during any given year or over a time span. It can be calculated by taking either the present value (PV) of future benefits over the PV of costs including investment and annual operating costs, or the PV of future net benefits over the one-time investment costs (Nas). The VCE study uses the latter approach, which is expressed as

$$B/C = PV\ of\ NB/I_0$$

where

NB is the stream of benefits net of annual operating cost and

I_0 is the one-time investment cost.

In the VCE EFNEP study, the one-time investment cost is the administrative cost incurred during the base year of the evaluation.

One of the limitations this method is comparing the sizes of two or more programs. A program that requires a $100 initial investment and yields $300 in benefits will generate the same B/C ratio as a program requiring a $1000 initial investment and yielding $3000 in benefits (B/C

ratio is 3/1 for both projects). However, the NPV for the former program is $200 and $2000 for the latter.

Internal Rate of Return

The specific discount rate that results in a zero NPV is known as the internal rate of return (IRR). This is the discount rate that equates the PV of future net benefits with investment costs. In a sense, the IRR is an average rate of profit. A project that produces a given IRR is equivalent to the time flow of the given initial investment compounded forward for the given number of years at an interest rate equal to the IRR (Schmid). It can be calculated by using the following equation:

$$0 = -I + \Sigma \frac{NB_n}{(1+p)^n}$$

where π is the IRR, and other symbols are defined as in the previous section. According to this rule, the project is accepted if π exceeds the market rate of return or any other predetermined rate viewed to be acceptable in the public sector. IRR computation is often used when budgets are constrained or when there is uncertainty about the appropriate discount rate (Nas).

The are some problem related to the IRR rule. For example, this method may produce more than one rate of return if a program's net stream of benefits alternate from positive to negative. Additionally, the IRR method may lead to incorrect decisions. A program with a high IRR may not be superior to one with a lower IRR if the former program yields benefits in the hundreds of dollars and the latter in the thousands of dollars (Nas).

Sensitivity Analysis

The usefulness of CBA depends largely on addressing the presence of uncertainty in the analysis (Haddix, Teutsch, Shaffer & Dunet). Sensitivity analysis can establish the minimum and maximum value a variable has to have for a program to appear worthwhile (Disbrow & Bertram). Examples of variables that an evaluator might consider are discount rates, annual cost of disease,

or incidence of disease.

Sample bias is a common cause of the uncertainty that necessitates sensitivity analysis. Sample bias may occur if the population covered in the study is not representative of the population at large. In other words, this problem may occur if there is an over- or under-representation of a group in the sample population (e.g., poor or females).

Because the target audience of EFNEP is low- income homemakers, any data that represent the entire population is likely inconsistent with characteristics of EFNEP participants. The literature suggests that the incidence rates of diseases related to diet are much higher in the low-income population. The reasons for this disparity in incidence rate for the poor range from engaging in riskier behaviors to the lack of health insurance (Singleton).

Sample bias is relevant to the VCE EFNEP study because the incidence rates used in this study for diseases/conditions are representative of the total U. S. population. Again, the EFNEP population consists of low-income homemakers. Consequently, their incidence rates are higher than those of the general population. This bias is addressed in the sensitivity analysis.

3.3.0 Methodology

3.3.1 Calculating Indirect Benefits

A major benefit of numerous health-enhancing activities is an increase in work productivity. Illness restricts both the amount of time individuals can work and their productivity on the job. Thus, decreases in morbidity and mortality can translate into improvements in work output (Warner & Luce).

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 economic purpose of which is productive output. This indirect benefit is added to health care resource savings to determine

total benefits (Warner & Luce).

The technical 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 are killed or disabled by a certain disease or accident 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). The value of work loss (i.e., wages forgone) is a function of age, gender, race and occupation (Schmid). 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 individuals working in their own homes (Warner &Luce). Also, leisure time is valued as market work times wage rates (Sloan).

Assumptions - Human Capital Approach

1) If participants in the program avoid a certain disease/condition, they will live to average life expectancy.
2) Individuals will be in the labor force and productive during his expected lifetime in accordance with the current pattern of the labor force participation for one's gender, color, and educational level (Rhoads).

Limitation - Human Capital Approach

Critics note that this approach values years saved for working-age white males more than those saved for the elderly, the very young, women, and blacks and other minorities. This reflects the typical employment and wage patterns of these groups in today's marketplace. Thus, the critics argue, the human capital approach thereby attributes more value to the life of a white male than to that of other people (Warner & Luce).

A second major problem with the human capital approach is that it does not measure the value of life; rather, it measures the market value of livelihood. To be sure, the productive potential in an individual represents something of value to society, but it is not the full measure of

either the individual's self-valuation of life or of society's valuation of the individual's life (Warner & Luce). **The market value of livelihood is what we are attempting to assess in the EFNEP evaluation, not the value of an individual's life**.

Benefit of delaying mortality

Nutrition related research suggests that the onset of type A diseases can be delayed by following the dietary behaviors promoted in EFNEP (Lambur, Rajgopal, Lewis, Cox, and Ellerbrock). There are two rational approaches to calculating the benefits for type A diseases. The first approach is to calculate the benefits based upon delaying morbidity cost (i.e., earnings lost from missed workdays) into the future.

The second approach is based upon the premise that type A disease are considered to be life threatening. Given this, the indirect benefits can be calculated as the earnings foregone resulting from mortality. When a disease is delayed, the indirect benefit is the present value of the annual salaries from the average time of death (determined by the average survival after the onset of a disease) until the delayed time of death. For example, if an EFNEP graduate delays the onset of a disease by five years, it can be assumed that their time in the workforce and time of death will be delayed by five years, as well. It is assumed that the estimated number of years that a disease may be delayed determines the number of years of earnings foregone, if onset of disease takes place before average retirement age. ***The latter approach was utilized in this paper.***

It should be noted that the calculated benefits derived from using the second approach would be larger than the benefits derived by using the first approach. The benefit of delaying morbidity is based on the earnings lost for up to 1.83 days missed from work per year while the mortality benefit is derive from annual salaries forgone. The implications of the two approaches are discussed in chapter 5.

Illustration: For indirect tangible benefits, if the average age of death resulting from disease Y is 50 and we assume that we can delay the death (i.e., delay the onset of the disease) by five years until age 55, then the productivity benefit is the present value of the annual earnings from age 50 until age 55.

Benefit of avoiding morbidity

Type B diseases are not considered to be life threatening, but result in earnings foregone due to work-lost days. These diseases/conditions can be avoided by following the dietary behaviors promoted in EFNEP (Lambur, Rajgopal, Lewis, Cox, Ellerbrock). When avoided, the indirect benefit is the present value of the earnings foregone each year from onset of the disease until retirement. The cost of morbidity per disease is a function of the wage rate, average number of work-lost days, and number of hours in the work day (i.e., **Annual earnings foregone** = wage rate ***** average numbers of work-lost days * number of hour in work day).

Illustration: For indirect tangible benefits, if the average onset of disease Y is at age 35 and we assume that we can avoid the onset of the disease, then the productivity benefit is the present value of earnings foregone resulting from work-lost days from age 35 until age 65 (average age of retirement).

Wage rate

Most EFNEP graduates are homemakers not employed in the job market (Lambur, Rajgopal, Lewis, Cox, Ellerbrock). To place a dollar value on their time, the EFNEP evaluation assumes that the graduates are fully employed as household workers. It should be noted that the increase in employment for low-income adults precipitated by welfare reform will likely result in real earnings for EFNEP graduates in the future that are comparable to the earnings used in this study. According to the Bureau of Labor Statistics, earnings for household workers vary from about $10 an hour or more in large cities to less than minimum wage (i.e., $5.15 an hour) in some rural areas (BLS 1998). **An hourly wage rate of $7.60 is used in this study for morbidity and mortality. This wage rate is the average based on the above information. The annual salaries reflect 40 hours of work per week for 52 weeks per year.**

Work-lost days

The procedure for generating the number of days missed from work varies for each disease/condition. The number of work-lost days is not available for osteoporosis, low birth

weight babies, and commonly occurring infant diseases. The derivations of the work-lost figures for the remaining type B diseases/conditions are explained below.

Foodborne illness: A study on the cost of microbial foodborne illness suggests that most people with foodborne illness miss only 1 or 2 days of work (Buzby & Roberts). The VCE EFNEP study uses 1.5 (i.e., the average of 1 and 2) days missed from work per year. The calculation for foodborne illness assumes that the beneficiaries will avoid one incidence of this condition every year until they retire.

Obesity*:* According to a study published in the Obesity Research Journal, the work-lost days for obese patients are 1.83 per year (Wolf & Colditz). The VCE EFNEP study uses 1.83 days missed from work per year.

Diabetes: The American Diabetes Association (ADA) asserts that 15.7 million people in the United States have diabetes and one million work-lost days were attributable to diabetes in 1992 (American Diabetes Association). The VCE EFNEP study uses 0.6 days missed from work per year. This figure was calculated by dividing the number of work-lost days (1 million) by the number of people with diabetes.

Productivity Increases

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 ten years from now will earn the same amount as a person of the same age, sex, color, and educational level earns today. To adjust for the gain in labor 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).

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

According to the Bureau of Labor Statistics, the average annual change in labor productivity between 1986 and 1995 is 0.93 percent (Bureau of Labor Statistics). However, the calculations in this study will not reflect any increase in labor productivity because the majority of the EFNEP graduates are unemployed.

3.3.2 Sensitivity analyses

The most common approach to conducting a *sensitivity analysis* involves several steps. First, the analyst selects one or more parameters in the net present value (NPV) calculation that may be subject to error and capable of significantly affecting the NPV calculation. Next, the analyst selects likely high and low estimates for the parameters and computes the NPV for each. The decision maker is presented with three NPV estimates--high, medium, and low--for each parameter selected for the sensitivity analysis.

The *major difficulty* with this approach is that it is usually unsuited for the analysis of more than a few parameters. A large number of figures with uncertain values complicates the decision making process (Sassone & Shaffer).

Incidence rate in the population

As indicated in the problem statement, the sensitivity analysis is conducted on two principal assumptions made in the EFNEP evaluation. The first assumption evaluated is that *the parameters included in the study characterizing EFNEP participants, such as incidence rate of diseases/conditions, are representative of the low-income population.* ***Under this assumption, the incidence rate of diseases/conditions is the only parameter analyzed.***

The incidence rates for most diseases/conditions included in this study are not representative of the low-income population because of the lack of data. However, the incidence rates for diabetes, hypertension, and heart disease in the low-income population are included in the initial CBA calculation. ***The approach taken to perform this component of the sensitivity analysis is: 1) calculate the average variance in the incidence rate between the total population and the low-income population for diabetes, hypertension, and heart disease; and***

2) adjust the incidence rates for all other diseases/conditions by the average variation derived in step one.

Retention of dietary behaviors

The second assumption is that *the EFNEP graduates who make changes in their diets upon exiting the program will continue to practice these behaviors for the duration of their lives.* Most of the benefit calculations are based on a stream of costs or earnings forgone from the average onset of a disease/condition until the average survival after onset, average lifespan, or average age of retirement. If EFNEP graduates do not continue to practice optimal dietary behaviors for the duration of their lives, then the benefits calculated in this study may be overstated.

There are several EFNEP studies that suggest that there was no dietary regression by EFNEP graduates, who were practicing optimal nutritional behaviors upon exiting the program, up to five years after exiting the program (Rajgopal). ***The calculations in the VCE EFNEP study are based on the assumption that 100% of the graduates practicing optimal nutritional behaviors will continue these behaviors for the duration of their lives***. Unfortunately, there are no available studies that have documented dietary behaviors beyond five years after exiting a nutrition education program. The VCE EFNEP study does not attempt to verify or falsify the validity of these retention studies. However, this high retention rate assumption is likely to draw a great deal of criticism. ***Therefore, the number of graduates who continue to practice optimal nutrition long enough to accrue benefits is decrease by 50% and 75% in the sensitivity analysis.***

Discount rate

The discount rate is a variable often analyzed in the sensitivity analysis of cost-benefit studies. Although it is common for health related studies to use a 3 to 5 percent discount rate, there remains some uncertainty about the appropriateness of those rates. The direct benefits of EFNEP far exceed the cost of administering the program. Consequently, it appears that it is only necessary to consider a higher discount rate in the sensitivity analysis. **The VCE EFNEP study**

uses a 10% discount rate to determine a possible worst case scenario.

Retention of dietary behaviors and discount rate

When conducting a sensitivity analysis, it is a common practice to change the value of two parameters simultaneously. There is a degree of uncertainty related to each parameter included in the sensitivity analyses. Therefore, it is necessary to consider the possibility of more than one of the parameters being over- or under-estimated. To this end, the VCE EFNEP study combines the 10 % discount rate with the 75% decrease in EFNEP graduates accruing benefits.

CHAPTER 4.0 Results

4.1 Indirect Benefits

4.1.1 Delaying Mortality

The indirect benefit associated with type A diseases is earnings forgone due to mortality. All mortality calculations are based on an annual salary of $15,808. The annual salary is calculated as follows:

*Annual Salary = Wage rate * hours worked per week * weeks worked per year*

$15,808 = $7.60 * 40 * 52

Below is a summary of the indirect benefits for delaying onset of type A diseases. The original calculations were performed using Microsoft Excel. These calculations are located in Appendix B.

Disease: Heart Disease (Type A)

A) Average age of death due to heart disease	60
B) Average delayed death resulting from EFNEP	65
C) Present value of annual earnings foregone	$10,718
D) Estimated number of graduates to accrue benefit	2.77
Total indirect benefit of delaying heart disease	**$29,689**

Disease: Stroke (Type A)

A) Average age of death due to stroke	50
B) Average delayed death resulting from EFNEP	55
C) Present value of annual earnings foregone	$17,458
D) Estimated number of graduates to accrue benefits	4.95
Total indirect benefit of delaying stroke	**$86,420**

Disease: Hypertension (Type A)

A) Average age of death due to hypertension	50
B) Average delayed death resulting from EFNEP	55
C) Present value of annual earnings foregone	$17,458
D) Estimated number of graduates to accrue benefits	49.04
Total indirect benefit of delaying hypertension	**$856,174**

Disease: Cancer (Type A)

A) Average age of death due to cancer	41
B) Average delayed death resulting from EFNEP	46
C) Present value of annual earnings foregone	$27,084
D) Estimated number of graduates to accrue benefits	3.09
Total indirect benefit of delaying cancer	**$83,690**

4.1.2 Avoiding Morbidity

The indirect benefit associated with type B diseases is avoiding lost earnings due to days missed from work. Below is a summary of the indirect benefits due to morbidity avoided. The Microsoft Excel calculations are located in Appendix B.

Disease: Obesity (Type B)

A) Average age of onset for obesity	23
B) Average age of retiremen	65
C) Average number of annual work-lost days	1.83
D) Present value of lost earnings	$1,952
E) Estimated number of graduates to accrue benefits	0.008
Total indirect benefit of delaying obesity	**$15**

Disease: Diabetes (Type B)	
A) Average age of onset for diabetes	40
B) Average age of retirement	65
C) Average number of annual work-lost days	0.06
D) Present value of lost earnings	$64
E) Estimated number of graduates to accrue benefits	3.84
Total indirect benefit of delaying diabetes	**$245**

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 work-lost days	1.5
D) Present value of lost earnings	$1,600
E) Estimated number of graduates to accrue benefits	46.6
Total indirect benefit of delaying foodborne Illness	**$74,568**

The productivity benefits were not calculated for osteoporosis, low birth weight infants, and commonly occurring infant diseases (COIDs) because of the lack of data. However, literature suggests that there are substantial productivity losses resulting from osteoporosis and COIDs. Consequently, the indirect benefits calculations are understated.

According to the Economic Research Service (ERS), osteoporosis-related hip fractures result in losses from premature death of $4.5 to $6.3 billion. For the 80 percent of patients who survive, osteoporosis- related hip fractures result in $75 to $104 million in lost productivity due to missed work. This estimate is based on a 4.6 percent laborforce participation rate for people 75 years and older and an average daily wage rate of $48.14 for those working at the time of the hip fracture (ERS).

One of the essential practices promoted by EFNEP is breast-feeding. Mothers who breast-feed greatly reduce the risk of *COIDs* (Cohen, Mrtek, Mrtek). A study published in 1995 compared maternal absenteeism and infant illness rates among breast-feeding and formula-feeding

women. The results suggested that approximately 28% of the infants in the study had no illnesses; 86% of those were breast-fed and 14% formula-fed. Furthermore, when illness occurred, 25% of all 1-day maternal absences were among breast-fed babies and 75% were among the formula-fed group (Cohen, Mrtek, Mrtek). The results of the study undergird the assertion that there is an amount of productivity loss due to COIDs, as well.

4.1.3 Interpretation of results

Warner and Luce assert that indirect benefits, such as the value of productivity loss avoided, outweighs direct medical care savings. Their assertion is partially consistent with the findings in this study. Table 4.1 lists the direct and indirect benefits associated with the diseases/conditions considered in this analysis. The indirect benefits of delaying type A diseases, which are based on increased productivity due to delayed mortality, exceed the direct benefits for the same diseases. Conversely, the indirect benefit associated with avoiding type B diseases/ conditions are considerably less than the direct benefits for the same disease. This difference is evident in the approaches taken to calculate the benefits. The indirect benefits for type A diseases are based on 5 years of annual salaries compared to several days of lost wages for type B diseases/conditions. The direct benefit for type A diseases is only the benefit of *delaying* treatment cost for 5 years compared to avoiding treatment cost up to 55 years for some type B diseases.

Table 4.1 EFNEP Benefits

Disease/Conditions	**Direct Benefits**	**Indirect Benefits**
Heart Disease (type A)	$ 19,263	$ 29,689
Stroke (type A)	$ 65,111	$ 86,420
Colorectal Cancer (type A)	$ 50,789	$ 83,690
Hypertension (type A)	$ 34,225	$ 856,174
Osteoporosis (type B)	$ 16,195,686	------

Obesity (type B)	$ 94	$ 15
Diabetes (type B)	$ 176,396	$ 245
Foodborne Illness (type B)	$ 879,413	$ 74,568
Low Birth Weight Babies (type B)	$ 216,334	------
Commonly Occurring Infant Diseases (type B)	$ 133,411	------

The addition of indirect benefits to the direct benefits increased the total benefit accrued by EFNEP graduates from $17,770,727 to $18,901,532. With a total administrative cost of $1,922,204, the net present value is $16,979,328. As discussed in the decision criteria section, the NPV is calculated as follows:

Total Benefit - Total Cost = NPV

$18,901,532 - $1,922,204 = $16,979,328

The *benefit-cost ratio is 9.83/1.00*. That is, for every dollar invested in EFNEP, there is a $9.83 return in benefits. Furthermore, the *internal rate of return is 14.38%*. As explained previously, this is the average rate of profit on the initial investment (annual cost of EFNEP). When compared to the 3 or 5 percent discount rate frequently used in health related studies, an IRR of 14.38% indicates that this program is acceptable.

4.2 Sensitivity Analysis

4.2.1 Discount Rate

When utilizing a 5% discount rate the benefits of EFNEP significantly outweigh the costs of the program. Performing the CBA calculations with a lower discount rate will further increase the benefits. Therefore, 10% discount rate is utilized to determine if the outcome of the EFNEP analysis is sensitive to the discount rate. A summary of the benefits, when using a 10% discount rate, is shown in table 4.2. The NPV decreased from $15,848,525 (at 5% discount rate) to

$2,807,384 (at 10% discount rate). The benefit-cost ratio has also decreased to 2.46 /1 or $2.46 of benefits for each $1.00 invested in the program.

Table 4.2 EFNEP benefits using a 10% discount rate

Disease/Conditions	Direct Benefits	Indirect Benefits	Totals
Heart Disease (type A)	$ 6,665	$ 4,437	$ 11,103
Hypertension (type A)	$ 29,564	$ 203,780	$ 233,344
Osteoporosis (type B)	$ 3,453,496	------	$ 3,453,496
Obesity (type B)	$ 50	$ 8	$ 59
Diabetes (type B)	$ 45,863	$ 137	$ 46,000
Foodborne Illness (type B)	$ 468,049	$ 41,802	$ 509,852
Low Birth Weight Babies (type B)	$ 216,334	------	$ 216,334
Commonly Occurring Infant Diseases (type B)	$ 133,411	------	$ 133,411
Total Benefit	**$ 4,428,575**	**$ 301,012**	**$ 4,729,588**

4.2.2 Incidence Rate of Disease

As mentioned in the methodology section, this study assumes that the incidence rate of diseases/conditions used in this study are representative of the low-income population. To account for the uncertainty in this critical assumption, the incidence rates were increased by 15% for all diseases/conditions for which the incidence rate in the low-income population is unknown. The process for generating the assumed rates in the low-income population is described in chapter 3. The adjusted rates are listed in Table 4.3.

Table 4.3 Incidence Rate of Diseases/Conditions

Disease/Conditions	General Population	Known Low-Income Population	Assumed Low-Income Population
Heart Disease	5.2%	31.2%	
Stroke	1.7%		16.7%
Colorectal Cancer	15%		30%
Hypertension	30%	37.4%	
Osteoporosis	28%		43%
Obesity	12.5%		27.5%
Diabetes	2.9%	14.5%	
Foodborne Illness	2.8%		17.8%
Low Birth Weight Babies	7.3%		22.3%
Commonly Occurring Infant Diseases	100%	100%	

Because the incidence rates for most diseases/conditions are higher in the low-income population, the net benefits are considerably higher when using the adjusted rates. The NPV is $32,683,100 and the benefit-cost ratio is 18.00 to 1.00. A summary of the benefits is listed in table 4.4.

Table 4.4 EFNEP benefits - incidence rates increased by 15%

Disease/Conditions	Direct Benefits	Indirect Benefits	Totals
Heart Disease (type A)	$ 19,263	$ 29,689	**$ 48,953**
Stroke (type A)	$ 639,627	$ 849,540	**$ 1,489,168**
Colorectal Cancer (type A)	$ 101,578	$ 167,380	**$ 268,959**

Hypertension (type A)	$ 34,225	$ 856,174	**$ 890,400**
Osteoporosis (type B)	$ 24,871,947	------	**$ 24,871,947**
Obesity (type B)	$ 208	$ 35	**$ 243**
Diabetes (type B)	$ 176,396	$ 245	**$ 176,642**
Foodborne Illness (type B)	$ 5,590,554	$ 474,167	**$ 6,064,722**
Low Birth Weight Babies (type B)	$ 660,856	------	**$ 660,856**
Commonly Occurring Infant Diseases (type B)	$ 133,411	------	**$ 133,411**
Total Benefit	**$ 32,228,071**	**$ 2,377,233**	**$ 34,605,304**

4.2.3 Retention of dietary behaviors

The initial CBA calculations were performed under the assumption that 100% of the EFNEP graduates who made changes in their diets upon exiting the program will continue to practice these behaviors for the duration of their lives. Skeptics are likely to question this high retention of dietary behaviors. In an effort to address this concern, the number of EFNEP graduates to accrue benefits was decreased by 50% and 75%.

When the number of beneficiaries is decreased by 50%, the NPV falls to $7,528,730 and the benefit-cost ratio drops to 4.92/1.00. At this level, the program continues to yield a net benefit. When adjusted by 75%, the NPV further decreases to $2,803,218 with a benefit-cost ratio of 2.45/1.00. Even at this level, EFNEP yields a positive net benefit. Table 4.5 shows the change in the number of EFNEP graduates when adjusted by 75%. Additionally, a summary of the benefit calculations with a 75% reduction in beneficiaries is listed in Table 4.6.

Table 4.5 Number of EFNEP graduates accruing benefits

Disease/Conditions	100%	25%
Heart Disease (type A)	2.77	0.69
Stroke (type A)	4.95	1.24
Colorectal Cancer (type A)	3.09	0.77
Hypertension (type A)	49.04	12.26
Osteoporosis (type B)	247.38	61.85
Obesity (type B)	0.008	0.002
Diabetes (type B)	3.84	0.96
Foodborne Illness (type B)	46.6	11.65
Low Birth Weight Babies (type B)	6.11	1.53
Commonly Occurring Infant Diseases (type B)	86.8	21.7

Table 4.6 EFNEP beneficiaries reduced by 75%

Disease/Conditions	Direct Benefits	Indirect Benefits	Totals
Heart Disease (type A)	$ 4,815	$ 7,416	**$ 12,232**
Stroke (type A)	$ 16,277	$ 21,613	**$ 37,891**
Colorectal Cancer (type A)	$ 12,697	$ 20,936	**$ 33,633**
Hypertension (type A)	$ 8,556	$ 214,061	**$ 222,617**
Osteoporosis (type B)	$ 4,048,921	------	**$ 4,048,921**
Obesity (type B)	$ 23	$ 3	**$ 27**
Diabetes (type B)	$ 44,099	$ 61	**$ 44,160**

Foodborne Illness (type B)	$ 219,853	$ 18,646	**$ 238,500**
Low Birth Weight Babies (type B)	$ 54,083	------	**$ 54,083**
Commonly Occurring Infant Diseases (type B)	$ 33,352	------	**$ 33,352**
Total Benefit	**$ 4,442,681**	**$ 282,740**	**$ 4,725,422**

4.2.4 Retention of dietary behaviors and discount rate

When a combined sensitivity analysis of dietary retention and the discount rate is performed, the outcome does not remain positive. In this analysis, the number of beneficiaries is decreased by 75% and the discount rate is increased to 10%. The result of this calculation yields the only net loss derived in the VCE study. The total benefit dipped below the annual administrative cost to $1,182,407. The NPV is - $739,797 and the benefit-cost ratio is 0.62 to 1.00. The benefit-cost ratio indicates that for every dollar invested in EFNEP there is only a $0.62 return in benefits, a loss of $0.38 per dollar invested. The summary of benefits resulting from this analysis is located in table 4.7.

Table 4.7 EFNEP beneficiaries reduced by 75% and using10% discount rate

Disease/Conditions	Direct Benefits	Indirect Benefits	Totals
Heart Disease (type A)	$ 1,666	$ 1,108	**$2,775**
Stroke (type A)	$ 8,151	$ 5,144	**$13,295**
Colorectal Cancer (type A)	$ 10,633	$ 7,573	**$18,207**
Hypertension (type A)	$ 7,391	$ 50,949	**$58,340**
Osteoporosis (type B)	$ 863,374	$ 0	**$863,374**

Obesity (type B)	$ 12	$ 2	**$14**
Diabetes (type B)	$ 11,465	$ 34	**$11,500**
Foodborne Illness (type B)	$ 117,012	$ 10,451	**$127,463**
Low Birth Weight Babies (type B)	$ 54,083	$ 0	**$ 54,083**
Commonly Occurring Infant Diseases (type B)	$ 33,352	$ 0	**$33,352**
Total Benefit	**$1,107,143**	**$75,263**	**$1,182,407**

CHAPTER 5.0 CONCLUSIONS & IMPLICATIONS

5.1 Indirect benefits

The results of the VCE EFNEP study suggest that EFNEP is an economically beneficial program. While producing a benefit-cost ratio of 9.83/1.00 and a NPV of $15,848,525 funders should be more than willing to support EFNEP. On the other hand, such high benefit-cost ratios often attract suspicion from economic professionals.

The addition of indirect benefits to the direct benefits of EFNEP provides VCE with a comprehensive cost-benefit analysis. As indicated in the results section, excluding the indirect benefits from the analysis will understate the total benefit by approximately $1.1 million.

Upon examining the direct and indirect benefit calculations for each disease/condition, it is evident that the direct benefit for delaying osteoporosis accounts for approximately 86% of the total tangible benefits of EFNEP. Consequently, the procedure for determining this benefit should be examined. While the incidence rate of osteoporosis in the population was documented (28%) and it was noted that research suggests that among the dietary factors, calcium may play an important role in preventing or delaying the onset of this condition, an incidence rate relating osteoporosis to diet was not available. Given this, the calculated tangible benefits for osteoporosis may be overstated. However, it should also be noted that osteoporosis is a condition that is not curable but it can be treated to slow its progress and even avoided through appropriate dietary practices (National Osteoporosis Foundation). Therefore, it might be reasonable to assume that the potential overestimated benefits resulting from the lack of available data related to incidence rate of osteoporosis related to diet may be offset by the effectiveness of known treatments (Lambur, Rajgopal, Lewis, Cox, Ellerbrock). Additionally, some may question the high cost of treating osteoporosis per patient per year. This cost is based on the treatment of conditions varying from low calcium to hip fractures (Barefield).

Another important observation is that the indirect benefit for hypertension accounts for approximately 76% of the total indirect benefits of EFNEP. The large number of EFNEP graduates who are practicing the optimal nutritional behaviors related to hypertension explains the

size of this benefit. Like osteoporosis, the procedure for calculating this benefit should be closely scrutinized.

5.1.1 Additional research

The accuracy of the VCE EFNEP study is limited by the lack of pertinent data necessary for evaluation of EFNEP. Further research is needed in the areas of health and nutrition to determine: 1) work-lost days resulting from diet-related diseases/conditions; 2) number of years diseases/ conditions can be delayed by practicing the appropriate nutritional behaviors; 3) incidence rates of diseases/conditions in the low-income population; and 4) long term retention of dietary behaviors that are acquired via nutrition education programs. As a result, the latter two issues are addressed using sensitivity analysis.

5.2 Sensitivity Analysis

Five separate sensitivity analyses were performed in the VCE EFNEP study. The sensitivity calculations accounted for uncertainty in the discount rate, incidence rate of diseases/conditions, and retention of dietary behavior. **The results indicate that the CBA outcome remained positive after altering the parameters. However, the benefit-cost ratio changed significantly for each analysis. Based on these results, the researched hypothesis is accepted**.

5.2.1 Selecting the most useful sensitivity calculations

Although all parameters considered in the sensitivity analyses required some scrutiny because of uncertainty, it is more effective to present decision makers with a minimum number of calculations. Therefore, it is necessary to evaluate each sensitivity analysis to determine which calculations would best serve decision makers and other reader of the VCE EFNEP study.

Incidence Rates

The incidence rates of the diseases/conditions used in the initial calculations were not reflective of the low-income population. This presents a legitimate concern and a sensitivity analysis was needed. However, the incidence rates were adjusted by 15%. This is the average difference between the low-income population and the general U.S. population for only three diseases/conditions. While the adjusted rates are probably closer estimates of the actual incidence rates in the low-income population, they may be overstated and considered to be the best case scenario. In addition, the benefit-cost ratio from the initial calculations is high and increasing this ratio by adjusting the incidence rate does not offer very useful information for overall decision making.

Discount Rate

The discount rates used in CBA studies often have a degree of uncertainty and are frequently included in the sensitivity analyses. The VCE EFNEP study uses a 5% discount rate that is common among health care studies. Hence, this rate should provide a sound basis for comparison to studies of a similar nature. A 10% discount rate is used in the sensitivity analysis to verify that the positive outcome of the EFNEP CBA is not sensitive to the discount rate, though the benefit-cost ratio proved to be quite sensitive. The findings of this sensitivity analysis were obvious because the IRR is 14.38%. Consequently, this analysis may not be critical to the decision making process.

Retention of dietary behaviors and discount rate

Although this combination of parameters in the sensitivity analysis yielded the only negative NPV in the VCE EFNEP study, it is not necessarily one of the most important findings. It should be noted that a 10% discount rate is considerably high and is unlikely to be used in the CBA of any social program. However, while this combined sensitivity analysis of a 25% dietary retention and a 10% discount rate appears to stretch the imagination, it provides a glance at the possibility of the EFNEP CBA yielding a benefit-cost ratio smaller than 2.45 to 1.00.

Retention of dietary behaviors

The sensitivity calculations related to the retention of dietary behaviors addressed what is possibly the greatest concern associated with the VCE EFNEP study. As stated previously, some studies suggest that approximately 100% of EFNEP graduates continue to practice their learned dietary behaviors up to five years after exiting the program. However, the following question is posed in this sensitivity analysis: "What if only 25% of the EFNEP graduates continue to practice those behaviors for the duration of their lives?" The calculations based on this assumption, while drastically reducing the number of EFNEP graduates accruing benefits, continues to produce a positive outcome. The 2.45/1.00 benefit-cost ratio generated in this analysis may be considered by some "a worst case scenario" and by others "a more accurate picture of the EFNEP benefits."

The retention sensitivity analysis, along with the initial CBA calculations, appears to be the most appropriate figures to present to decision makers. There are two obvious reasons for recommending the use of the retention figures. First, this assumption is expected to create the greatest concern pertaining to the validity of the EFNEP evaluation. Second, the sensitivity calculations on retention generated the lowest (same as the sensitivity calculations for discount rate) benefit-cost ratio in the study.

5.3 The Bottom Line

The analysis of Virginia EFNEP does not suggest that everyone who participates in EFNEP will delay or avoid one or more of the diet related diseases/conditions. It does, however, suggest that the benefits accruing to the derived number graduates exceed the cost of administering the program to 6,375 homemakers in 1996. The CBA of Virginia EFNEP generated a net gain (i.e., a positive return on each dollar invested in EFNEP).

5.4 Policy Implications

Whether a decision maker gives more weight to the assumptions in the initial CBA calculation or to the assumptions in the sensitivity analyses, the outcome of this study remains

positive. That is, if EFNEP generates net gains, then taxpayers are receiving positive returns. The positive outcome does not necessarily mean that the U. S. should spend more of the taxpayers' dollars on EFNEP. Investing more dollars in EFNEP will likely require the shifting of funds from other social programs with similar objectives. Therefore, the decision to increase dollars allocated to EFNEP will depend on relative CBA outcomes of other social programs.

5.4.1 Possible underestimates

The results of the sensitivity analysis on incidence rates of diseases/conditions in the low-income population suggest that there may be tremendous social benefits derived from EFNEP that are not captured in the initial calculation. Given that the majority of EFNEP participants are unemployed and receive some type of government food assistance (i.e., food stamps or WIC), it is probably appropriate to assume that they also receive medical care assistance in the form of medicare or medicaid. Therefore, based on the result of this sensitivity analysis, Virginia EFNEP could potentially save taxpayers approximately $32 million dollars per year in medical costs for low-income homemakers. As mentioned in a previous section, there will be spillover effects to children and other family members in the home. This fact could only magnify the medical-related savings to society.

Considering the effect that EFNEP is having on the low-income population and its potential to increase savings for taxpayers, decision makers and EFNEP professionals should evaluate programming efforts to ensure that the maximum benefit is generated. Efforts should be made to reach as many as possible in the low-income population and to increase the number of graduates practicing optimal nutritional behaviors after exiting the program.

5.4.2 Possible overestimates

Besides the way the benefits were calculated for osteoporosis (discussed in the conclusion section), there are several other factors in the EFNEP evaluation that could contribute to an overestimate of benefits: 1) retention of dietary behaviors; 2) mortality assumption – indirect benefits; and 3) value of participants' time.

The first area of uncertainty is the assumption that EFNEP participants who are practicing

optimal nutritional behaviors upon exiting the program will continue those behaviors for the duration of their lives. This assumption was examined via sensitivity analysis and discussed in a previous section. Although the outcome of the study remained positive in the sensitivity calculation, the results were extremely sensitive to this factor. The other two factors were not examined via sensitivity analysis. However, they are critical assumptions made in the CBA of EFNEP that could have a significant effect on the results if not considered appropriately.

Indirect benefit calculations for type A diseases are based on the assumption that patients will eventually die as a result of the disease. The benefit is delaying the annual salaries foregone as a result of premature death caused by the disease. The average age of death associated with each disease was derived from the average onset and average survival after onset for that disease. Implicit in the "average survival" is that some patients may live much longer than the average, even beyond retirement. Given this, it may not be plausible to assume that all patients will forego annual salaries due to premature death. If this assumption is inappropriate, the indirect benefits may be exaggerated.

Finally, all indirect benefits were calculated using the average wage rate for a household worker (wage rate is $7.60 and annual salary is $15,808). Recall that the majority of EFNEP participants are low-income and unemployed. Consequently, decision makers may view this as an overestimate of the value that should be placed on their time.

There could be negative consequences to society if these factors are causing the benefits to be biased upward. If the benefits are overestimated, a reallocation of funds from programs relative to EFNEP may result in a loss of social welfare by not investing the appropriate dollars in programs that produce the optimal benefits to society. Therefore, it is the responsibility of decision makers to scrutinize the assumptions made in this evaluation of EFNEP to determine if there are areas where the benefits are exaggerated. If so, what effects do that assumption(s) have on the total benefits and/or will the possible overestimates offset the possible underestimates?

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APPENDIX A

HEART DISEASE

A) Annual number of graduates in EFNEP	3100
B) Incidence rate of heart disease	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%
Estimated number of graduates to accrue benefits	*2.7662*
E) Present value of the benefits related to heart disease	$6,964
DIRECT BENEFIT OF DELAYING HEART DISEASE	**$19,263**

STROKE

A) Annual number of graduates in EFNEP	3100
B) Incidence rate of stroke	1.7%
C) Incidence rate of heart disease related to diet	N/A
D) Percent of graduates practicing optimal nutritional behaviors related to stroke	9.4%
Estimated number of graduates to accrue benefits	4.9538
E) Present value of the benefits related to stroke	$13,143
DIRECT BENEFIT OF DELAYING STROKE	**$65,111**

HYPERTENSION

A) Annual number of graduates in EFNEP	3100
B) Incidence rate of hypertension	37.4%
C) Incidence rate of hypertension related to diet	45%
D) Percent of graduates practicing optimal nutritional behaviors related to hypertension	9.4%
Estimated number of graduates to accrue benefits	49.04
E) Present value of the benefits related to hypertension	$697
DIRECT BENEFIT OF DELAYING HYPERTENSION	**$34,225**

CANCER

A) Annual number of graduates in EFNEP	3100
B) Incidence rate of cancer	15%
C) Incidence rate of cancer related to diet	35%
D) Percent of graduates practicing optimal nutritional behaviors related to cancer	1.9%
Estimated number of graduates to accrue benefits	3.09225
E) Present value of the benefits related to cancer	$16,424
DIRECT BENEFIT OF DELAYING CANCER	**$50,789**

OSTEOPOROSIS

A) Annual number of graduates in EFNEP	3100
B) Incidence rate of osteoporosis	28%
C) Incidence rate of osteoporosis related to diet	N/A
D) Percent of graduates practicing optimal nutritional behaviors related to osteoporosis	28.5%
Estimated number of graduates to accrue benefits	247.38
E) Present value of the benefits related to osteoporosis	$65,468
DIRECT BENEFIT OF DELAYING OSTEOPOROSIS	**$16,195,686**

OBESITY

A) Annual number of graduates in EFNEP	3100
B) Incidence rate of obesity	12.5%
C) Incidence rate of obesity related to diet	0.11%
D) Percent of graduates practicing optimal nutritional behaviors related to obesity	1.9%
Estimated number of graduates to accrue benefits	0.0081
E) Present value of the benefits related to obesity	$11,686
DIRECT BENEFIT OF DELAYING OBESITY	**$94**

DIABETES

A) Annual number of graduates in EFNEP	3100
B) Incidence rate of diabetes	14.5%
C) Incidence rate of diabetes related to diet	45%
D) Percent of graduates practicing optimal nutritional behaviors related to diabetes	1.9%
Estimated number of graduates to accrue benefits	3.84
E) Present value of the benefits related to diabetes	$45,898
DIRECT BENEFIT OF DELAYING DIABETES	**$176,396**

FOOD BORNE ILLNESS

A) Annual number of graduates in EFNEP	3100
B) Incidence rate of food borne illness	2.8%
C) Incidence rate of food borne illness related to diet	100%
D) Percent of graduates practicing optimal nutritional behaviors related food borne illness	53.7%
Estimated number of graduates to accrue benefits	46.61
E) Present value of the benefits related to food borne illness	$18,866
DIRECT BENEFIT OF DELAYING FD BRN ILLNESS	**$879,413**

LOW BIRTH WEIGHT BABIES

A) Annual number of graduates in EFNEP	3100
B) Incidence rate of LBWB	7.3%
C) Incidence rate of LBWB related to diet	100%
D) Percent of graduates practicing optimal nutritional behaviors related to LBWB	3%
Estimated number of graduates to accrue benefits	6.11
E) Present value of the benefits related to LBWB	$35,406
DIRECT BENEFIT OF DELAYING LBWB	**$216,334**

COMMONLY OCCURRING INFANT DISEASES

A) Annual number of graduates in EFNEP	3100
B) Incidence rate of COID	100%
C) Incidence rate of COID related to diet	100%
D) Percent of graduates practicing optimal nutritional behaviors related to COID	3%
Estimated number of graduates to accrue benefits	86.8
E) Present value of the benefits related to COIDs	$1,537
DIRECT BENEFIT OF DELAYING COIDs	**$133,411**

APPENDIX B

HEART DISEASE

Indirect Benefit of Delaying Onset of Heart Disease

Estimated number of graduates to delay onset of heart disease = 2.77

		Years		
Average age of participant	=	23		
Average age of onset of heart disease	=	55	*	*
Avg. survival after onset of heart disease	=	5	* **BENEFIT = 2.77 x $10,718.13 =**	**$ 29,689.22** *
Average delay of onset of heart disease	=	5	*	*

Discount rate = 5%

Annual Salary = WR * 40 (hrs per wk) * 52 (week)

Age	wage rate (WR)	Age	Annual Salary	PV(Salary)
23	$7.60	23	$0.00	**$10,718.13**
24	$7.60	24	$0.00	
25	$7.60	25	$0.00	
26	$7.60	26	$0.00	
27	$7.60	27	$0.00	
28	$7.60	28	$0.00	
29	$7.60	29	$0.00	
30	$7.60	30	$0.00	
31	$7.60	31	$0.00	
32	$7.60	32	$0.00	
33	$7.60	33	$0.00	
34	$7.60	34	$0.00	
35	$7.60	35	$0.00	
36	$7.60	36	$0.00	
37	$7.60	37	$0.00	
38	$7.60	38	$0.00	
39	$7.60	39	$0.00	
40	$7.60	40	$0.00	
41	$7.60	41	$0.00	
42	$7.60	42	$0.00	
43	$7.60	43	$0.00	
44	$7.60	44	$0.00	
45	$7.60	45	$0.00	
46	$7.60	46	$0.00	
47	$7.60	47	$0.00	
48	$7.60	48	$0.00	
49	$7.60	49	$0.00	
50	$7.60	50	$0.00	
51	$7.60	51	$0.00	
52	$7.60	52	$0.00	
53	$7.60	53	$0.00	
54	$7.60	54	$0.00	
55	$7.60	55	$0.00	
56	$7.60	56	$0.00	
57	$7.60	57	$0.00	
58	$7.60	58	$0.00	
59	$7.60	59	$0.00	
60	$7.60	60	$0.00	
61	$7.60	61	15,808.00	
62	$7.60	62	15,808.00	
63	$7.60	63	15,808.00	
64	$7.60	64	15,808.00	
65	$7.60	65	15,808.00	

Indirect Benefit of Delaying Onset of Stroke

Estimated number of graduates to delay onset of stroke = 4.95

		Years				
Average age of participant	=	23				
Average age of onset of stroke	=	45	*			*
Avg. survival after onset of stroke	=	5	*	**BENEFIT = 4.95 x $17,458.70 =**	**$**	**86,420.58** *
Average delay of onset of stroke	=	5	*			*

Discount rate = 5%

Annual Salary = WR * 40 (hrs per wk) * 52 (week)

Age	**wage rate (WR)**
23	$7.60
24	$7.60
25	$7.60
26	$7.60
27	$7.60
28	$7.60
29	$7.60
30	$7.60
31	$7.60
32	$7.60
33	$7.60
34	$7.60
35	$7.60
36	$7.60
37	$7.60
38	$7.60
39	$7.60
40	$7.60
41	$7.60
42	$7.60
43	$7.60
44	$7.60
45	$7.60
46	$7.60
47	$7.60
48	$7.60
49	$7.60
50	$7.60
51	$7.60
52	$7.60
53	$7.60
54	$7.60
55	$7.60

Age	**Annual Salary**	**PV(Salary)**
23	$0.00	**$17,458.70**
24	$0.00	
25	$0.00	
26	$0.00	
27	$0.00	
28	$0.00	
29	$0.00	
30	$0.00	
31	$0.00	
32	$0.00	
33	$0.00	
34	$0.00	
35	$0.00	
36	$0.00	
37	$0.00	
38	$0.00	
39	$0.00	
40	$0.00	
41	$0.00	
42	$0.00	
43	$0.00	
44	$0.00	
45	$0.00	
46	$0.00	
47	$0.00	
48	$0.00	
49	$0.00	
50	$0.00	
51	15,808.00	
52	15,808.00	
53	15,808.00	
54	15,808.00	
55	15,808.00	

Indirect Benefit of Delaying Onset of Hypertension

Estimated number of graduates to delay onset of hypertension = 49.04

		Years				
Average age of participant		23	*			*
Average age of onset of hypertension	=	30	*	**BENEFIT = 49.04 x $17,458.70 =**	**$**	**856,174.76** *
Avg. survival after onset of hypertension	=	20	*			*
Average delay of onset of hypertension	=	5				

(The avgerage survival after onset is 20 years. This study will account for the additional years of productivity during the last five years of the survival period. This is the most conservative approach.)

Discount rate = 5%

Annual Salary = WR * 40 (hrs per wk) * 52 (week)

Age	wage rate (WR)	Age	Annual Salary	PV(Salary)
23	$7.60	23	$0.00	**$17,458.70**
24	$7.60	24	$0.00	
25	$7.60	25	$0.00	
26	$7.60	26	$0.00	
27	$7.60	27	$0.00	
28	$7.60	28	$0.00	
29	$7.60	29	$0.00	
30	$7.60	30	$0.00	
31	$7.60	31	$0.00	
32	$7.60	32	$0.00	
33	$7.60	33	$0.00	
34	$7.60	34	$0.00	
35	$7.60	35	$0.00	
36	$7.60	36	$0.00	
37	$7.60	37	$0.00	
38	$7.60	38	$0.00	
39	$7.60	39	$0.00	
40	$7.60	40	$0.00	
41	$7.60	41	$0.00	
42	$7.60	42	$0.00	
43	$7.60	43	$0.00	
44	$7.60	44	$0.00	
45	$7.60	45	$0.00	
46	$7.60	46	$0.00	
47	$7.60	47	$0.00	
48	$7.60	48	$0.00	
49	$7.60	49	$0.00	
50	$7.60	50	$0.00	
51	$7.60	51	15,808.00	
52	$7.60	52	15,808.00	
53	$7.60	53	15,808.00	
54	$7.60	54	15,808.00	
55	$7.60	55	15,808.00	

Indirect Benefit of Delaying Onset of Cancer

Estimated number of graduates to delay onset of cancer = 3.09

		Years		
Average age of participant	=	23	*	*
Average age of onset of cancer	=	36	* **BENEFIT = 3.09 x $27,084.18 = $ 83,690.11**	*
Average survival after onset of cancer	=	5	*	*
Average delay of onset of cancer	=	5		

Discount rate = 5%

Annual Salary = WR * 40 (hrs per wk) * 52 (week)

Age	wage rate (WR)
23	$7.60
24	$7.60
25	$7.60
26	$7.60
27	$7.60
28	$7.60
29	$7.60
30	$7.60
31	$7.60
32	$7.60
33	$7.60
34	$7.60
35	$7.60
36	$7.60
37	$7.60
38	$7.60
39	$7.60
40	$7.60
41	$7.60
42	$7.60
43	$7.60
44	$7.60
45	$7.60
46	$7.60

Age	Annual Salary	PV(Salary)
23	$0.00	**$27,084.18**
24	$0.00	
25	$0.00	
26	$0.00	
27	$0.00	
28	$0.00	
29	$0.00	
30	$0.00	
31	$0.00	
32	$0.00	
33	$0.00	
34	$0.00	
35	$0.00	
36	$0.00	
37	$0.00	
38	$0.00	
39	$0.00	
40	$0.00	
41	$0.00	
42	15,808.00	
43	15,808.00	
44	15,808.00	
45	15,808.00	
46	15,808.00	

Indirect Benefit of Delaying Onset of Obesity

Estimated number of graduates to delay onset of obesity = 0.008

		Years		
Average age of onset of obesity	=	23	*	
Average age of retirement	=	65	*	BENEFIT = 0.008 x $1,952.23 = $ 15.62
Average work-lost days per year due to Obesity	=	1.83	*	

Discount rate = 5%

Wage Foregone = WR * 8 (hours in work day) * Work-lost days

Age	wage rate (WR)
23	$7.60
24	$7.60
25	$7.60
26	$7.60
27	$7.60
28	$7.60
29	$7.60
30	$7.60
31	$7.60
32	$7.60
33	$7.60
34	$7.60
35	$7.60
36	$7.60
37	$7.60
38	$7.60
39	$7.60
40	$7.60
41	$7.60
42	$7.60
43	$7.60
44	$7.60
45	$7.60
46	$7.60
47	$7.60
48	$7.60
49	$7.60
50	$7.60
51	$7.60
52	$7.60
53	$7.60
54	$7.60
55	$7.60
56	$7.60
57	$7.60
58	$7.60
59	$7.60
60	$7.60
61	$7.60
62	$7.60
63	$7.60
64	$7.60
65	$7.60

Age	Annual Salary	PV(Salary)
23	$111.26	$1,952.23
24	$111.26	
25	$111.26	
26	$111.26	
27	$111.26	
28	$111.26	
29	$111.26	
30	$111.26	
31	$111.26	
32	$111.26	
33	$111.26	
34	$111.26	
35	$111.26	
36	$111.26	
37	$111.26	
38	$111.26	
39	$111.26	
40	$111.26	
41	$111.26	
42	$111.26	
43	$111.26	
44	$111.26	
45	$111.26	
46	$111.26	
47	$111.26	
48	$111.26	
49	$111.26	
50	$111.26	
51	$111.26	
52	$111.26	
53	$111.26	
54	$111.26	
55	$111.26	
56	$111.26	
57	$111.26	
58	$111.26	
59	$111.26	
60	$111.26	
61	$111.26	
62	$111.26	
63	$111.26	
64	$111.26	
65	$111.26	

Indirect Benefit of Delaying Onset of Diabetes

Estimated number of graduates to delay onset of Diabetes = 3.84

		Years		
Average age of onset of Diabetes	=	40	*	
Average age of retirement	=	65	* BENEFIT = 3.84 x $64.01 =	$ 245.79
Average work-lost days per year due to Diabetes	=	0.06	*	

Discount rate = 5%

Wage Foregone = WR* 8 (hours in work day) * Work-lost days

Age	wage rate (WR)	Age	Annual Salary	PV(Salary)
23	$7.60	23	$3.65	$64.01
24	$7.60	24	$3.65	
25	$7.60	25	$3.65	
26	$7.60	26	$3.65	
27	$7.60	27	$3.65	
28	$7.60	28	$3.65	
29	$7.60	29	$3.65	
30	$7.60	30	$3.65	
31	$7.60	31	$3.65	
32	$7.60	32	$3.65	
33	$7.60	33	$3.65	
34	$7.60	34	$3.65	
35	$7.60	35	$3.65	
36	$7.60	36	$3.65	
37	$7.60	37	$3.65	
38	$7.60	38	$3.65	
39	$7.60	39	$3.65	
40	$7.60	40	$3.65	
41	$7.60	41	$3.65	
42	$7.60	42	$3.65	
43	$7.60	43	$3.65	
44	$7.60	44	$3.65	
45	$7.60	45	$3.65	
46	$7.60	46	$3.65	
47	$7.60	47	$3.65	
48	$7.60	48	$3.65	
49	$7.60	49	$3.65	
50	$7.60	50	$3.65	
51	$7.60	51	$3.65	
52	$7.60	52	$3.65	
53	$7.60	53	$3.65	
54	$7.60	54	$3.65	
55	$7.60	55	$3.65	
56	$7.60	56	$3.65	
57	$7.60	57	$3.65	
58	$7.60	58	$3.65	
59	$7.60	59	$3.65	
60	$7.60	60	$3.65	
61	$7.60	61	$3.65	
62	$7.60	62	$3.65	
63	$7.60	63	$3.65	
64	$7.60	64	$3.65	
65	$7.60	65	$3.65	

Indirect Benefit of Delaying Onset of FBI

Estimated number of graduates to delay onset of FBI = 46.6

		Years	
Average age of onset of Diabetes	=	23	*
Average age of retirement	=	65	* BENEFIT = 46.6 x $1,600.19 = $ 74,568.72
Average work-lost days per year due to Diabetes	=	1.5	*

Discount rate = 5%

Wage Foregone = WR* 8 (hours in work day) * Work-lost days

Age	wage rate (WR)
23	$7.60
24	$7.60
25	$7.60
26	$7.60
27	$7.60
28	$7.60
29	$7.60
30	$7.60
31	$7.60
32	$7.60
33	$7.60
34	$7.60
35	$7.60
36	$7.60
37	$7.60
38	$7.60
39	$7.60
40	$7.60
41	$7.60
42	$7.60
43	$7.60
44	$7.60
45	$7.60
46	$7.60
47	$7.60
48	$7.60
49	$7.60
50	$7.60
51	$7.60
52	$7.60
53	$7.60
54	$7.60
55	$7.60
56	$7.60
57	$7.60
58	$7.60
59	$7.60
60	$7.60
61	$7.60
62	$7.60
63	$7.60
64	$7.60
65	$7.60

Age	Annual Salary	PV(Salary)
23	$91.20	$1,600.19
24	$91.20	
25	$91.20	
26	$91.20	
27	$91.20	
28	$91.20	
29	$91.20	
30	$91.20	
31	$91.20	
32	$91.20	
33	$91.20	
34	$91.20	
35	$91.20	
36	$91.20	
37	$91.20	
38	$91.20	
39	$91.20	
40	$91.20	
41	$91.20	
42	$91.20	
43	$91.20	
44	$91.20	
45	$91.20	
46	$91.20	
47	$91.20	
48	$91.20	
49	$91.20	
50	$91.20	
51	$91.20	
52	$91.20	
53	$91.20	
54	$91.20	
55	$91.20	
56	$91.20	
57	$91.20	
58	$91.20	
59	$91.20	
60	$91.20	
61	$91.20	
62	$91.20	
63	$91.20	
64	$91.20	
65	$91.20	

VITA

Edwin C. Lewis

Edwin C. Lewis was born in Columbus, Ohio on August 29, 1971. He grew up in Landover, Maryland and graduated from Crossland High School in Temple, Maryland in 1989. Edwin received a B. S. degree in Agricultural Economics from Southern University in Baton Rouge, Louisiana in 1994 and immediately began his professional career with Virginia Cooperative Extension. After working two year as a 4-H Extension Agent in Petersburg, Virginia, he was granted educational leave to pursue a Master's degree in Agricultural and Applied Economics at Virginia Tech.