

CHAPTER III

METHODOLOGY

The purposes of the study were to estimate the economic value of the participant's nutritional behavior changes brought about by EFNEP in Virginia and to determine if the total estimated economic value outweighed the yearly cost of implementing the program. The research design in this study consisted of a cost-benefit analysis (CBA) involving the following five steps. 1) conducting a comprehensive literature search to determine chronic disease incidence, economic costs and relationship with diet; 2) compiling a list of dietary behaviors and food-related practices from the Expanded Food and Nutrition Education Program (EFNEP) data which could potentially prevent the chronic diseases identified in this study; 3) selecting the sample; 4) monetizing the direct costs and benefits; and 5) using an appropriate analytic measure to calculate the cost-benefit results. Existing ERS data for the 1996 EFNEP graduates were used, and all costs and benefits were determined for the 1996 fiscal year.

Steps in the CBA procedure

Step 1: Determination of disease incidence, cost, and dietary relationship from scientific literature. Information on diet-related chronic diseases and conditions, their incidence rates in the low-income American population, the economic costs associated with each disease, survival rates after treatment and the incidence rates of each disease attributable to diet, was obtained from scientific literature. An extensive search was conducted using both computer databases and manual searches. The computer databases included were AGRICOLA, MEDLINE, ERIC, FIRSTSEARCH, PSYCHLIT, DISSERTATION ABSTRACTS, SocioAbs and PsychFirst. Manual searches focused on key journals in the appropriate fields, such as clinical nutrition, nutrition education, program evaluation, medicine and public health, economics, finance, and policy planning. Reports and additional information were sought from various agencies, such as

the Center for Chronic Diseases, the American Heart Association, the American Cancer Society, and the U.S. Department of Agriculture (USDA). Also key individuals in each of these fields were consulted.

Step 2: Identify dietary behaviors measured in EFNEP. Literature reviewed in the previous chapter has shown that there is increasing scientific consensus that diet is related to chronic diseases and that changes in dietary practices can help to lower the risk for these diseases. Using data recorded in the food behavior checklist and the 24-hour food recall, an initial list of nutritional practices associated with avoidance of a particular disease, was developed. (See Appendix B) From a benefit perspective, this initial list included direct tangible benefits associated with EFNEP, as they relate to appropriate nutrition-related diseases or conditions that would be affected through associated behaviors taught or measured through EFNEP. An initial list of direct tangible costs associated with EFNEP was also developed. (See Appendix C)

Step 3: Selection of the sample. The sample for this study included the 3100 EFNEP graduates from fiscal year 1996. All the EFNEP graduates were female and had completed a food practice checklist (FPC) and a 24-hour food recall on entry and on exit from the program. The scores on each had been treated as entry or pre- and exit or post-program participation scores. A critical assumption made in this study was that the changes in dietary behaviors and food-related practices on graduation were solely a result of program participation. To establish this criterion, the same set of optimal nutrition behaviors for avoidance of disease, was applied to both the pre- and the post-data. Graduates, who satisfied the criteria at entry, were eliminated from the study as they were already practicing optimal nutrition behaviors and, therefore, EFNEP would not have influenced these practices. Those participants who satisfied the criteria only on exit, and not on entry, and who graduated between October 1, 1995 and September 30, 1996, comprised the study sample.

In light of the contribution of certain dietary factors to major chronic diseases and the

demonstrated or potential ability to prevent nutrition-related morbidity, the Federal government had recommended population-wide changes in eating patterns. These recommendations have been summarized in the Dietary Guidelines for Americans²⁴ a joint product of the U.S. Department of Agriculture and the U.S. Department of Health and Human Services. The Dietary Guidelines²⁴ advise Americans to: eat a variety of foods; maintain desirable weight; avoid too much fat, saturated fat, and cholesterol; eat foods with adequate starch and fiber; avoid too much sodium; and drink alcoholic beverages in moderation, if at all

To calculate the percent of graduates practicing optimal nutritional behaviors related to a particular disease or condition addressed in this study, the following method was used. Dietary behaviors of the 1996 Virginia EFNEP graduates had previously been assessed with a 14-item FPC and a 24-hour food recall taken at entry and exit from the program. The FPC questions measure food related behaviors and food handling practices on a scale of 1-5, where 1 = Do not do, 2 = Seldom, 3 = Sometimes, 4 = Most of the time, and 5 = Almost always. For the 24-hour food recall, participants had indicated the number of servings they had eaten of all foods in the last 24 hours. This data had been entered into the EFNEP Reporting/Evaluation System (ERS 3.0) , stored on disks as Dbase (dbf) files, and were available for use.

Based on evidence in the scientific literature, behaviors measured by the FPC and food/nutrient intakes were categorized according to their contribution to the prevention of specific diet-related chronic diseases. Using the stored ERS data on the 1996 graduates, a comparison was made to determine which graduates had improved their food behaviors and food/nutrient intake to an optimal level deemed essential for the prevention of various diseases. A very stringent and conservative approach was taken to calculate the percent of graduates practicing optimal nutritional behaviors. This approach was taken because of the assumption that EFNEP participants practicing optimal nutritional behaviors at graduation would continue to practice these behaviors throughout their life span and would accrue the appropriate benefits alluded to in this study. To be included in the percent of graduates practicing optimal nutritional behaviors, the graduate needed to score a 4 or greater when a positive response was desired, or a 2 or less when

a negative response was required from entry to exit assessment. In addition, the graduate's food/nutrient intake on the exit 24-hour food recall, related to the specified diseases, had to be in a predetermined range. (see Table 1)

Table 1. Criteria for FBC and Food Recall Selection

| Disease/condition | <u>FBC Question #</u> | <u>FBC Score</u> | 24 Hour Food Recall Intake Criteria |
|------------------------------------|-----------------------|------------------|--|
| Colo-rectal cancer | 3 & 8 | ≥ 4 | fat \leq 65 gms veg + fruits \geq 5svgs fiber \geq 20 gms |
| Heart disease | 6 & 7 & 8 | ≥ 4 | fat \leq 65 gms veg + fruits \geq 5svgs fiber \geq 20 gms |
| Stroke & hypertension | 6 & 7 | ≥ 4 | veg + fruits \geq 5svgs Ca \geq 800 mgs |
| Osteoporosis | 3 | ≥ 4 | Dairy \geq 2 svgs Ca \geq 800 mgs |
| NID Diabetes | 3 & 8 | ≥ 4 | fiber \geq 20 gms cal \leq 2300kcal carbohydrate \leq 250gm |
| Obesity | 3 & 8 | ≥ 4 | fat \leq 65 gms veg + fruits \geq 5svgs fiber \geq 20 gms cal \leq 2300kcal |
| Foodborne illness | 4 & 5 | ≤ 2 | --- |
| Commonly occurring infant diseases | --- | --- | true response for nursing |
| Low birth weight | --- | --- | true response for |

| | | | |
|---------|--|--|----------------------------|
| infants | | | pregnant cal>= 2100kcal |
|---------|--|--|----------------------------|

The dbf files were analyzed to identify and select only those graduates who reported the appropriate changes at exit, but not at entry. The personal computer version of the Statistical Package for the Social Sciences (SPSS-PC) was used to compare the entry and exit data.⁸⁵ (See Appendix D for the procedure). Graduates meeting the criteria were then selected as those practicing optimal nutritional behaviors to prevent the designated diseases. The number of 1995-1996 Virginia EFNEP graduates, practicing optimal nutritional behaviors for avoidance of a particular disease, from each EFNEP unit is available in Appendix (E). The percent was then calculated by taking the total number of graduates from all units practicing optimal nutritional behaviors for each disease and dividing it by the total number of Virginia EFNEP graduates.(see Table 2)

Step 4: Monetizing direct tangible benefits and costs. The approach taken to monetizing benefits of EFNEP for this study was to characterize the benefits as the health care costs that were either delayed or avoided from practicing appropriate nutritional behaviors as a result of participating in EFNEP. Therefore, the benefits can be valued in dollars by their non-biased market prices (i.e., the cost of medical care associated with the disease or condition either delayed or avoided). Direct, tangible benefits from EFNEP are equal to the net present value of the estimated dollars saved by avoiding or delaying onset of the disease or condition. Net present value is the value of the benefits over time in today's dollars using an appropriate discount rate. Since the EFNEP graduates were all women, the average lifespan for the American female was used in the calculations. The diseases and conditions were separated into three categories or types.

Type A - These diseases were considered life threatening. The approach taken in calculating these tangible benefits was to assume a delayed onset of the disease or

condition. If the onset of the disease is delayed, the direct tangible benefit would be the difference in the net present value of delaying cost of treatment into the future at time 1 and time 2, with time 1 being the actual age of onset of the disease and time 2 being the delayed age at which the disease occurs due to better nutritional practices. The diseases included in this category were cancer, heart disease, stroke and hypertension. The following illustration explains the benefit:

Illustration of direct tangible benefits: If the average onset of the disease/condition is at age 55 and we can delay its onset for five years until age 60, then the benefit is the difference in the net present value of accruing the costs at age 60 rather than at age 55.

Type B - These diseases were not considered as an immediate threat to life, but assumed to result in treatment costs that would be incurred from the time of onset throughout the participant's life. The approach taken in calculating these direct tangible benefits was to assume avoidance of the disease. When a disease is avoided, the direct tangible benefit is the net present value of the avoided treatment costs from average onset of the disease through the average life span. The average life span for American women was estimated at 78 years.⁸⁶ The diseases and conditions included in this category were osteoporosis, Type 2 diabetes, obesity, commonly occurring infant diseases (e.g., otitis media, respiratory infections, viral infections, gastroenteritis) and, foodborne illnesses. In the case of obesity and diabetes, the treatment costs of these diseases contributing to Type A diseases were factored out, resulting in the incorporation of benefits solely from Type B diseases. The following illustration explains the benefit:

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

There were three critical assumptions made in deriving the benefits for Type A and B diseases or conditions. These were as follows:

1) Benefits for Type A diseases/conditions would be based upon delaying onset of the disease/condition for a minimum of five years and benefits for Type B diseases/conditions would be based upon avoiding the disease/condition for the duration of the participant's natural and working life.

2) Monetized benefits would only be calculated for EFNEP participants (low-income homemakers) practicing optimal nutrition behaviors upon graduation from the program. While it is known that benefits would also spillover to the families, there was no way to accurately calculate these benefits from the ERS data.

3) Selected EFNEP graduates practicing optimal nutritional behaviors upon graduation would continue to practice the nutritional behaviors acquired in EFNEP for the rest of their lives. As described in chapter II, studies within the past decade have shown that regression did not occur among EFNEP graduates after graduation from the program. It has also been shown that they maintained significantly positive behaviors in consumption of the four basic food groups as well as food-related behaviors. For the purpose of the study, only EFNEP graduates who met very stringent criteria for practicing optimal nutritional behaviors as described in the previous section, were selected for the calculation of benefits. Graduates who had satisfied the criteria, prior to entry into the program, have been excluded from the study.

Type C - The third condition used in benefit calculation was that of low-birth-weight (LBW) infants. This condition differs from Types A and B diseases/conditions because treatment costs would be incurred on a one-time basis when the child is born. The benefit was avoiding the treatment costs associated with a low birth weight infant. This benefit was the present value of the treatment costs avoided when infants are of normal weight. It

was calculated on the number of participants indicating they are pregnant and the value was not discounted as it would have occurred in less than one year of graduating from the program.

Table 2. Percent of participants practicing optimal nutritional behaviors

| Disease/condition | Percent practicing optimal nutritional behaviors |
|------------------------------------|--|
| Colo-rectal cancer | 1.9% |
| Heart disease | 1.1% |
| Stroke | 9.4% |
| Hypertension | 9.4% |
| Osteoporosis | 28.5% |
| Type 2 Diabetes | 1.9% |
| Obesity | 1.9% |
| Foodborne illness | 53.7% |
| Commonly occurring infant diseases | 3.0% |
| Low birth-weight infants | 3.0% |

Formula for monetizing the tangible benefits

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

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

Variables A through D are used to derive the number of people who will either avoid or delay onset of the disease/condition. The following example illustrates the use of the formula.

Example: Disease X

[A] Annual number of graduates in EFNEP = 3,100 (EFNEP participants who completed an entry and exit assessment)

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

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

[D] Percent of EFNEP graduates practicing optimal nutritional behaviors related to the disease/condition = 5% or 4 people
(5% of the graduates are practicing appropriate nutritional behaviors related to the disease/condition, as measured by entry and exit FPC scores and 24-hour food recall intake, such that they will either avoid or delay onset of the disease/condition—4 is 5% of

the 77 who could delay or avoid disease through diet related behaviors)

[E] Net present value of appropriate benefits for Disease X = \$3,000

BENEFIT = $4 \times \$3000 = \$12,000$ for Disease X

The annual number of graduates in EFNEP is the number of participants who complete an entry and exit FPC and a 24-hour recall. The incidence rate of the disease/condition in the population is the estimated percent of people who would get the disease/condition regardless of other factors. Incidence rates of low-income populations were used if available; otherwise incidence rates for the general American population were used. The incidence rate of the disease/condition related to diet is the percent of disease cases that could be prevented or delayed if the recommended dietary behaviors were practiced. The percent of EFNEP graduates practicing optimal nutritional behaviors related to the disease/condition, are those graduates meeting a specified set of criteria generated from ERS data, based on entry and exit FPC responses for certain questions and 24-hour food recall intake data.

The calculations for the direct tangible benefits for Type A diseases/conditions are: (The cost of treatment per patient per year \times the average number of years of survival after treatment) discounted to 1996 dollars beginning with the average age of onset of the disease/condition - (The cost of treatment per patient per year \times the average number of years of survival after treatment) discounted to 1996 dollars beginning with the average age of onset of the disease/condition plus five years.

For Type B diseases/conditions, the calculations for the present value of direct tangible benefits are: the cost of treatment per patient per year discounted to 1996 dollars from the age of onset through the age 78. Figures for calculating the direct tangible benefits, associated with avoidance of each category of diseases/conditions, are provided in Table 3 and Table 4 and accompanying explanations. The costs discussed here are the unadjusted costs for all diseases/conditions. (See Appendix F for adjusted costs)

Colorectal cancer. Colo-rectal cancer is the second leading cause of cancer in the United States. According to the Healthy People 2000⁴⁵, 15% of the population are likely to be affected by colorectal cancer. Despite high incidence rates, death rates due to cancer have decreased with a current 5-year survival rate after diagnosis associated with it.⁸⁷ Doll and Peto³⁹ established 35% as their best estimate for the proportion of all cancer deaths attributable to diet. Economic costs associated with colorectal cancer were \$28,000.⁴⁵

Heart disease. According to the 1994 National Health Interview Survey,⁸⁸ the incidence rate of chronic heart disease in the low-income population was 31.2%. This incidence rate was derived for the 45-64 age group, the group in which the average age of onset of heart disease falls within. Studies have associated approximately 22-30% of CHD deaths to dietary factors, especially an increased consumption of cholesterol and saturated fat and a decreased consumption of fiber. This study utilized the average, which is 26%. Coronary bypass surgery costs per patient averaged \$30,000.⁴⁵ Mortality rates from CHD had decreased from the '60s where 30-35% of the heart attacks was fatal within the first three weeks. Currently, an average of 5 years is associated with survival from critical attacks.⁸⁷

Stroke. Strokes affect over 60,000 people each year, while more than 3 million people suffer from stroke-related disabilities.³³ The incidence rate of 1.7% was derived by dividing the number of people suffering from stroke-related disabilities in the U.S. (3 million) by the average American population between 1990-1994 (256 million). Information on the incidence rate of stroke related to diet was not available. Hemiplegia treatment and rehabilitation costs, as a result of stroke, was \$22,000 per patient.⁴⁵ Under proper medical guidance and supervision, a 10-year survival period is averaged among stroke patients.⁸⁷

Hypertension. Hypertension or high blood pressure is a common and important risk factor for CHD, stroke and renal disease affecting 30% of the adult American population. According to the

1994 National Health Interview Survey,⁸⁸ the incidence for hypertension among the low-income people was 37.4%. This incidence rate was derived for the 45-64 age group. Literature has suggested that the incidence rate of this disease related to diet was between 29-60%.⁸⁷ In this study, the average of 45% has been utilized. Annual costs associated with hypertension were found to be \$17,400 million or \$348 per patient.³³ Improvements in the detection, treatment, and control of hypertension have contributed to an average 20-years of survival from other fatal chronic diseases.⁸⁷

Table 3. Type A Diseases/Conditions Benefit Information

| 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 treatment | Cost of treatment per patient per year |
|-----------------------|---|---|---|---|---|
| Colorectal Cancer | 15% | 35% | 36 | 5 | \$33,046 |
| Heart Disease | 31.2% | 26% | 55 | 5 | \$35,406 |
| Stroke | 1.7% | Not available | 45 | 10 | \$23,025 |

| | | | | | |
|--------------|-------|-----|----|----|-------|
| Hypertension | 37.4% | 45% | 30 | 20 | \$364 |
|--------------|-------|-----|----|----|-------|

Osteoporosis. Osteoporosis and osteoporosis-related fractures afflict an estimated 9.3% of the American population.⁸⁹ The incidence rate of osteoporosis has been listed as 28%. This has been derived by dividing the number of people affected in the U.S. (24 million) by the adult population aged 44, where it commonly occurs, and above in 1995 (85,742,000). Information on the incidence rate of osteoporosis related to diet was not available. Initial medical costs per patient suffering from osteoporotic fractures were approximately \$11,582.⁸⁹

Type 2 diabetes. Type 2 diabetes has been diagnosed in 2.9% of the U.S population, though an equal number of afflicted people are unaware and go undiagnosed. According to the 1994 National Health Interview Survey,⁸⁸ the incidence rate of diabetes in the low-income population was 14.5%. This incidence rate was derived from the 45-64 age group, which provided the most accurate probability of contracting diabetes. Most people with diabetes have Type 2 diabetes, which usually appears after the age of 40. Approximately 45% of the diagnosed cases have resulted from poor diet and inactivity.⁴⁸ Appendix F gives the adjusted treatment costs used for Type 2 diabetes in this study.

Obesity: 1992 data derived from the third National Health and Nutrition Examination Survey (NHANES III) study estimated, for all ethnic/race groups in the United States combined, 35% of the adult female population (ages 20-74 years) were overweight.⁵¹ The average age of the homemaker (23 years) has been used for age of onset since it was not possible to derive from the

ERS at what age obesity actually affected the individual. For treatment costs, see the adjusted costs for diseases in Appendix F. In 1993, 300,000 deaths were a result of poor diet and inactivity.⁵⁰ Since there has been no exact figure for the incidence rate related to diet, this figure has been used to derive the incidence rate related to diet. Not including the economic costs of other chronic conditions linked to overweight or obesity (e.g., heart disease, and hypertension), costs associated with weight-related products and services including diet foods, products, and programs for an individual were found to be \$625.⁹⁰

Foodborne illness. The estimate of the annual costs of foodborne illnesses to society would have been considerably higher if the total number of episodes experienced by each individual for each pathogen were available for this study. However, it has been estimated that about 2.8% of the population have been affected by foodborne pathogens each year.⁶⁸ This was derived by dividing the number of people affected in the U.S. (7,130,767) by the average U.S population between 1990-1994 (256 million). Since foodborne illnesses are solely related to diet through food handling, the incidence rate related to diet used was 100%. Cost of illness per person was derived by dividing the total costs for foodborne illnesses by the number of cases per year.⁶⁸

Commonly occurring infant diseases. Breastfeeding has been shown to lower infant mortality as well as the incidence of certain frequently occurring childhood diseases/conditions like otitis media, gastroenteritis, and viral infections. Kaiser Permanente, in research to determine the benefits of sponsoring an official lactation program, calculated the additional cost of the bottle-fed over a breastfed baby in the first year of life as \$1,435 (adjusted to \$1,537 for this study).⁶⁷ These costs would potentially be avoided if the child were breastfed. Hence the incidence rate or disease occurrence related to these costs is 100%.

Table 4. Type B diseases/conditions benefit information

| Disease/condition | Incidence rate of disease in the population | Incidence rate of disease related to diet | Average age of onset of disease | Cost of treatment per patient per year |
|-------------------|---|---|---------------------------------|--|
| Osteoporosis | 28% | Not available | 45 | \$11,828 |
| Type 2 Diabetes | 14.5% | 45% | 40 | \$6,182 |
| Obesity | 12.5% | 0.11% | 23 | \$625 |
| Foodborne illness | 2.8% | 100% | 23 | \$1,009 |

| | | | | |
|------------------------------------|------|------|-----|---------|
| Commonly occurring infant diseases | 100% | 100% | 0-1 | \$1,537 |
|------------------------------------|------|------|-----|---------|

For Type C diseases/conditions, low-birth-weight infants (LBW), maternal age, high parity, poor reproductive history, low socio-economic status, and poor maternal nutritional status are among chief factors responsible for LBW infants.⁴⁵ An expectant mother with no prenatal care is three times more likely to have a LBW baby. Studies have proven that adequate nutritional care of high risk groups namely adolescence and poor women is likely to result in the birth of a normal weight baby. The incidence rate of LBW infants in the U.S. is 7.3%.⁹¹ The incidence rate of this condition related to diet was 100% because of the importance of adequate nutritional care in pregnancies. The average onset of this condition is one year (for graduates who were pregnant during their participation in EFNEP). Costs associated with neonatal intensive care for a LBW baby for a year was estimated at \$30,000 (adjusted to \$35,406 for this study).⁵⁸

Monetizing indirect tangible benefits

Calculations and a full discussion of the procedure for monetizing the indirect tangible benefits of EFNEP has been provided elsewhere.^{14,18} However, a brief discussion of the approach has been given below.

The indirect tangible benefit for Type A diseases/conditions is the difference in the present value of delaying morbidity costs (workdays lost) into the future. For example, if the average onset of the disease/condition is at age 55 and its onset can be delayed for five years until age 60, then the benefit is the difference in the present value of delaying treatment costs until age 60 rather than at age 55.¹⁴

Type B diseases were not considered to be life threatening, but resulting in earnings foregone due to lost workdays (i.e., morbidity). These diseases/conditions could be avoided by following the dietary behaviors promoted in EFNEP. When avoided, the benefit was the net

present value of the earnings forgone each year through workdays lost from onset of the disease to retirement. For example if the average age of onset of the disease/condition is at age 30, the benefit is the present value of earnings foregone resulting from lost work days from age 30 until 65 (average age of retirement).

Monetizing the costs of EFNEP

The direct tangible costs of conducting the EFNEP program in Virginia were identified as: salaries and benefits, office space, utilities, equipment, supplies/training, and staff travel.

Salaries and benefits. This cost consisted of direct payments of real dollars as salaries and benefits to EFNEP professionals, paraprofessionals, and support staff. Salaries and benefits could be calculated by multiplying the total number of hours expended for program planning, implementing, evaluating, marketing, etc., by the average salary earned per hour, including benefits. In Virginia, specified yearly salaries are paid to all full-term employees and are not calculated on an hourly basis. The total state allocation of funds for this category was derived by summing the salaries and benefits of EFNEP staff in the local units and in the state office.

Office space. This cost included in-kind values and/or real dollars expended for rent or purchase of office space for staff directly administering or implementing EFNEP. The funding for office space is provided to the Virginia Cooperative Extension through state and local dollars. The value of space used by EFNEP was estimated, though no EFNEP funds are used directly. The cost of office space was calculated using the following procedure based on the methods used by the federal Office of Management and Budget (1997).⁹²

- a) Data on each EFNEP unit was used to address the following questions: 1) What was the original price of an entire building where Extension is located? (If the exact price

- was not known, an estimated value was provided based on market values of the government building at the time of acquisition), and 2) What was the total cost of renovations and improvements made in the building since it was acquired by the local government? These values were added together to yield the total value of the building.
- b) Data on each EFNEP unit was used to determine what portion or percent of the building is used by Extension (including meeting/conference rooms used frequently by Extension).
 - c) The values for items a and b were averaged across all units and then multiplied together to yield the average value of the Extension space in the building where EFNEP units exist.
 - d) Data from each EFNEP unit was then used to estimate what portion or percent of Extension space was used to conduct or support EFNEP activities. At a minimum, this included a portion or percent based on the number of EFNEP faculty/staff using Extension space.
 - e) The average value for item c was multiplied by the average value for item d. This figure was then multiplied by a 2.0% usage fee to reflect the average yearly value of space in an EFNEP unit office.
 - f) Data from each EFNEP unit was then used to determine the yearly cost of janitorial and maintenance service for Extension space in the office.
 - g) The average value for item f was multiplied by the average value of item d to yield the average value of janitorial and maintenance service in an EFNEP unit office.
 - h) Values for items e and g were summed and then multiplied by the total number of EFNEP units to yield the total value of EFNEP office space, plus janitorial and maintenance costs.⁹²

Utilities. This cost included real dollars and in-kind funds expended for utilities (e.g. electricity, water, telephone, gas etc.) used to conduct EFNEP. The cost of utilities for EFNEP was

calculated by multiplying the total cost to the Extension unit by the same percentage used in item d in the office space procedure above. The funding for utilities has been provided primarily by local government dollars. The utility estimates in the Virginia-EFNEP calculations were based on conversations with the local Extension staff.¹⁸ The total cost of utilities in a unit was prorated by the number of agents and program assistants at that unit.

Equipment. This cost included real dollars expended for the direct purchase of any equipment (e.g., computers, audio-visual equipment, etc.) that was used for EFNEP work. Also included was the in-kind value of existing equipment. The total amount expended for equipment was calculated by summing the equipment expenditure from each EFNEP unit. The federal government only allows 6.67% of the total cost of equipment expenditure to be used each year as in-kind expense.⁹²

Supplies and training. Office and educational supplies consist of real dollars paid for office supplies, printing, training manuals, and other educational materials. Training costs included real dollars and in-kind funds expended for direct training of professionals and paraprofessionals to specifically carry out EFNEP. This cost included materials for distribution, payment to guest speakers, travel, lodging, and meals. Also included were the costs associated with participating in federal, state, and regional conferences. The total amount expended for supplies and training was calculated by summing these expenditures across all EFNEP units as reflected in the overall program accounting records (obtained from the Virginia EFNEP office, Virginia Tech).

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

Marginal excess burden (MEB). When government expenditures are financed by tax collection, distortions are introduced that create losses because not all of the funds collected will re-enter the economy in productive activities that stimulate the gross national product. These losses need to be charged against public expenditures to more accurately reflect the social opportunity costs of public programs. A marginal excess burden (MEB) estimate measures the incremental welfare costs of raising extra revenues from an existing distorting tax. Measures of the costs of public expenditures can be underestimated by failing to account for the MEB of the tax collection system. Since EFNEP is funded by federal dollars, the MEB was included as a direct cost to ensure that the cost associated with administering EFNEP was not underestimated. The MEB of taxation used for the study was 17%¹⁴

Step 5: Calculation of the cost-benefit results. As stated in the previous chapter, the three most common types of analytic measures used in cost-benefit studies include benefit-cost ratios, internal rates of return, and net present values. Before considering the specific type of analytic measure used, the discount rate had to be selected. Assumptions on a general rate of inflation have been avoided, as future inflation is highly uncertain. Many analysts have recommended the use of real discount rates for both costs and benefits, monetary and non-monetary. The term “real” indicates that no additional adjustment should be made to this discount rate to account for the effect of inflation. When a real discount rate is used, all monetary costs and benefits are reported in real or constant dollars for a specific base year. Constant dollars have been used to separate increases in the value of production which are due to inflation, from those which are due to actual increases in the quantity of a good or service product.

Several economic analyses in the past years that have focused on disease and injury prevention-effectiveness, health care intervention, and public health services have used a 3% or a 5% discount rate.¹⁶ It has been recommended that most cost-effectiveness studies use 5%. The discount rate used for this study was 5%.

Net Present Value. Although there are many different types of analytic measures used in cost benefit analysis, the three most commonly used are the benefit cost ratios, internal rates of return, and net present values.¹⁶ The net present value method (NPV) reduces the 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.⁹³ The formula used to generate a net present value was:

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

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

Internal Rate of Return (IRR). The specific discount rate that results in a zero NPV is known as internal rate of return.¹⁶ This is the discount rate that equates the PV of future net benefits with investment costs. It can be calculated as

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

where π is the IRR, and other symbols are defined in the above sections. According to this rule, the program is acceptable if π exceeds the market rate of return or any other predetermined rate viewed to be acceptable in the public sector.

There have been two main problems encountered when using the internal rate of return (IRR).¹⁶ The first has been technical and related to the way in which the social discount rate is calculated, leading to a number of IRRs to be calculated. When this occurs, it has been usually unclear as to which calculated value is correct. The second problem, at least in some cases, is that the method has assumed that the social discount rate is constant over the entire life of the project.

In many instances, the evaluator has had to vary the discount rate over the life of the project, especially if it has been known that returns would not be immediately evident.

Benefit-Cost Ratio. A benefit-cost ratio 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.¹⁶ This study used the latter approach, which is expressed as

$$B/C = PV \text{ of } NB/I_o$$

Where NB is the stream of benefits net of annual operating costs I_o is the one-time investment cost.

Of the three types of analytic measures discussed previously, the benefit-cost ratio has a long history of use in cost-benefit analysis, and is the most familiar analytic measure. It gives the benefits obtained per dollar of cost. The benefit-cost ratio, has been the most easily understood of the three types of analytic measures and hence, was determined as most appropriate for this study. In addition, it was decided that the other two measures would be reported.

Sensitivity analysis was applied to address the presence of uncertainty in the CBA based on the various assumptions made in the analysis.¹⁶ In this way, the CBA becomes more robust concerning any challenges to its original assumptions. The process, application, and discussion of sensitivity analyses for the CBA of the Virginia EFNEP are reported elsewhere.^{14,18}