CHAPTER IV
RESULTS AND DISCUSSION

Results

The results of this study include the following: a) the demographics of the Virginia Expanded Food and Nutrition Education Program (EFNEP) population, b) a list of the key assumptions used and decisions made in the research design of the study, c) results of the direct, tangible cost of the Virginia EFNEP, d) results of the direct, tangible benefits accruing with the 1996 Virginia EFNEP graduates, and e) the cost-benefit ratio for the Virginia EFNEP.

Demographics of the EFNEP population. A total of 6,375 homemakers participated in the Virginia EFNEP in the 1996 fiscal year (October 1, 1995-September 30, 1996). Of the 6,375 homemakers, 3,100 met program objectives and completed both, an entry and an exit Food Practice Checklist (FPC) and a 24-hour dietary recall which assessed the intake of food groups of the Food Guide Pyramid and several key nutrients. Of the 6,375 homemakers, 3% were male and the remainder female. Forty-eight percent of the homemakers were white, 46% were African-American, 4% were Hispanic and 2% were Asian or Pacific Islanders.[21] Of the 6,375 homemakers, 3,100 or approximately 50% completed the program, and thus, had pre- and post-data. About 41% continued the program, while about 10% of the participants terminated the program for various reasons.

Key decisions and assumptions made in the study. One of the first decisions made was that of the study perspective. As discussed in chapter II, three different perspectives exist in cost-benefit analysis. The investigators chose to approach the analysis from the program sponsor perspective, Cooperative State Research, Education and Extension (CSREES), in this study, along with elements of the societal perspective. The investigators used only data collected in the EFNEP Evaluation/Reporting System (ERS 3.2) to determine if the ERS provided sufficient and

appropriate data for a cost-benefit analysis. Thus no primary or additional data were collected for the study. Though a youth component exists in the Virginia EFNEP, it was decided that the cost-benefit analysis would be conducted only on the adult component of EFNEP. Since this study was based on existing EFNEP records for the 1996 graduates, it focused on monetizing only the direct tangible costs and benefits associated with the Virginia EFNEP. Data on intangible benefits have not been collected in the ERS, and hence these benefits were not assessed in this study. Other decisions made were to use 5% as discount rate and to use the cost-benefit ratio as the appropriate analytic measure.

A key assumption used in this study was that the dietary behaviors and food-related practices acquired by the participants as a result of EFNEP would be practiced for the remainder of their lifetime. As discussed in chapter II, EFNEP studies have indicated that participants maintain the positive dietary and food-related behaviors acquired through EFNEP for as long as five years after graduating from the program.[10] This assumption was also reinforced in this study by the stringent selection criteria of the EFNEP graduates who practiced optimal nutritional behaviors for avoidance or delay of a disease/condition.

The investigators of the study decided that the 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.[14] It was also decided by the investigators, that the monetized benefits would be calculated for EFNEP participants practicing optimal nutritional behaviors at graduation from the program. The investigators also decided to include only the homemaker (one receiving direct nutrition education) in the analysis. While it is known that benefits will spillover to the families, there is no way to accurately calculate this from the existing ERS data. Thus, benefits were being calculated only for that subset of the EFNEP population that practiced the optimal nutritional behaviors as specified by the study. Participants who did practice positive nutritional behaviors or maintained positive nutritional behaviors at

levels other than that specified by the optimal nutritional behaviors were not included in the analysis.

Results of the assessment of direct tangible benefits accruing to EFNEP graduates

The diseases/conditions were separated into three different categories. Type A diseases/conditions were considered life threatening. When the onset of the disease/condition was delayed, the direct tangible benefit was the difference between the net present value of delaying the cost of treatment into the future at time 1 and time 2. The diseases included in this category were colo-rectal cancer, heart disease, stroke and hypertension. Benefits for Type A diseases were based upon delaying the onset of the disease/condition by a minimum of five years. The direct tangible benefits from delaying the onset of Type A diseases/conditions are given in Table 5. The calculated benefit associated with delaying the onset of colo-rectal cancer for five years was 450,789.43, while the benefit for heart disease was $19,263.83. The calculated benefit for stroke was $65,111.81 and for hypertension it was $34,225.37.

Type B diseases /conditions were not considered life threatening, but resulting in treatment costs that would be incurred from time of onset throughout the participant's life. The approach taken to calculating these direct benefits was to avoid the disease/condition for the duration of the participant's natural and working life. When avoided, the direct tangible benefit was the net present value of the avoided treatment costs. The diseases/conditions included in this category were osteoporosis, Type 2 diabetes (non-insulin dependant diabetes mellitus), obesity, commonly occurring infant diseases (COID), and foodborne illnesses (FBI). Results of the direct tangible benefits associated with avoiding Type B diseases are given in Table 6.

The calculated benefit associated with avoiding the onset of diabetes was $176,396.84, while the benefit for osteoporosis was $16,195,686. The benefit for avoiding obesity was $94.65. The calculated benefit for avoiding foodborne illnesses was $879,413.13 and for commonly occurring infant diseases it was $133,411.6

Table 5. Results of the direct tangible benefits for Type A diseases

Disease/condition	Colorectal Cancer	Heart Disease	Stroke	Hypertension
Annual number of EFNEP graduates	3100	3100	3100	3100
Incidence rate of disease in population	15%	31.2%	1.7%	37%
Incidence rate related to diet	35%	26%	NA	45%
% graduates practicing ONB	1.9%	1.1%	9.4%	9.4%
Number of graduates to accrue benefits	3.09255	2.7662	4.9538	49.04262
Net present value of benefits	$16,424.75	$6,964.02	$13,143.81	$697.87
Total benefit	$50,789.43	$19,263.82	$65,111.81	$34,225.37

ONB = optimal nutritional behaviors practiced by EFNEP graduates to avoid disease

Table 6. Results of the direct tangible benefits for Type B diseases/conditions

Diseases	Osteoporosis	Type 2 Diabetes	Obesity	FBI	COIDs
Annual number of EFNEP graduates	3,100	3,100	3,100	3,100	3,100
Incidence rate of disease in population	28%	14.5%	12.5%	2.8%	100%
Incidence rate related to diet	NA	45%	0.11%	100%	100%
% graduates practicing ONB	28.5%	1.9%	1.9%	53.7%	3%
Number of graduates to accrue benefits	247.38	3.843225	0.0081	46.6116	86.8
Net present value of benefits	$65,468.86	$45,898.13	$11,686.59	$18,866.83	$1,537.0
Total benefits	$16,195,686	$176,396.84	$94.65	$879,413.13	$133,411.6

Type C disease/condition, which included only low birthweight infants, was the third type of condition. It differed from Types A and B in that treatment costs were incurred on a one-time basis when the child was born. The benefit was avoiding the treatment costs associated with a low birthweight infant. It was not discounted as it occurred within less than one year of graduating from the program. The result of the direct tangible benefit in avoiding Type C condition was $216,334.20. Table 7 gives the results of the benefit of avoiding Type C condition.

Table 7. Result of the direct tangible benefits for Type C condition

Disease/condition	Low-birth-weight infants
Annual number of EFNEP graduates	3,100
Incidence rate of condition in population	7.3%
Incidence rate related to diet	100%
% graduates practicing ONB	3%
Number of graduates to accrue benefit	6.1101
Net present value of benefit	$35,406.00
Total benefit	$216,334.20

The total direct tangible benefits for all the three types of diseases and conditions together was **$17,770,722**.

In a parallel analysis to the current study, the human capital approach was tutilized to monetize indirect tangible benefits from EFNEP.[14] The human capital approach views the value of personal health benefits as the economic productivity they permit to take place. This means that, 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 in earnings constitutes the value of avoiding work loss. In essence, the human being is viewed as a capital investment, the sole purpose of which is to produce a positive economic output. This indirect benefit was added to health care resource savings to determine total benefits. For Type A and B diseases/conditions, indirect benefits were calculated based on the earnings foregone due to lost work days (i.e., morbidity). Indirect benefits for type A and B diseases/conditions were found to be **$321,462**.[14,18] The total direct and indirect tangible benefit for the subset of the Virginia EFNEP graduates practicing the optimal nutritional behaviors was $**18,092,184**.

Results of the direct tangible costs associated with EFNEP for the 1996 fiscal year

Costs associated with the 26 EFNEP units were based on information collected by the State EFNEP Coordinator. The direct tangible costs of conducting the entire 1996 adult Virginia EFNEP for all participants were identified as: salaries and benefits, office space, utilities, equipment, supplies/training, and staff travel. The marginal excess burden was included as a direct cost in administering EFNEP, since EFNEP is funded by federal dollars. The marginal excess burden (MEB) of taxation used for the study was 17%. The direct tangible costs of the Virginia EFNEP are given in Table 8. The total cost of administering the Virginia EFNEP was

found to be **$1,922,204**.

The benefit-cost ratio for the Virginia EFNEP was calculated as **9.41/1.00**. This is translated as a $9.41 return in benefits for every one dollar invested in the Virginia EFNEP. The net present value, calculated as the total benefits minus the total costs, was $16,169,980. The third analytic measure, internal rate of return, was calculated as 18.93%. This was the discount rate that reduced future benefits to equal the initial investment cost

Table 8. Direct tangible costs associated with the Virginia EFNEP for 1995-96

Costs	Description	Amount	Funding source
Salaries And Benefits	Total Funds Allocated To Program Assistants, Area Coordinators And Administrators	$1,363,204.00	Federal
Office space	Value Of Office Space	$35,568.00	State & Local
Utilities	Electricity: $78,000.00 Phone: $12,480.00	$90,480.00	State & Local
Equipment	Equipment Used In All 26 Units	$3,588.00	Federal
Supplies/training	Total Funds Allocated To All EFNEP Units For Supplies And Training	$78,269.00	Federal
Staff Travel	Total Funds Allocated To EFNEP Staff For Travel	$71,800.00	Federal
Marginal Excess Burden	Marginal Excess Burden Of Taxation Was 17%Of The Total Direct Costs	279,295	
Total costs		$1,922,204	

Discussion

A benefit of $9.41 for every dollar spent in the Virginia EFENEP is a very encouraging result for a nutrition education program that targets low-income families. Economic evaluations, especially cost-benefit analysis, in health care are not frequent and those conducted with nutrition programs are few. A cost-benefit analysis of the Women, Infant and Children Program (WIC) participation in North Carolina estimated that for each $1.00 spent on WIC services, Medicaid savings in costs for newborn medical care were $2.91.[77] The researchers concluded that a higher level of WIC participation was associated with better birth outcomes and lower costs. Another similar study, conducted in Missouri, found that for every dollar spent on WIC, approximately 83 cents was saved in Medicaid newborn costs.[57]

Motivated primarily by pressures to curtail inflationary increases in health care costs, decision-makers in both the public and the private sectors have been forced to make value judgments that explicitly recognize resource constraints and, therefore, imply trade-offs among efficiency, equity, and quality objectives. When making decisions concerning resource allocations, especially choices among alternative uses of scarce resources, it seems reasonable to allocate those resources to the most deserving of programs in terms of economic and process efficiency. The USDA spent $295 million on nutrition education in the fiscal year 1994.[25] To ensure that the public are receiving maximum benefits from their tax dollars, it is important to objectively assess program effectiveness. The emphasis on program evaluation has been expected to increase in the future as efforts toward providing more effective nutrition education are being with constrained budgets. USDA has recently increased its emphasis on quantitative/impact evaluations of the programs it funds.[25]

In order to sustain the credibility of the study, stringent selection criteria was applied to the subject sample that would eventually accrue the benefits by virtue of having practiced

optimum nutritional behaviors and food-related practices. A high benefit to cost ratio was also obtained based on a significant proportion of the Virginia EFNEP graduates having practiced the optimum behaviors as a result of the program. Though there is a possibility that influences outside of EFNEP contributed to the behavior changes, this possibility was minimized by excluding those participants who already practiced the selected behaviors and practices at entry. This implies that the positive dietary and food-related behaviors practiced by EFNEP participants was a result of EFNEP only. The achievement of stringent criteria by the graduates also indicates that the Virginia EFNEP was successful in achieving its program objectives. In a climate of scarce health care resources, the results of this study indicate that allocation of federal funds to the Virginia EFNEP is justified. If the other state EFNEPs can also show a positive benefit to cost ratio as seen in the Virginia EFNEP the nationwide appropriation represents a very good investment. EFNEP primarily targets limited-income, low-literacy families. Economic benefits from avoidance of disease, due to adoption of proper dietary habits and food handling skills, can be a good incentive to these families to enroll in the program as well as to encourage legislators to maintain or increase funding for the program.

Sensitivity Analysis. The usefulness and full interpretation of CBA results depends largely on the presentation of the uncertainties in the analysis. Program evaluations that directly address uncertainties and report a range of estimates through sensitivity analyses are most useful, because they provide comprehensive information for further analysis and interpretation by the decision-maker. Sensitivity analyses test the robustness of conclusions based on variations in underlying assumptions and estimates. Such analysis is of paramount importance because of the universal need for investigators to use assumptions and estimates for unknown variables. The use of sensitivity analysis can show that conclusions are valid despite a wide range of uncertainty regarding an important variable. It can identify those costs and benefits that are most likely to change the dollar value and the interpretation of the benefit to cost ratio or the net present value (NPV) calculation of a CBA. Conversely, it can also demonstrate when an assumption does not substantially affect study conclusions.[16]

A variable that could have affected the results of this study is the incidence rate of diseases in the low-income population. The incidence rates of six of the 10 diseases/conditions were not reflective of the low-income population. Incidence rates for heart disease, hypertension, and Type 2 diabetes in the low-income population were used in the initial calculation of benefits. Due to lack of sufficient information on incidence rates of the remaining diseases and health conditions in the low-income population, incidence rates in the general population where used. Thus, a sensitivity analysis was performed to adjust the general population incidence rates to be more reflective of the low-income population.[18] The approach taken to do this was to calculate the average difference in the incidence rates between the general population and the low-income population for heart disease, hypertension, and Type 2 diabetes and then adjust the incidence rates for all other diseases/conditions by the average difference to be more reflective of low-income populations. The results revealed a higher benefit to cost ratio of $**17.19**/$**1.00** for the Virginia EFNEP.[18]

Studies undertaken in developed countries show that socioeconomic status has an

influence on all causes of morbidity and mortality, in particular mortality from certain cancers, coronary heart disease and stroke, respiratory diseases, and digestive diseases.[94] In most chronic diseases, although not all, higher disease rates are seen in those of lower socioeconomic status. This supports the assumption that, had only incidence rates of chronic diseases in the low-income population been used, the benefit to cost ratio for the Virginia EFNEP would have been higher. On similar lines, there is insufficient information on incidence rates of chronic diseases attributable to diet. In this study, for obesity, the proportion of deaths due to physical inactivity and poor diet was used, as there is no specific value for the extent to which it is caused by diet. It is known that a large proportion of obesity is diet-related, and had specific figures been available, the results for the benefits accruing from avoidance of obesity would have been higher.

Another variable that plays an important role in cost-benefit analysis is the choice of the discount rate. A discount rate is used in calculating costs and benefits to reflect the fact that the value of the future benefits (costs) is worth less than a similar quantity of benefits (costs) today. If the time stream of costs and benefits are very different, the choice of the discount rate plays a critical role in affecting the size of the benefits and costs. A consequence of the use of a high discount rate is that it will lower the value placed on benefits (or costs) that will accrue far into the future. Although it is common for evaluations in healthcare to use a 3-5% discount rate, there remains some uncertainty about the appropriateness of these rates. In the current study, sensitivity analysis using a discount rate of 10% resulted in a benefit to cost ratio of $**2.43**/$**1.00**. However, it should be noted that a 10% discount rate is considered high and is unlikely to be used in the CBA of any social program.[14] It is notable that the use of a high discount rate still resulted in a positive benefit to cost ratio for the Virginia EFNEP.

Sensitivity analysis for the long-term retention of changed dietary behaviors among 1996 Virginia EFNEP graduates was conducted in a parallel analysis by Lewis[18] and has been discussed in detail elsewhere.[14,18] In that analysis, a positive benefit to cost ratio of $**4.71**/$**1.00** was obtained when it was assumed that only 50% of the 1996 EFNEP graduates would retain the

optimal nutritional behaviors over their lifetime. Similarly, sensitivity analysis was also conducted using the assumption that only 25% of graduates would retain the behaviors and this resulted in a lower, but still positive, benefit to cost ratio of $2.45/$1,00. Considering the fact that the benefit cost ratio was calculated only on the subset of participants, who practiced the optimal nutritional behaviors as specified by the study, these results are very gratifying. It supports the assumption that if such benefit accrues to a participant who practices the stringent criteria as prescribed by the optimal nutritional behaviors, there would be some benefit to even those participants who practice positive nutritional behaviors, even though these behaviors may not be at the optimal level.

When conducting any CBA study, that relates nutrition education to the value of future health benefits, there must be some basis for assuming that participants will retain their positive nutritional behaviors over their lifetime.[95] This is due to the fact that, in any health or nutrition education program, the ultimate effect of the improved behavior and lifestyle practices on the incidence and/or severity of disease and or health conditions takes many years to materialize. In fact, morbidity and mortality changes may take at least 10 years to be measurable.[96]

In any health-related cost benefit analysis study, outcome results collected at the conclusion of an intervention are essential in conducting cost-benefit and cost-effectiveness analyses, but it is premature to expect similar evaluation of long-term health outcomes for health-promotion programs due to the time needed for complete results.[9] Most diet-related problems develop gradually and do not present immediate or dramatic symptoms. In turn, risk factor reduction and disease prevention through nutrition education requires long-term changes in habitual food intake. Furthermore, some dietary changes, such as weight loss, provide obvious physical feedback, but others do not, such as the effect of increased fiber intake on serum cholesterol.

Sustained behavioral change has been the focus of a number of evaluations in EFNEP.[8,10,28] The most striking results of long-term retention of improved dietary practices was

seen in the Michigan EFNEP, where significantly higher behavior and practice scores were reported in a five-year follow-up than at enrollment or at graduation from a nine-month EFNEP program.[10] In Maryland, a 75% retention of improved dietary habits was observed in homemakers more than 18 months after graduation from EFNEP.[8] The transient nature of the low-income population, as well as the difficulty in measuring habits and attitudes that take time to change, have limited the number of such evaluations in the EFNEP population.[19] In a study in New York, adult EFNEP participants were assessed for retention of positive dietary practices and food-related behaviors at 9 to 16 months after graduation from EFNEP.[28] Significant increases in nutrition knowledge and practices existed after graduation from the program, with additional improvements at follow-up. The participants also attributed personal and social improvements to EFNEP participation at follow-up, including help in their jobs, community participation and, improved family and personal health.

Among non-EFNEP nutrition intervention studies, the North Karelia Project in the 1970s, to decrease serum cholesterol and blood pressure in males in Finland, has recorded long-term retention of positive behavior. At a 10-year follow-up, the significant reductions in serum cholesterol and blood pressure still held, and the decline in cardiovascular disease mortality was significantly greater than national trends.[97] In the Women's Health Trial Vanguard Study, a 2-year trial directed at women with a high risk of breast cancer, women aged 45-59 were randomly assigned to a low-fat dietary group or a usual diet control group.[98] Results showed that the women were highly motivated and, within 6 months, achieved a reduction of fat intake from 39% to about 21% calories as fat and were still consuming 22.6% of calories as fat at 24 months post-intervention.

The Minnesota Heart Health Program (MHHP), initiated in the 1980s, was a 10-year research and demonstration project to reduce cardiovascular risk factors and associated behaviors to subsequently reduce CVD mortality and morbidity. Follow-up results indicated a modest but steady decline in serum cholesterol and a similar result for other risk factors.[96] However, results

on dietary intake have not been reported. The Heart-To-Heart project that operated in Florence, South Carolina, from 1986 through 1990, was a 5-year demonstration project funded by the center for Disease Control and Prevention (CDC). The outcome evaluation suggested that the Heart-To-Heart Project had a slightly favorable intervention effect associated with change in the prevalence of high cholesterol levels and of smoking in some sub-groups. The comparison community also experienced favorable changes in certain risk factor prevalence in the cohort.

Other factors affecting the study. Further examination of the analyses revealed that the disease osteoporosis accounted for the majority (89%) of the tangible benefits from EFNEP. This resulted primarily because, the incidence rate relating osteoporosis to diet was not available and only the incidence rate of the disease in the population was used in the calculation. Given this, the tangible benefits from osteoporosis calculated for this study may have been over-stated. Research has suggested an important role for calcium in preventing the onset of osteoporosis.[55] Therefore, it may be reasonable to assume that the potential over-estimates of benefits from the lack of available data on the incidence rates of osteoporosis related to diet may be offset by the effectiveness of known treatments through nutrition education programs such as EFNEP.[14] However, if the incidence rate of osteoporosis attributable to diet was known, it would have resulted in decreasing the value of the direct benefit and lowered the benefit-cost ratio.

Results of the current study could have been greatly enhanced if the Food Behavior Checklist and the dietary record had captured more impacts of the program. For instance, information on the duration and extent of physical activity of the participant could greatly contribute to the practices to avoid heart disease or obesity. Similarly, perinatal information on pre-pregnancy and pregnancy weight gain of the mother, birthweight of the neonate and duration of breastfeeding could support the criteria of selection of graduates who accrue the benefits of avoidance of disease.

One of the problems the investigators had while conducting this CBA was in applying the

data stored in the ERS to a statistical format. It had been decided that only existing records would be used and, while both pre- and post-intervention data were available, applying it to a statistical format was difficult due to the complexity of the ERS coding system. However, the availability of both pre- and post-intervention data allowed the investigators to select only those graduates who satisfied the stringent selection criteria at graduation but not at entry into the program. This supported the assumption that the changes made and practiced by the EFNEP graduates was a result of the program only. The data recorded for the Virginia EFNEP and needed for most parts of the analysis were stored efficiently in files that allowed easy access. However, it was noted that there were some problems in the data for some EFNEP units had a problem in that multiple entries existed for the same graduates for pre- or post-intervention information, or information on previous graduates existed in the same file. This made it difficult to rely entirely on the computer manipulation of data, and, hence, manual checking was required that could have been avoided had the data been properly stored.

As mentioned earlier, the study results would have been enhanced, if the instruments used to record data in EFNEP, namely the Food Practice Checklist, had captured the intangible impacts of the program. One of the main reasons that CBA has not been commonly applied to nutrition education programs is because of the difficulty in monetizing the intangible benefits or costs. Assigning a monetary value to health outcomes, especially the value of a human life is a difficult and a controversial task.[16] The value of averting pain and suffering, a part of the intangible costs, presents a similar problem. If the instruments used in EFNEP to capture the changes in dietary behaviors and food-related practices were also designed, such that they captured fully the program impact in terms of the intangible costs and benefits, the results of this cost-benefit analysis would have been more complete. This would involve recording more data in the food behavior checklist about intangible benefits such as improved quality of life, self-esteem, increased stamina, etc., accrued as a result of participation in EFNEP. Our study found that, if the intangible impacts had been recorded in the ERS, or if it had been possible to interact with the sample population to collect the data during the time frame of the CBA, the value of the

intangible impacts could have enhanced the benefit side of the CBA ratio.