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Evaluation of the Cost and Effectiveness of Direct Nutrition Education to Low-Income Audiences in Iowa: EFNEP and SNAP-Ed graduates practicing Optimal Nutritional Behaviors (ONB)

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Abstract

The Expanded Food and Nutrition Education Program (EFNEP) and the Family Nutrition Program (FNP) (the Supplemental Nutrition Assistance Program-Education, or SNAP-Ed in Iowa) are community outreach programs in Iowa designed to help teens and adults who have limited income and are parenting acquire the knowledge, skills, attitudes, and practices to improve total family diet and nutritional well-being. This study uses current information on Iowa's EFNEP and FNP today to evaluate the costs and benefits of the two related programs and provides updated information to a study conducted in Iowa from 1998 to 2000.

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Executive Summary

The Expanded Food and Nutrition Education Program (EFNEP) and the Family Nutrition Program (FNP) (the Supplemental Nutrition Assistance Program-Education, or SNAP-Ed in Iowa) are community outreach programs in Iowa designed to help teens and adults who have limited income and are parenting acquire the knowledge, skills, attitudes, and practices to improve total family diet and nutritional well-being. This study uses current information on Iowa's EFNEP and FNP today to evaluate the costs and benefits of the two related programs and provides updated information to a study conducted in Iowa from 1998 to 2000.

In 2001, Iowa State University (ISU) Extension conducted the first study to estimate the costs and benefits of Iowa EFNEP and to measure the net economic impact of the program. At that time, EFNEP was offered in seven Iowa counties to eligible participants. The results of the 2001 cost-benefit analysis showed that the benefits of the program outweighed the costs and large economic savings exist because of the EFNEP program. Since 2000, there have been changes in the structure of Iowa's EFNEP and FNP programs, as well as the delivery and population served. Today EFNEP and FNP work as sister programs under the same name: *Buy. Eat. Live Healthy.* The programs, delivered through ISU Extension and Outreach, operate out of 14 county offices. In 2015, the programs had over 1600 participants and just under 1000 graduates (n=947) during the year. The number of graduates in 2015 were about half the number graduating in 2000 (n=1881).

Today, under *Buy. Eat. Live Healthy.*, program staff meet with participants one-on-one and in small groups and provide lessons designed to teach the main messages of the Dietary Guidelines for Americans and MyPlate on healthy food choices, food preparation, and keeping food safe. This study provides an analysis of program participant outcomes and costs based on updated data collected from the Iowa EFNEP and FNP program. The methods and approach from the previous study were updated to incorporate current dietary guidance and recommendations, specifically the 2015 Dietary Guidelines for Americans (DGA), current dietary references (Dietary Reference Intakes or DRIs) and current health science, as well as data on the nutrient intake from reported food intakes. The new data and approach allow us to conduct an economic assessment of the resources used (costs) and benefits of the EFNEP and FNP programs in Iowa today. Program costs include direct program costs from direct funding and in-kind contributions from participating counties, and indirect costs incurred by ISU for outreach projects. Program benefits are measured as the value of health benefits achieved through changes in nutrition behaviors during the program and observed for graduates as the difference in reported behaviors between entry and exit of the program. Data on changes in behavior come from two assessment instruments—a food behavior checklist and a 24-hour dietary recall—with data collected through the program's Evaluation/Reporting System.

The updated estimates of the costs and monetized benefits of Iowa's EFNEP and FNP (SNAP-Ed) programs provide a benefit-to-cost ratio of \$2.48/\$1.00 for the programs—a result that indicates the economic value of the EFNEP and FNP programs outweigh their costs and provide long-term health benefits that exceed costs. Less restrictive measures of benefits lead to different benefit-to-cost ratios (\$1.51/\$1.00 - \$2.48/\$1.00 with updated criteria) although in all cases, the values are greater than 1:1 indicating benefits are greater than costs. The measure similar to that used in the previous Iowa study (2001), but based on current data, provides a benefit-to-cost ratio of \$5.44/\$1.00. This larger ratio value reflects the greater ability to meet the criteria when the nutrient (DRI) information is not included.

Although the relative value of the benefits is lower than estimated in 2001, the differences can be attributed to several factors. First, the updated criteria apply current dietary recommendations and guidance in the optimal nutritional practices to reduce risk of specific diseases. The result of applying the additional nutrient criteria leads to the difference between a ratio of \$5.44/\$1.00 and the estimate of \$2.48/\$1.00. Second, other underlying changes have occurred in terms of benefits. Improved health care and medical advances have reduced the risk of disease and increased the onset age of some diseases, which, to some extent, has reduced the benefits of dietary changes today. Third, with fewer program graduates today than 15 years ago (947 versus 1881), cost per graduate of delivering the program has increased and contributed to the lower benefit-to-cost ratio. Even considering the sensitivity of results to some of the underlying assumptions, the results of positive benefits are relatively robust (\$1.51/\$1.00–\$2.48/\$1.00 with the updated criteria) The updated criteria align the estimated benefits of the program with current scientific evidence and show the value of program to health in terms of resources used in program delivery.

Evaluation of the Cost and Effectiveness of Direct Nutrition Education to Low-Income Audiences in Iowa: EFNEP and SNAP-Ed graduates practicing Optimal Nutritional Behaviors (ONB)

The Expanded Food and Nutrition Education Program (EFNEP) and the Family Nutrition Program (FNP) (the Supplemental Nutrition Assistance Program Education, or SNAP-Ed in Iowa) are community outreach programs in Iowa designed to help teens and adults with limited income who are pregnant or parenting acquire the knowledge, skills, attitudes, and practices to improve total family diet and nutritional well-being. The programs have the same public name in Iowa, *Buy. Eat. Live Healthy*. In the United States, the two programs combined represent the largest federally funded nutrition education program operating today (NIFA/USDA 2015) (See <https://nifa.usda.gov/program/expanded-food-and-nutrition-education-program-efnep>). In recent years there have been approximately 1500–2000 limited-resource families in Iowa enrolled annually in either EFNEP or FNP (ISU Extension and Outreach Program Records 2014–2016).

In 2000, ISU Extension conducted a study to estimate the costs and benefits of Iowa EFNEP to measure the net economic impact of the program from September 1998 to February 2000 for the seven Iowa counties offering the program to eligible participants (Wessman, Betterly, and Jensen 2001). The results of this cost-benefit analysis showed that the benefits of the program outweighed the costs (\$10.75/\$1.00). Corresponding sensitivity analyses found results in the range of \$2.64/\$1.00 to \$12.50/\$1.00. The results indicated that large economic savings exist because of the EFNEP program. A previous study in Virginia found similar results (Rajgopal et al. 2002).

Since 2000, there have been changes in the structure of Iowa's EFNEP and FNP programs, as well as the delivery and population served. Today in Iowa, EFNEP and FNP (funded by SNAP-Education) work as sister programs delivered through ISU Extension and Outreach in 14 counties. To the consumer, the programs appear identical, both using the name *Buy. Eat. Live*

Healthy. In 2015, the programs had just under 1000 graduates (947), about half the number graduating in 2000 (1881)¹.

Program staff meet with participants one-on-one and in small groups and provide lessons designed to teach the main messages of the Dietary Guidelines for Americans and MyPlate on healthy food choices, food preparation, and keeping food safe. Other lessons focus on meal planning, budgeting, having a healthy pregnancy, increasing physical activity, and feeding children.

This study uses information on the two related programs' costs and benefits to obtain an updated estimate of the costs and benefits of Iowa's EFNEP and FNP. Data on costs were collected and assembled from available program reports, cost reports, and program offices. Data on benefits were developed based on program data on program participants' reported diets and food-related behaviors. Also, the methods and approach from the previous study were updated to incorporate current dietary guidance and recommendations, specifically the 2015 Dietary Guidelines for Americans (DGA), current dietary references (Dietary Reference Intakes or DRIs) and health science. The new data and approach allow us to conduct an economic assessment of the resources used (costs) and benefits of the EFNEP and FNP programs in Iowa today.

Study Approach

Economic evaluations of nutrition interventions and programs allow consideration of the effectiveness of the intervention relative to the resources used in delivering the benefits. Cost analysis yields information on the resources used in achieving results in a specific program. Other measures, including cost effectiveness analysis or cost-benefit analysis, provide measures that compare the effectiveness of programs relative to the resources used in program delivery (Dollahite, Kenkel, and Thompson 2008).

The previous Iowa EFNEP study from Wessman, Betterly, and Jensen (2001) used data from Iowa's EFNEP program and followed the methodology of an earlier economic evaluation of EFNEP done in Virginia (Rajgopal et al. 2002, based on a 1999 report). Both studies measured benefits as the savings achieved from avoidance of future health care costs and the loss of future

¹ Although program data report the number of graduates in 2015 as 935, 12 additional program graduates were included based on their recorded participation dates for entry and exit.

productivity due to diet-related health problems. The Iowa study based evaluation of program effects on the percentages of graduates who were practicing optimal nutritional behaviors related to a particular disease/condition and found that EFNEP benefits outweighed the program costs by a relatively large amount (\$10.75/\$1.00) (sensitivity \$2.64/\$1.00 to \$12.50/\$1.00). These results were similar to those found by the earlier study in Virginia. Since the time of these two studies, other states have conducted similar studies (Burney and Houghton 2002; Dollahite, Kenkel, and Thompson 2008) and Baral et al. (2012) have developed estimates across states. Dollahite, Kenkel, and Thompson's (2008) study conducted in New York State evaluated the costs, cost-effectiveness, and monetized health benefits of the New York program using both measures that account more broadly on societal benefits and costs (e.g., using Quality Adjusted Life Years, or QALYs to value benefits), and also using a narrower (governmental) method of valuing the benefits and costs similar to that used in the previous Virginia and Iowa-based studies. They found that the societal willingness to pay benefit-to-cost ratio was \$9.58/\$1.00 using societal values, regardless of who pays for them; and a benefit-to-cost ratio of \$0.82/\$1.00 when the benefits were measured using the narrower definition of benefits valued in terms of the costs avoided in future health costs. This latter approach is the one followed in the current study.

This study provides an analysis of program participant outcomes and costs based on updated data collected from the Iowa EFNEP and FNP program. Program benefits are measured as changes in nutrition behaviors during the program, observed for graduates as the difference in reported behaviors between entry and exit from the program. The focus on the change in behaviors after participating in EFNEP and FNP is designed to measure associated program benefits. In consideration of the sensitivity of results to the measures used, and in order to compare the results to those of the previous Iowa study, we conducted additional analysis of the benefits (and benefit-to-cost ratios) using different measures of outcomes.

Program Costs: Costs of EFNEP and FNP

EFNEP and SNAP-Ed (called FNP in Iowa) are federally funded programs through the USDA. EFNEP and SNAP-Ed funds are used to support direct nutrition education in Iowa under one umbrella program called *Buy. Eat. Live Healthy*. Though the program delivery is the same between the two funding streams, the financial administration is different. The direct program costs consist of direct funding and in-kind contributions from participating counties. Costs

include salary and benefits, county costs such as rent and utilities, supplies needed to run the program, travel for employees, and subcontracts that cover costs like the employment portion of salary and benefits and supplies supplemented by ISU Extension. The costs are summarized in Table 1. The detailed components of the costs are included as follows.

County Costs

The daily operations of the EFNEP and FNP programs are run out of county offices. To determine the cost that these counties contribute, ISU Extension staff asked each county to estimate the proportion of their office that is used for EFNEP or FNP purposes. The cost of rent, supplies, and utilities over the 12-month analysis period (October 1, 2014–September 30, 2015) was then multiplied by this percentage. Other costs on the county level included items such as food used for the program, equipment, and data entry support. Some counties own their offices and therefore do not pay a monthly rent. We asked these counties to calculate what they might pay in rent over 12 months based on price-per-square-foot estimates in their respective communities. All costs were assigned to the 947 graduates.

Table 1. Summary of EFNEP and FNP Costs in Iowa, 2015

Category	Cost-EFNEP	Cost-FNP	Total Cost
County Level Costs	\$34,717	\$19,392	\$54,109
Salary & Benefits	\$837,721	\$302,602	\$1,140,323
Supplies	\$69,213	\$35,568	\$104,781
Travel	\$49,215	\$27,118	\$76,333
Subcontracts	Included in Supplies	\$183,441	\$183,441
Indirects		\$36,932	\$36,932
Subtotals	\$990,866	\$605,052	\$1,595,919
Total Cost			\$1,595,919
Cost per graduate (n=947)^a			\$1,685.24

Source: Administrative costs assembled from EFNEP and FNP Extension and Outreach records, and reported county information.

^a On average, about 55% of participants graduate. During the 2015 study period, 1,692 individuals participated in EFNEP and FNP. 947 completed 8 lessons and pre- and post-evaluation instruments and were therefore considered a graduate. Cost per participant is \$943.21.

Salaries & Benefits

Some employees work solely on EFNEP or FNP projects, while some divide their time between EFNEP or FNP and other assignments. When the allocation of time included other assignments, the reporting units recorded employee hours spent working on EFNEP or FNP (versus other assignments) to accurately reflect how much employee time was spent working on the EFNEP and FNP programs. The salary and benefits costs for training and regular operation of the programs are included. These costs were calculated for each county and summed to find the salary and benefit costs for the state program.

Supplies

There are a variety of different supplies categories, but some of the greatest costs come from printing/duplicating/copying, office supplies, training costs, and other services, among others. EFNEP and FNP differ in how they record certain costs, including salary and payment to counties for a portion of costs of temporary workers. The EFNEP program reports these costs as “other services,” which are included here as supplies. FNP uses a separate category called “subcontracts” for these costs, as reported below.

Travel

Travel costs include mileage reimbursements for personal cars, meals, public transportation, and hotels. This travel could either be for local costs of facilitating the program, or for travel needed for training.

Subcontracts

Subcontracts are included in supplies for EFNEP, but with FNP, the category “subcontracts” is used to cover costs like employment portion of salary and benefits and supply costs supplemented by ISU Extension and Outreach.

Indirect Costs

Indirect costs, otherwise known as Facilities and Administrative costs, are costs incurred by ISU for outreach projects. Examples of this category include IT support, accounting, and salaries of administrators that cannot be charged directly to the account. The indirect rate is applied to the FNP program at a rate of 8%.

The detailed costs and total costs assigned to EFNEP and FNP are shown in Table 1. Salary and benefits represents the largest share of costs. Total costs from the two programs combined are estimated to be \$1,595,919. With 947 participants graduating in the two programs, the cost per graduate for the 2015 fiscal year was \$1,685.² Graduates are those participants who complete eight lessons and pre and post evaluation instruments. In total, 1,692 people participated during this period.

Program Outcomes

EFNEP uses an Evaluation/Reporting System that collects data on standardized questions to assess the behavior changes in participants in the program. Data collection is standardized at the state level, and follows the national questionnaire design. The two assessment instruments that are used are a food behavior checklist and a 24-hour dietary recall.

The Food Practice Checklist (FPC) is administered both at entry and exit and measures a variety of nutrition, food safety, and resource management practices. This tool helps determine the effectiveness that EFNEP and FNP have had in changing the behavior of the participants during the time that they were involved in the program. The 24-hour food recall is a widely used dietary data collection method used to measure actual food intake. Data from dietary intakes can be used to assess the quality of diets and provide information designed to encourage participants to improve their dietary intake.

The criteria on food- and nutrition-related behaviors were assessed at both entry to and exit from the program. Improvement in outcomes was measured based on the difference between meeting specific criterion at entrance and exit. Failing to meet a criterion at entry, but success at meeting the criterion at exit is determined a successful program outcome in achieving the measure of optimal nutritional behavior. The key assumption in this study is that graduates who have shown improvements in their dietary and nutritional behavior while involved in the program will continue to practice such behavior in the future. There is some program evidence to support this assumption (Koszewski et al. 2011).

² Although there were additional participants in the programs during 2015, some dropped out and did not complete the education program. Others continued and graduated in the next year. The assignment of costs to the 2015 graduates assumes that these costs were incurred to achieve the total number of graduates in the 2015 year.

Criteria for Optimal Nutritional Behaviors (ONB)

The determination of whether a graduate was practicing Optimal Nutritional Behaviors (ONB) was based on specific entry and exit FPC and 24-hour food recall responses. The ONB criteria are listed in Table 2 (see Appendix A-2 for the 2001 ONB).

Participants answered 10 FPC questions that measured specific food consumption and handling behaviors on a scale of 1–5, where 1 = “never do,” 2 = “seldom,” 3 = “sometimes,” 4 = “most of the time,” and 5 = “almost always” indicate how often the participant performs the action. Among the questions were five used in estimating success in meeting optimal nutrition behaviors:

- Q5: This question is about meat and dairy foods. How often do you let these foods sit out for more than two hours?
- Q6: How often do you thaw frozen foods at room temperature?
- Q7: When deciding what to feed your family, how often do you think about healthy food choices?
- Q8: How often have you prepared foods without adding salt?
- Q9: How often do you use the “Nutrition Facts” on the food label to make food choices?

To be considered as practicing ONB, the person had to have a FPC score of either 4 or 5 on questions 7, 8, and 9, and a score of either 1 or 2 on questions 5 and 6. The components are summarized in Table 2 (also see Appendix A-2 for the Iowa 2001 study).

Participants also recorded the 24-hour food recalls at entry and exit indicating the number of daily servings of all foods they had eaten. From the 24-hour food recall records, food and nutrient intakes were compared to the 2015 Dietary Guidelines for Americans (DGA2015) and recommended dietary allowances (RDA).

We followed existing studies of Virginia and Iowa (2001) EFNEP to score FPC and updated 24-hour food recall criteria based on the 2015 DGA and the current RDA.³ The exact questions used to report food recall are similar in the two state studies (see Appendix A-1 and A-2).

³ The Virginia study used information from a 24-hour food recall for the nutrient and food group intakes. Food recall questions required the graduates to state their daily consumption of foods and from different food groups. The reported dietary data were assessed on computed nutrient intakes and number of servings of foods in a certain food group over the 24-hour period. For the Iowa study, conducted in 2000, only reported food group data were available; the nutrient intake data were not.

Table 2. Updated Criteria for Iowa EFNEP Analysis, 2015^a

	FPC questions (#)	FPC Score	Updated ONB criteria	
			Normal Graduates (2000 kcal)	Pregnant or nursing Graduates (2600 kcal)
Colon Cancer	7 & 9	≥ 4	total fat ≤ 78gms, saturated fat ≤ 22gms fiber ≥ 25gms, fv ≥ 4.5cup-eq	total fat ≤ 101, saturated fat ≤ 29gms fiber ≥ 28gms, fv ≥ 5cup-eq
Heart Diseases	8 & 9	≥ 4	total fat ≤ 78gms, saturated fat ≤ 22gms fiber ≥ 25gms, fv ≥ 4.5cup-eq	total fat ≤ 101, saturated fat ≤ 29gms fiber ≥ 28gms, fv ≥ 5cup-eq
Stroke / hypertension	8 & 9	≥ 4	Fv ≥ 4.5 cup-eq, Ca ≥ 1000mg	Fv ≥ 5 cup-eq, Ca ≥ 1000mg
Osteoporosis	7	≥ 4	Ca ≥ 1,000 mg , Dairy ≥ 3 cup-eq	Ca ≥ 1,000 mg , Dairy ≥ 3 cup-eq
Diabetes	7 & 9	≥ 4	fiber ≥ 25gms, kcal ≤ 2300 kcal carbohydrate ≤ 325gms	fiber ≥ 28gms, kcal ≤ 2600 kcal for pregnant women kcal ≤ 2500 kcal for nursing women carbohydrate ≥ 423gms
Obesity	7 & 9	≥ 4	fiber ≥ 25gms, fv ≥ 4.5cup-eq total fat ≤ 78gms, saturated fat ≤ 22 gms kcal ≤ 2300 kcal	fiber ≥ 28gms, fv ≥ 5cup-eq total fat ≤ 101, saturated fat ≤ 29gms kcal ≤ 2600 kcal for pregnant women kcal ≤ 2500 kcal for nursing women
Foodborne Illness	5 & 6	≤ 2	-	-
Infant Diseases	7	≥ 4		yes for nursing
low Birthweight	9	≥ 4		yes for pregnant kcal ≥ 2200 ^b

^aCriteria based on 2015 DGA. **Total fat** (AMDR) as 20%–35%kcal; **saturated fats** to consume less than 10% of calories per day; **carbohydrate(RDA/AI)** as >130g, 175g for pregnant, 210g for nursing women; **carbohydrate**(AMDR) as 45%–65%kcal; **Fiber** as 25g for women, 28g for pregnant women, 29g for nursing women(RDA/AI) -; **Vegetables** to follow U.S.-Style Eating Pattern at the 2000-calorie level is 2.5 cup-equivalents of vegetables per day; **Fruits** with the recommended amount of fruits in the Healthy U.S.-Style Eating Pattern at the 2000-calorie level is 2 cup-equivalents per day; **Dairy** as 3 cup-equivalents per day for adolescents ages 9 to 18 years and for adults; **Calcium** (RDA): 1000 mg, 1000mg for pregnant or nursing 19<age.

FPC # Q5. This question is about meat and dairy foods. How often do you let these foods sit out for more than two hours?

Q6. How often do you thaw frozen foods at room temperature?

Q7. When deciding what to feed your family, how often do you think about healthy food choices?

Q8. How often have you prepared foods without adding salt?

Q9. How often do you use the “Nutrition Facts” on the food label to make food choices?

^bThe calorie recommendation varies by trimester. The recommendation for the second trimester is 2200 kcal/day (Hark and Catalano 2012).

The updated criteria used to estimate the **ONB (Updated Criteria)** for the current Iowa EFNEP analysis are presented in Table 2 and used to support the assessment of program outcomes. The DGA2015 eating patterns were used to set food group intakes for a 2000-kcal diet, the reference level for graduates who were not pregnant or nursing, and for a 2600 kcal level as reference for the total graduates who were nursing or pregnant.

Several other estimates are used in this study for comparisons. Differences in the criteria are especially apparent in applying the food- and nutrient-based criteria from the 1995 Dietary Guidance (see Appendix A-1). One of the other estimates used the criteria from the original Virginia study (to the extent possible) (ONB with original Virginia criteria). A third set of estimates apply the 2001 Iowa criteria (ONB with 2001 Iowa criteria), which do not include nutrient-based measures, as those data were not available.

We follow the methodology of the previous Iowa and Virginia studies for determining whether a “graduate” was practicing optimal nutritional behavior to avoid or delay the onset of a given disease. The criteria are based on entry and exit dietary recall questions and the Food Practice Checklist (FPC). “Achieving” a practice uses a measure that requires moving from not following the practice at entry to achieving the practice at exit.

Quantifying Program Benefits

The estimation of tangible benefits was measured as the health care costs avoided due to achieving a better diet and food practices. Associated benefits stem from avoiding diet-related diseases. As in the previous Iowa study, the diseases were classified as: (a) life-threatening diseases that can be positively affected by good nutritional habits (e.g., colorectal cancer, heart disease, stroke, or hypertension); (b) non-life-threatening diseases that are positively affected by good nutritional and food-related habits (e.g., osteoporosis, Type 2 diabetes, obesity, infant diseases, and foodborne illness); and (c) diseases that have only a one-time cost (e.g., treatment costs for a low-birthweight baby) (see Wessman et al. 2001).

Data on the benefits from the program outcomes come from estimates of benefits based on: (a) the incidence rate of the disease or condition in a low-income population; (b) the incidence of the disease or condition that is related to diet; and, (c) the percent of the EFNEP and FNP graduates who are practicing optimal nutritional behavior.

The first two of these percentages is based on published and updated scientific evidence, while the last percentage is the percentage recorded as meeting the specific dietary criteria for

each disease or condition. The calculation of the present value of the benefits from avoiding the given disease or condition is estimated by multiplying the estimated savings on disease related costs by the three rates to find the total benefit for each disease.

Program Benefits Estimation

Total Benefit for each Disease = (Annual number of graduates in EFNEP and FNP) x (incidence rate of the disease/condition in the low-income population) x (incidence rate of the disease related to diet) x (percent of graduates achieving ONB conditions for each disease) x (present value of the estimated benefit of avoiding the disease), where the present value is estimated in 2015 dollars.

For **Type A diseases**, the *direct benefit* is the difference between two sums of present values: one, the summation of the present values of medical costs from average age of onset to average age of death; and two, the summation of the present value of the medical costs from the delayed age of onset to the delayed age of death. The direct benefit is:

$$\text{Direct benefit for avoiding Type A disease} = PV_{\text{average age}} - PV_{\text{delayed onset age}}$$

$PV_{\text{average age}}$: (Medical costs per year) x (average number of years between age of onset and age of death), discounted to 2015 dollars, after “setting ahead” to the average age of onset.

$PV_{\text{delayed onset age}}$: (Medical costs per year) x (average number of years between age of onset and age of death), discounted to 2015 dollars, after “setting ahead” to (average age of onset + number of years which the ONB is able to delay onset of the disease), where PV is the present value.

The *indirect benefit* for avoiding a Type A disease is an estimate of the present value of the lost wages due to an early death. The indirect benefit is:

$$\text{Indirect Benefit for avoiding “Type A” Disease} = PV_{\text{average age}} - PV_{\text{delayed onset age}}$$

$PV_{\text{average age}}$: (Morbidity costs per year) x (average number of years between age of onset and age of death), discounted to 2015 dollars, after “setting ahead” to the average age of onset.

$PV_{\text{delayed onset age}}$: (Morbidity costs per year) x (average number of years between age of onset and age of death), discounted to 2015 dollars, after “setting ahead” to (average age of onset + number of years which ONB is able to delay onset of the disease).

For **Type B diseases**, the benefit is based on foregone medical costs of avoiding the disease or condition altogether. Therefore, the direct benefit is the cost of treatment per year discounted to 2015 dollars from the average age of onset to the average age of death.

The *direct benefit* for Type B diseases is:

Direct Benefit for “Type B” Disease = (Medical costs per year) x (average number of years between age of onset and age of death); discounted to 2015 dollars.

The *indirect benefit* for Type B diseases is the amount of lost wages per year (morbidity costs) from average age of onset to average age of death. The indirect benefit is:

Indirect Benefit for “Type B” Disease = (Morbidity costs per year) x (average number of years between age of onset and age of death), discounted to 2015 dollars.

Finally, for **Type C diseases**, the benefit generated is one-time only. Therefore, the current cost of treating the condition is used as the total benefit for Type C. Since these are current health care costs, they are already at 2015 dollars and do not need to be discounted. The benefit is:

Benefit for “Type C” Disease = Medical Cost of treating “Type C” disease or outcomes.

Results

We estimated results of ONB behavior based on the updated criteria that include the optimal food practices and the 2015 DGA and recommended nutrient intakes in order to evaluate the performance of Iowa EFNEP graduates in 2015. The percentages of graduates practicing ONB in 2015 were estimated by using scoring of the FPC questions and the updated ONB criteria, as shown in Table 2. A graduate was assessed as “achieving” an ONB practice related to a specific disease if she or he failed the practice at entry and succeeded in meeting the practice at exit. The difference between the number of graduates practicing ONB in each disease at entry compared to the number practicing at exit was the calculated measure of EFNEP and FNP performance.⁴ The interpretation of differencing of the numbers at entry and at exit is that a graduate had to fail at the entry and pass them at exit in order to be considered achieving ONB through the program. The percentage of ONB graduates achieving the criterion for each disease was estimated by taking this difference (ONB graduates for each disease at entry and exit) and dividing it by the total number of EFNEP and FNP graduates for 2015.

⁴ We follow the conservative method of 2001 Iowa study calculating the percentages of ONB by taking the difference between ONB graduates at entry and at exit.

Table 3 shows the number of recent Iowa EFNEP and FNP graduates meeting the ONB EFNEP and FNP criteria, and includes criteria related to the 24-hour food recalls and food intake. The total number of graduates of Iowa EFNEP and FNP in 2015 was 947. As an example, 1.37% of graduates achieved the ONB criterion related to colorectal cancer $[(14-1)/947 = 1.37\%]$. In comparison, 1.48% of the graduates achieved the ONB for this disease—a less strict measure for the evaluation of program benefit.

For comparison, we also used the same outcomes data but applied the original criteria of the Virginia and Iowa studies and computed the passing rates based on these criteria, as shown in Table 4.

Table 3. Iowa EFNEP Graduates Practicing Optimal Nutrition Behavior (ONB) at Entry and Exit or Graduation Rates with ONB using Updated ONB Criteria by Disease/Outcome

Disease	Entry	Exit	Difference	% of Total Achieving ONB at Graduation	% of Total with ONB at Exit
Colon Cancer	2	45	45	4.75%	4.75%
Heart Diseases	2	21	21	2.22%	2.22%
Stroke	2	44	44	4.65%	4.65%
Hypertension	2	44	44	4.65%	4.65%
Osteoporosis	61	151	139	14.68%	15.95%
Diabetes	13	82	78	8.24%	8.66%
Obesity	5	45	45	4.75%	4.75%
Foodborne Illness	258	683	455	48.05%	72.12%
Infant Diseases	46	55	18	1.90%	5.81%
Low Birthweight	9	22	19	2.01%	2.32%
nursing	69	69			
pregnant	107	105			
Total graduates (N)	947	947			

Source: EFNEP Evaluation Reporting System data.

The percentages in each disease category with the different criteria show similar achievement to the 2015 Iowa EFNEP and FNP when using the ONB updated criteria as when using the updated ONB with the Virginia criteria. However, when the nutrient-based criteria are not included (as was done in the original Iowa study), a larger share of graduates achieved the ONB performance (e.g., 20.6% achieving ONB at graduation related to colorectal cancer). The stricter criteria of meeting the DGA and DRI on nutrient intakes narrow the possible numbers of final ONB graduates achieving the desired outcomes.

The percentages used to value success in achieving ONB in the program (Table 4) were used to compute the direct and indirect benefits for each disease following the methods for quantifying program benefits described above. Summing across all of the diseases yields the total

Table 4. Comparison of Outcome Criteria: Iowa EFNEP and FNP Graduates Achieving Optimal Nutrition Behavior (ONB) at Graduation and with ONB at Exit using Updated Criteria, Original (2001) Criteria and Updated Iowa Criteria with no Nutrient Information, 2015

Disease	EFNEP and FNP Graduates Assessed with Updated Criteria ^a		EFNEP and FNP Graduates Assessed with Original Virginia/DGA Criteria ^b		EFNEP and FNP Graduates Assessed with Original (Iowa 2001) Criteria with no Nutrient Information ^c	
	% of Total Achieving ONB at Graduation	% of Total with ONB at Exit	% of Total Achieving ONB at Graduation	% of Total with ONB at Exit	% of Total Achieving ONB at Graduation	% of Total with ONB at Exit
Colon cancer	4.75%	4.75%	4.54%	4.54%	37.06%	43.40%
Heart diseases	2.22%	2.22%	1.80%	1.80%	22.81%	23.02%
Stroke	4.65%	4.65%	5.17%	5.17%	19.32%	19.43%
Hypertension	4.65%	4.65%	5.17%	5.17%	19.32%	19.43%
Osteoporosis	14.68%	15.95%	27.56%	35.27%	42.56%	72.12%
Diabetes	8.24%	8.66%	8.98%	8.13%	42.03%	43.40%
Obesity	4.75%	4.75%	4.33%	4.33%	42.77%	43.40%
Foodborne Illness	48.05%	72.12%	51.00%	77.61%	51.00%	77.61%
Infant Diseases	1.90%	5.81%	1.90%	5.81%	1.90%	5.81%
Low Birthweight	2.01%	2.32%	1.69%	1.90%	4.33%	5.07%
nursing	69	69				
pregnant	107	105				
Total Graduates (N)	947	947				

^a ONB measured with updated criteria based on 2015 DGA. Nutrient information is included.

^b ONB measured with original Iowa/Virginia criteria. Nutrient information is included.

^c ONB measured with original Iowa/Virginia criteria. Nutrient information is not included.

direct program benefits, the total indirect program benefits and the overall total program benefits, as shown in Table 5. Detailed information for each disease is provided in Appendix A-9.

As shown in Table 5, using updated criteria, direct and indirect benefits are estimated to be \$3,660,693 and \$301,972, respectively, with total benefits of \$3,962,665 for the program in 2015—benefits of \$4,184 per graduate. Estimated benefits are higher using the older, original Virginia criteria or the Iowa criteria without estimated nutrient intakes included.

Table 5. Economic Evaluation of Iowa EFNEP and FNP Graduates Achieving Optimal Nutrition Behavior (ONB): Benefits and Costs, Adjusted to 2015 dollars, 2015–2016

	Updated Criteria, ONB Achieved at Graduation (2015-16) ^a	Original Virginia ONB at Exit (2015-16) ^b	Updated Criteria, ONB Achieved, No Nutrient Criteria Applied (2015-16) ^c	Virginia 1999 Result ^d	Iowa 2000 Result ^e
Annual number of graduates in EFNEP	947	947	947	3100	1881
Sum of Direct benefits	\$3,660,693.40	\$4,397,747.06	\$7,827,445.28	\$17,880,625.44	\$14,098,754.65
Direct benefits per graduate	\$3,865.57	\$4,643.87	\$8,265.52	\$5,767.94	\$7,495.35
Sum of Indirect Benefits	\$301,972.03	\$343,019.08	\$847,916.98	\$343,354.46	\$255,724.04
Indirect benefits per graduate	\$318.87	\$362.22	\$895.37	\$110.76	\$135.95
Total benefits	\$ 3,962,665.43	\$4,740,766.14	\$8,675,362.26	\$18,223,979.90	\$14,354,478.69
Total benefits per graduate	\$4,184.44	\$ 5,006.09	\$9,160.89	\$5,878.70	\$7,631.30
Costs	\$1,595,918.52	\$1,595,918.52	\$1,595,918.52	\$1,713,081.00	\$ 1,334,847.00
Costs per graduate	\$1,685.24	\$1,685.24	\$1,685.24	\$552.61	\$709.65
Benefit cost ratio	\$2.48	\$2.97	\$5.44	\$10.64	\$10.75

^a ONB measured with updated criteria and as achieved values. Nutrient information is included.

^b ONB measured with Virginia criteria and as exit values. Nutrient information is included.

^c ONB measured with updated criteria and as achieved values. Nutrient information is not included.

^d ONB measured with original, Virginia criteria. Nutrient information is included.

^e ONB measured with original, Iowa criteria. Nutrient information is not included.

Assessment of Benefits and Costs

Table 5 provides the summary of results on both benefits and costs. The program costs are the same in the three cases with the current data. Using the updated criteria for the EFNEP and FNP programs, the estimated benefit-cost ratio is \$2.48/\$1.00. The measure more similar to the previous Iowa study (2001) provides a ratio of benefits to costs of \$5.44/ \$1.00. This larger ratio value reflects the greater ability to meet the criteria when the nutrient (DRI) information is not included.

One other alternative was developed based on a 2200 kcal dietary reference, instead of 2000 kcal. Such a value would be appropriate with slightly greater physical activity than sedentary. This change leads to a benefit-to-cost ratio of \$2.45/\$1.00, little changed from the previous estimate.

In addition to evaluating results with different criteria, the analysis included testing the sensitivity of results for four different assumptions related to the effectiveness of the program benefits. The changes included the programs' being less effective in reducing the incidence of foodborne illness, osteoporosis, Commonly Occurring Infant Diseases, and Low Birthweight for Infants. The results based on the different assumptions of effectiveness lead to different benefit-to-cost ratios when evaluated individually of \$1.74/\$1.00–\$2.48/\$1.00, and a ratio of benefits to costs of \$1.51/\$1.00 for the updated criteria (2000 kcal) when all of the changes occur simultaneously. In all cases, the values are greater than 1:1 indicating benefits are greater than costs.

Discussion and Conclusions

The updated estimates of the costs and monetized benefits of Iowa's EFNEP and FNP (SNAP-Ed) program show a benefit-to-cost ratio of \$2.48/\$1.00—a result that indicates the economic value of the EFNEP and FNP programs outweigh their costs and provide long-term health benefits that exceed costs. Although the relative value of the benefits is lower than that estimated in 2001, the differences can be attributed to several factors. First, the updated criteria apply current dietary recommendations and guidance in the optimal nutritional practices to reduce risk of specific diseases. Also, with currently available nutrient intake data, the additional nutrient criteria were applied. The result of applying the nutrient criteria leads to the difference between a ratio of \$5.44/\$1.00 and the estimate of \$2.48/\$1.00. Other underlying changes have occurred in

terms of benefits as well, including improved health care and medical advances have increased the age of onset of some diseases and reduced the risk of disease, all of which reduce benefits of dietary changes today, to some extent.

Costs of delivering the program to graduates increased. With fewer program graduates today in comparison to 15 years ago (947 versus 1881), costs of delivering the program per graduate have increased and contribute to the lower benefit-to-cost ratio.

The results are sensitive to other factors as well. The discount rate for the benefits was 5%. Selecting a lower discount rate would increase the relative value of benefits obtained in the future (valuing avoiding future disease) and increase the benefit-cost ratio. Alternatively, if the assumption that graduates retained the improved nutritional behaviors was not accurate, benefits would decrease.

Even considering the sensitivity of results to some of the underlying assumptions, the results of positive benefits are relatively robust. The updated criteria align the estimated benefits of the program with current scientific evidence and show the value of program to health in terms of resources used in program delivery.

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Appendix A-1. ONB criteria in Virginia (1999) Study

Table A-1.1. Criteria for Optimal Nutritional Behavior Selection

Disease/condition	FPC Question #	FPC Score	24-hour recall criteria
Colorectal cancer	3 & 8	≥ 4	Fat ≤ 65 gms veg + fruits 5svgs fiber 20 gms
Heart disease	6 & 7 & 8	≥ 4	Fat ≤ 65 gms veg + fruits 5svgs fiber 20 gms
Stroke/hypertension	6 & 7	≥ 4	veg + fruits ≥ 5 svgs Ca ≥ 20 gms
Osteoporosis	3	≥ 4	veg + fruits ≥ 2 svgs Ca ≥ 800 mgs
Diabetes	3 & 8	≥ 4	Fiber ≥ 20 gms Ca $\leq 2,300$ keals ^a Carbohydrate ≤ 250 gms ^b
Obesity	3 & 8	≥ 4	veg + fruits ≥ 5 svgs fiber ≥ 20 gms
Foodborne illness	4 & 5	≤ 2	veg + fruits ≥ 2 svgs Fiber ≥ 20 gms Cal $\leq 2,300$ keals ^c Fat ≤ 65 gms
Infant Diseases	----	----	Yes for nursing
Low birthweight	----	----	Ca $\geq 2,100$ keals

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

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

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

Relevant questions in Food Practice Checklist

- (3) When deciding what to feed your family, how often do you think about *healthy food choices*?
- (4) This question is about *meat and dairy foods*. How often do you let these foods sit out of the refrigerator for more than two hours?
- (5) How often do you *thaw frozen food* by leaving it out on the counter or table (at room temperature)?
- (6) In the past **two weeks**, how often did you prepare or eat foods *without adding salt*?
- (7) In the past **two weeks**, how often did you read food labels to select foods with *less salt or sodium*?
- (8) In the past **two weeks**, how often did you read food labels to select foods with **less fat**?

Appendix A-2. ONB Criteria in Iowa (2001) Study

Table A-2.1. Requirements for Graduates to be Practicing “Optimal Nutritional Behavior” for Each Disease or Condition for Food Practice Checklist and Food Groups Scores^a

Disease/Cond.	FPC Question	FPC Score	Food Group Requirement	Servings Req.
Colorectal Cancer	How often do you think of healthy food choices?	≥ 4	Fruit + Veg	≥ 5
	How often do you use the "Nutrition Fact" label?	≥ 4	Other	≤ 4
Heart disease	How often do you prepare food without salt?	≥ 4	Fruit + Veg	≥ 5
	How often do you use the "Nutrition Fact" label?	≥ 4	Other	≤ 4
Stroke	How often do you prepare food without salt?	≥ 4	Fruit + Veg	≥ 5
	How often do you use the "Nutrition Fact" label?	≥ 4	Dairy	≥ 2
Hypertension	How often do you prepare food without salt?	≥ 4	Fruit + Veg	≥ 5
	How often do you use the "Nutrition Fact" label?	≥ 4	Dairy	≥ 2
Osteoporosis	How often do you think of healthy food choices?	≥ 4	Dairy	≥ 2
Diabetes	How often do you think of healthy food choices?	≥ 4	Fruit + Veg	≥ 5
	How often do you use the "Nutrition Fact" label?	≥ 4		
Obesity	How often do you think of healthy food choices?	≥ 4	Fruit + Veg	≥ 5
	How often do you use the "Nutrition Fact" label?	≥ 4	Other	≤ 4
Foodborne illness	How often do you let food sit out?	≤ 2		
	How often do you thaw frozen foods?	≤ 2		
Commonly occurring infant diseases	How often do you think of healthy food choices? Nursing = True	≥ 4		
Low Birthweight Pregnant = True	How often do you use the "Nutrition Fact" label?	≥ 4		

^a To determine whether a graduate is practicing ONB, the 2001 Iowa study used criteria based on entry and exit food recall questions and the Food Practice Checklist (FPC). The FPC questions measure food consumption behaviors and food handling practices on a scale from 1 to 5, where 1 indicates that the respondent “never performs” the action, and 5 indicates that the respondent “almost always” performs the action. The food recall questions require the graduates to state their daily consumption of foods from different food groups. For a respondent to pass a given requirement and be considered practicing ONB, the graduate had to have a score of either 4 or 5 when a larger score was required, and a score of either 1 or 2 when a lower score was required. Additionally, the graduate had to pass the appropriate requirement for a minimum number of servings of food in a certain food group over the 24-hour period. These requirements follow the method of the Virginia study although the exact questions used are somewhat different.

**Appendix A-3 (2.2) 1999 ONB Graduates in Virginia Study
(total graduates, N=3100)**

Table A-3.1. Percent of Graduates Practicing Optimal Nutritional Behaviors

Disease/ Condition	Percent Practicing Optimal Nutritional Behaviors	Disease/ Condition	Percent Practicing Optimal Nutritional Behaviors
Colorectal cancer	1.9%	Diabetes	1.9%
Heart disease	1.1%	Obesity	1.9%
Stroke	9.4%	Foodborne illness	53.7%
Hypertension	9.4%	Infant Diseases	2.8%
Osteoporosis	28.5%	Low birth weight infants	2.7%

**Appendix A-4 (2.3) 2001 ONB Graduates in Iowa Study
(total graduates, N=1881)**

Table A-4.1. Iowa EFNEP Graduates Practicing Optimal Nutrition Behavior (ONB) at Entry and Exit or Graduation Rates with ONB

Disease	Entry	Exit	Difference	Percent of Total Achieving ONB at Graduation
Colorectal Cancer	17	196	179	9.50%
Heart Disease	9	110	101	5.37%
Stroke/hypertension	6	167	161	8.56%
Osteoporosis	341	962	621	33.01%
Diabetes	30	321	291	15.47%
Obesity	17	196	179	9.52%
Foodborne Illness	633	1401	768	40.83%
Infant Diseases	57	126	69	3.67%
Low birthweight	20	80	60	3.19%

Appendix A-5. Iowa EFNEP and FNP Graduates Practicing Optimal Nutrition Behavior (ONB) at Entry and Exit or Graduation Rates with ONB Using Criteria from Original Virginia Study, 2015

Table A-5.1.

Disease	Graduates with Improvement between Entry and Exit	% of Total Achieving ONB at Graduation	% of Total with ONB at Exit
Colorectal cancer	43	4.54%	4.54%
Heart diseases	17	1.80%	1.80%
Stroke	49	5.17%	5.17%
Hypertension	49	5.17%	5.17%
Osteoporosis	261	27.56%	35.27%
Diabetes	85	8.98%	8.13%
Obesity	41	4.33%	4.33%
Foodborne illness	483	51.00%	77.61%
Infant diseases	18	1.90%	5.81%
Low birthweight	16	1.69%	1.90%

Appendix A-6. Iowa EFNEP and FNP Graduates Practicing Optimal Nutrition Behavior (ONB) at Entry and Exit, and Graduation Rates with ONB Using 2001 Iowa Criteria, 2015

Table A-6.1.

Disease	Graduates with Improvement between Entry and Exit	% of Total Achieving ONB at Graduation	% of Total with ONB at Exit
Colon cancer	351	37.06%	43.40%
Heart diseases	216	22.81%	23.02%
Stroke	183	19.32%	19.43%
Hypertension	183	19.32%	19.43%
Osteoporosis	403	42.56%	72.12%
Diabetes	398	42.03%	43.40%
Obesity	405	42.77%	43.40%
Foodborne illness	483	51.00%	77.61%
Infant diseases	18	1.90%	5.81%
Low birthweight	41	4.33%	5.07%

**Appendix A-7. 2015 Updated Criteria for Iowa EFNEP and FNP Analysis
(with 2200 kcal Standard)**

Table A-7.1.

	FPC questions #	FPC Score	Updated ONB criteria	
			Normal Graduates (2200 kcal)	Pregnant or nursing Graduates (2600 kcal)
Colorectal Cancer	7 & 9	≥ 4	total fat ≤ 86gms, saturated fat ≤ 24gms fiber ≥ 25gms, fv ≥ 5cup-eq	total fat ≤ 101, saturated fat ≤ 29gms fiber ≥ 28gms, fv ≥ 5cup-eq
Heart Disease	8 & 9	≥ 4	total fat ≤ 86gms, saturated fat ≤ 24gms fiber ≥ 25gms, fv ≥ 5cup-eq	total fat ≤ 101, saturated fat ≤ 29gms fiber ≥ 28gms, fv ≥ 5cup-eq
Stroke/hypertension	8 & 9	≥ 4	Fv ≥ 5 cup-eq, Ca ≥ 1000mg	Fv ≥ 5 cup-eq, Ca ≥ 1000mg
Osteoporosis	7	≥ 4	Ca ≥ 1,000 mg , Dairy ≥ 3 cup-eq	Ca ≥ 1,000 mg , Dairy ≥ 3 cup-eq
Diabetes	7 & 9	≥ 4	fiber ≥ 25gms, kcal ≤ 2300 kcal carbohydrate ≤ 358gms	fiber ≥ 28gms, kcal ≤ 2600 kcal for pregnant women kcal ≤ 2500 kcal for nursing women carbohydrate ≤ 423gms
Obesity	7 & 9	≥ 4	fiber ≥ 25gms, fv ≥ 5cup-eq total fat ≤ 86gms, saturated fat ≤ 24 gms kcal ≤ 2300 kcal	fiber ≥ 28gms, fv ≥ 5cup-eq total fat ≤ 101, saturated fat ≤ 29gms kcal ≤ 2600 kcal for pregnant women kcal ≤ 2500 kcal for nursing women
Foodborne Illness	5 & 6	≤ 2	-	-
Infant Diseases	7	≥ 4		yes for nursing
Low Birthweight	9	≥ 4		yes for pregnant kcal ≥ 2200*

FPC # Q5. This question is about meat and dairy foods. How often do you let these foods sit out for more than two hours?

Q6. How often do you thaw frozen foods at room temperature?

Q7. When deciding what to feed your family, how often do you think about healthy food choices?

Q8. How often have you prepared foods without adding salt?

Q9. How often do you use the “Nutrition Facts” on the food label to make food choices?

Appendix A-8. Iowa EFNEP and FNP Graduates Practicing Optimal Nutrition Behavior (ONB) at Entry and Exit, and Graduation Rates with ONB (Updated Criteria with 2200 kcal for Sensitivity Analysis)

Table A-8.1.

Disease	Entry	Exit	Difference	% of Total Achieving ONB at Graduation	% of ONB at Exit
Colorectal cancer	2	38	38	4.01%	4.01%
Heart diseases	2	20	20	2.11%	2.11%
Stroke	1	37	37	3.91%	3.91%
Hypertension	1	37	37	3.91%	3.91%
Osteoporosis	61	151	139	14.68%	15.95%
Diabetes	13	84	80	8.45%	8.87%
Obesity	5	33	33	3.48%	3.48%
Foodborne Illness	258	683	455	48.05%	72.12%
Infant Diseases	46	55	18	1.90%	5.81%
Low Birthweight	9	22	19	2.01%	2.32%
nursing	69	69			
pregnant	107	105			
Total graduates (N)	947	947			

*The number of graduates who passed at entry but fail at exit.

Appendix A-9. Quantifying Direct Tangible Benefits

Table A-9.1.

Colon Cancer	Updated Criteria	ONB (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Annual number of graduates in EFNEP and FNP	947	947	947	3100	1881
prevalence rate of colon cancer in the fem pop	8%	8%	8%	15%	15%
Incidence rate of colon cancer related to diet	80%	80%	80%	35%	35%
Percent of graduates practicing optimal nutritional behaviors related to cancer	4.75%	4.54%	37.06%	1.90%	9.51%
Estimated number of graduates to accrue benefits	2.88	2.75	22.46	3.09	9.39
Present value of benefits related to cancer	\$8,927.07	\$8,927.07	\$8,927.07	\$16,424.75	\$17,137.49
Total direct benefit of delaying cancer	\$25,699.97	24,563.76	200,513.84	\$50,789.43	\$160,944.39

Heart Disease	Updated Criteria	ONB (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Annual Graduates in EFNEP and FNP	947	947	947	3100	1881
Incidence of heart rate in pop.	25.80%	25.80%	25.80%	31.20%	31%
Incidence of heart rate related to diet	50.00%	50.00%	50.00%	26%	26%
% of graduates practicing optimal nutritional behavior related to heart disease	2.22%	1.80%	22.81%	1.10%	5.37%
Estimated number of graduates to accrue benefits	2.71	2.20	27.87	2.77	8.19
Present value of benefits related to heart disease	\$2,981.17	\$2,981.17	\$2,981.17	\$691.76	\$721.85
Total direct benefit of delaying heart disease	\$8,085.00	\$6,555.40	\$83,071.52	\$1,913.54	\$5,914.77

Table A-9.1. Continued

Stroke	Updated criteria	ONB (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Annual number of graduates in EFNEP and FNP	947	947	947	3100	1881
Incidence rate of stroke in the pop.	8.1%	8.1%	8.1%	1.70%	1.70%
Incidence rate of stroke related to diet	49%	49%	49%	-	-
Percent of graduates practicing optimal nutritional behavior related to stroke	4.65%	4.33%	19.32%	9.40%	8.56%
Estimated number of graduates to accrue benefits	3.57	3.32	14.82	4.95	2.74
Present value of benefits related to stroke	\$14,439.32	\$14,439.32	\$14,439.32	\$13,143.81	\$14,139.04
Total direct benefits related to stroke	\$51,503.27	\$47,958.96	\$213,987.77	\$65,111.81	\$38,701.82
Hypertension	Updated criteria	ONB (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Annual number of graduates in EFNEP and FNP	947	947	947	3100	1881
Incidence rate of hypertension in the pop	29.30%	29.30%	29.30%	37.40%	37.40%
Incidence rate of hypertension related to diet	45%	45%	45%	45%	45%
Percent of graduates practicing optimal nutritional behavior related to hypertension	4.65%	4.33%	19.32%	9.40%	8.56%
Estimated number of graduates to accrue benefits	5.81	5.41	24.12	49.04	27.01
Present value of benefits related to hypertension	\$948.23	\$948.23	\$948.23	\$697.87	\$717.97
Total direct benefit of delaying hypertension	\$5,505.47	\$5,126.60	\$22,874.34	\$34,225.37	\$19,455.97

Table A-9.1. Continued

Osteoporosis	Updated criteria	ONB (Virginia)	No Nutrient (Iowa 2000)	Virginia 1999 Result	Iowa 2000 Result
Annual number of graduates in EFNEP and FNP	947	947	947	3100	1881
Incidence rate of osteoporosis in the pop	10.3%	10.3%	10.3%	28%	28%
Incidence rate of osteoporosis related to diet	?			-	
Percent of graduates practicing optimal nutritional behavior related to osteoporosis	14.68%	27.56%	42.56%	28.50%	33.30%
Estimated number of graduates to accrue benefits	14.32	26.88	41.51	247.38	145.36
Present value of benefits related to osteoporosis	\$46,742.24	\$46,742.24	\$46,742.24	\$65,468.86	\$68,308.59
Total direct benefit of avoiding osteoporosis	\$669,303.05	\$1,256,538.96	\$1,940,431.72	\$16,195,686.59	\$11,875,948.56
Diabetes	Updated criteria	ONB (Virginia)	No Nutrient (Iowa 2000)	Virginia 1999 Result	Iowa 2000 Result
Annual number of graduates in EFNEP and FNP	947	947	947	3100	1881
Incidence rate of diabetes in the pop	28%	28%	28%	14.50%	14.50%
Incidence rate of diabetes related to diet	45%	45%	45%	45%	45%
Percent of graduates practicing optimal nutritional behavior related to diabetes	8.24%	8.98%	42.03%	1.90%	15.47%
Estimated number of graduates to accrue benefits	9.80	10.68	49.97	3.84	18.99
Present value of benefits related to diabetes	\$29,566.36	\$29,566.36	\$29,566.36	\$45,898.13	\$47,887.89
Total direct benefit of avoiding diabetes	\$289,662.14	\$315,675.48	\$1,477,487.81	\$176,396.84	\$909,254.22

Table A-9.1. Continued

Obesity	Updated criteria	ONB (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Annual number of graduates in EFNEP and FNP	947	947	947	3100	1881
Incidence rate of obesity in the pop	38%	38%	38%	37%	37%
Incidence rate of obesity related to diet	50%	50%	50%	50%	50%
Percent of graduates practicing optimal nutritional behavior related to obesity	4.75%	4.33%	42.77%	1.90%	9.51%
Estimated number of graduates to accrue benefits	8.55	7.79	76.96	10.90	33.09
Present value of benefits related to obesity	\$16,008.52	\$16,008.52	\$16,008.52	\$11,686.59	\$12,191.45
Total direct benefit of avoiding obesity	\$136,819.61	\$124,721.87	\$1,231,952.56	\$127,342.93	\$403,456.21
Foodborne Illness	Updated criteria	ONB (Virginia)	No Nutrient (Iowa 2000)	Virginia 1999 Result	Iowa 2000 Result
Annual number of graduates in EFNEP and FNP	947	947	947	3100	1881
Incidence rate of foodborne illness in the pop	16.7%	16.7%	16.7%	2.80%	2.8%
Incidence rate of foodborne illness related to diet	100%	100%	100%	100%	100%
Percent of graduates practicing optimal nutritional behavior related to foodborne illness	48.05%	51.00%	51.00%	53.70%	40.83%
Estimated number of graduates to accrue benefits	75.99	80.66	80.66	46.61	21.50
Net present value of benefits related to foodborne illness	\$31,594.88	\$31,594.88	\$31,594.88	\$18,866.83	\$19,689.57
Total direct benefit of avoiding foodborne illness	\$2,400,913.35	\$2,548,315.94	\$2,548,315.94	\$876,413.13	\$423,400.92

Table A-9.1. Continued

Commonly Occurring Infant Diseases (COID)	Updated criteria	ONB (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Annual number of graduates in EFNEP and FNP	947	947	947	3100	1881
Incidence rate of COID in the pop	100%	100%	100%	100%	100%
Incidence rate of (COID) related to diet	?	?	?	-	?
Percent of graduates practicing optimal nutritional behavior related to (COID)	1.90%	1.90%	1.90%	2.80%	3.67%
Estimated number of graduates to accrue benefits	17.99	17.99	17.99	86.80	69.03
Present value of benefits related to (COID)	\$2,353.77	\$2,353.77	\$2,353.77	\$1,537.00	\$1,537.00
Total direct benefit of avoiding (COID)	\$42,351.34	\$42,351.34	\$42,351.34	133,411.60	\$106,103.26
Low Birthweight Infants (LBW)	Updated criteria	ONB (Virginia)	No Nutrient (Iowa 2000)	Virginia 1999 Result	Iowa 2000 Result
Annual number of graduates in EFNEP and FNP	947	947	947	3100	1881
Incidence rate of LBW in the pop	8.0%	8.0%	8.0%	7.30%	7%
Incidence rate of LBW related to diet	100%	100%	100%	100%	100%
Percent of graduates practicing optimal nutritional behavior related to LBW	2.01%	1.69%	4.33%	2.70%	3.20%
Estimated number of graduates to accrue benefits	1.53	1.28	3.29	6.11	4.39
Present value of benefits related to LBW	\$20,208.68	\$20,208.68	\$20,208.68	\$35,406.00	\$35,406.00
Total direct benefit of avoiding LBW	\$ 30,850.22	\$25,938.74	\$ 66,458.44	\$216,334.20	\$155,574.53

Table A-9.1. Continued

	Updated criteria	ONB (Virginia)	No Nutrient (Iowa 2000)	Virginia 1999 Result	Iowa 2000 Result
Sum of Direct benefits	\$3,660,693.40	\$4,397,747.06	\$7,827,445.28	\$17,880,625.44	\$14,098,754.65
Direct benefits per graduate	\$3,865.57	\$4,643.87	\$8,265.52	\$5,767.94	\$7,495.35
Sum of Indirect Benefits	\$301,972.03	\$343,019.08	\$847,916.98	\$343,354.46	\$255,724.04
Indirect benefits per graduate	\$318.87	\$362.22	\$895.37	\$110.76	\$135.95
Total benefits	3,962,665.43	\$4,740,766.14	\$8,675,362.26	\$18,223,979.90	\$14,354,478.69
Total benefits per graduate	\$4,184.44	\$5,006.09	\$9,160.89	\$5,878.70	\$7,631.30
Costs	\$1,595,918.52	\$1,595,918.52	\$1,595,918.52	\$1,713,081.00	\$1,334,847.00
Costs per graduate	\$1,685.24	\$1,685.24	\$1,685.24	\$552.61	\$709.65
Benefit cost ratio	\$2.48	\$2.97	\$5.44	\$10.64	\$10.75

Appendix A-10. Economic Evaluation of Iowa EFNEP and FNP Graduates Achieving Optimal Nutrition Behavior (ONB): Benefits and Costs, 2015 (2015 Dollar Values) Summary

Table A-10.1.

Dollar adjusted to 2015 year value	Updated criteria (2015)	ONB exit (Virginia)	No Nutrient (Iowa 2000)	Virginia 1999 Result	Iowa 2000 Result
Annual number of graduates in EFNEP and FNP	947	947	947	3100	1881
Sum of Direct benefits	\$3,660,693.40	\$4,397,747.06	\$7,827,445.28	\$25,444,130.00	19,399,886.40
Direct benefits per graduate	\$3,865.57	\$4,643.87	\$8,265.52	\$8,207.78	\$10,313.60
Sum of Indirect Benefits	\$301,972.03	\$343,019.08	\$847,916.98	\$488,593.40	\$351,876.28
Indirect benefits per graduate	\$318.87	\$362.22	\$ 895.37	\$157.61	\$187.07
Total benefits	\$3,962,665.43	\$4,740,766.14	\$8,675,362.26	\$25,932,723.40	\$19,751,762.68
Total benefits per graduate	\$4,184.44	\$5,006.09	\$9,160.89	\$8,365.39	\$10,500.67
Costs	\$1,595,918.52	\$1,595,918.52	\$1,595,918.52	\$2,437,714.26	\$1,836,749.47
Costs per graduate	\$1,685.24	\$ 1,685.24	\$1,685.24	\$786.36	\$976.47
Benefit cost ratio	\$2.48	\$2.97	\$5.44	\$10.64	\$10.75

Appendix A-11. Quantifying Indirect Benefits

Table A-11.1.

Colon Cancer	Updated criteria	ONB exit (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Average age of onset for the disease	50	50	50	36	36
Average delayed onset resulting from EFNEP and FNP	55	55	55		
Average number of annual lost work days	50	50	50		
Estimated number of graduates to accrue benefits	2.88	2.75	22.46	3.09	9.39
Present value of lost earnings for the disease	\$1,088.23	\$1,088.23	\$1,088.23		
Total indirect benefit of delaying the disease	\$3,134.11	\$2,992.64	\$24,441.71		
Heart Disease	Updated criteria	ONB exit (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Average age of onset for the disease	55	55	55	55	55
Average delayed onset resulting from EFNEP and FNP	60	60	60	60	60
Average number of annual lost work days	59	59	59	58	58
Estimated number of graduates to accrue benefits	2.71	2.2	27.87	2.77	8.19
Present value of lost earnings for the disease	\$1,006.14	\$1,006.14	\$1,006.14	\$693.53	\$693.61
				\$1,918.44	\$5,680.67
Total indirect benefit of delaying the disease	\$2,726.63	\$2,213.50	\$28,041.05	\$1,921.08	\$5,683.38

Table A-11.1. Continued

Stroke	Updated criteria	ONB exit (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Average age of onset for the disease	45	45	45	45	45
Average delayed onset resulting from EFNEP and FNP	50	50	50	50	50
Average number of annual lost work days	65	65	65	60	60
Estimated number of graduates to accrue benefits	3.57	3.32	14.82	4.95	2.74
Present value of lost earnings for the disease	\$3,464.10	\$3,464.10	\$3,464.10	\$2,084.54	\$2,242.38
Total indirect benefit of delaying the disease	\$12,366.82	\$11,500.80	\$51,337.90	\$10,318.48	\$6,137.91
Hypertension	Updated criteria	ONB exit (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Average age of onset for the disease	41	41	41	30	30
Average delayed onset resulting from EFNEP and FNP	46	46	46	35	35
Average number of annual lost work days	40	40	40	41	41
Estimated number of graduates to accrue benefits	5.81	5.41	24.12	49.04	27.01
Present value of lost earnings for the disease	\$3,999.51	\$3,999.51	\$3,999.51	\$4,779.67	\$4,916.94
Total indirect benefit of delaying the disease	\$23,237.17	\$21,637.37	\$96,468.27	\$234,395.01	\$133,242.14

Table A-11.1. Continued

	Updated criteria	ONB exit (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Osteoporosis					
Average age of onset for the disease	50	50	50	45	45
Average age of retirement	65	65	65	65	65
Average number of annual lost work days	7	7	7		
Estimated number of graduates to accrue benefits	14.32	26.88	41.51		
Present value of lost earnings for the disease	\$2,601.35	\$2,601.35	\$2,601.35		
Total indirect benefit of delaying the disease	\$37,251.28	\$69,924.20	\$107,981.90		
	Updated criteria	ONB exit (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Diabetes					
Average age of onset for the disease	54	54	54	40	40
Average age of retirement	65	65	65	65	65
Average number of annual lost work days	11	11	11	0.6	0.6
Estimated number of graduates to accrue benefits	9.8	10.68	49.97	3.84	18.99
Present value of lost earnings for the disease	\$3,413.44	\$3,413.44	\$3,413.44	\$228.80	\$270.84
Total indirect benefit of delaying the disease	\$33,451.73	\$36,455.56	\$170,569.69	\$878.58	\$5,142.48

Table A-11.1. Continued

	Updated criteria	ONB exit (Virginia)	No Nutrient (Iowa 2000)	Virginia 1996 Result	Iowa 2000 Result
Obesity					
Average age of onset for the disease	40	40	40	23	23
Average age of retirement	65	65	65	65	65
Average number of annual lost work days	3.72	3.72	3.72	1.83	1.83
Estimated number of graduates to accrue benefits	8.55	7.79	76.96	10.90	33.09
Present value of lost earnings for the disease	\$2,469.01	\$2,469.01	\$2,469.01	\$1,952.23	\$2,080.40
Total indirect benefit of delaying the disease	\$21,110.04	\$19,233.59	\$190,015.03	\$21,272.46	\$68,847.45
Foodborne Illness					
Average age of onset for the disease	24	24	24	23	23
Average age of retirement	65	65	65	65	65
Average number of annual lost work days	1.5	1.5	1.5	1.5	1.5
Estimated number of graduates to accrue benefits	75.99	80.66	80.66	46.61	21.50
Present value of lost earnings for the disease	\$2,219.95	\$2,219.95	\$2,219.95	\$1,600.19	\$1,705.31
Total indirect benefit of delaying the disease	\$168,694.24	\$179,061.42	\$179,061.42	\$74,568.85	\$36,670.68
Sum of Indirect Benefits	\$301,972.03	\$343,019.08	\$847,916.98	\$343,354.46	\$255,724.04

Appendix B. Sources used in Determining the Benefits of Iowa EFNEP and FNP Incidence Rates (Prevalence Rates)

Table A-B.1.

Disease/Condition	Incidence Rate in Population (Low-income pop/Female pop)		Incidence rate due to Diet	
Colorectal Cancer	8% (F)	National Center for Health Statistics (2015)	80%	Cummings and Bingham (1998)
Heart Disease	25.8% (L)	National Center for Health Statistics (2015)	50%	Bibbins-Domingo et al. (2010)
Stroke	8.1% (L)	National Center for Health Statistics (2015)	49%	Bibbins-Domingo et al. (2010)
Hypertension	29.3% (F)	National Center for Health Statistics (2015)	45%	Lambur et al. (2009)
Osteoporosis	10.3%	Wright et al.(2014)	NA	
Type 2 Diabetes	28% (L)	National Center for Health Statistics (2015)	45%	Lambur et al. (2009)
Obesity	38% (L)	National Center for Health Statistics (2015)	50%	Lambur et al. (2009)
Foodborne Illness	16.7%	Scallan et al. (2011)	100%	Assumption used in Lambur et al. (2009)
Infant Diseases	100%	Assumption used in Lambur et al. (2009)	NA	
Low Birthweight	8.02%	National Center for Health Statistics (2015)	100%	Assumption used in Lambur et al. (2009)

Table A-B.2. Onset Ages and Onset of Disease Delayed

Disease/Condition	Average Age of Onset		Onset of Disease Delayed	
	Age	Source	Number of Years	Source
Colorectal Cancer	50 ^a	American Cancer Society (2014)	5	Lambur et al. (2009)
Heart Disease	55	Khamis, Ammari and Mikhail (2014)	5	Lambur et al. (2009)
Stroke	45	Lloyd-Jones et al. (2010)	5	Lambur et al. (2009)
Hypertension	41	Allen et al. (2012)	5	Lambur et al. (2009)
Osteoporosis	50 ^b	Kanis et al. (1994)		
Type 2 Diabetes	54	Centers for Disease Control and Prevention (2014)		
Obesity	40 ^c	Ogden et al.(2014)		
Foodborne Illness	24	Average Age of EFNEP homemaker		
Infant Diseases	0	Infant		
Low Birthweight	0	Infant		

^a “90% of new cases and 93% of deaths for colorectal cancer occur in people 50 and older.” (American Cancer Society 2014).

^b “The prevalence of osteoporosis with age is approximately exponential after the age of 50 years.” (Kanis et al. 1994).

^c Obesity is higher among adults age 40–59 years (40.2%) and older, and age 60 and over (37.0%) than among younger adults age 20–39 (32.3%). (Ogden et al. 2014).

Table A-B.3. Survival Time after Treatment and Cost of Treatment

Disease/Condition	Survival Time after Treatment		Cost of Treatment	
	Number of Years	Source	Per Patient/Year adjusted to 2015 Dollars	Source
Colorectal Cancer	5	Healthy People 2000 (1990)	\$32,255	Luo, Dahman and Gardiner (2010)
Heart Disease	5	National Research Council (1989)	\$13,748	Shanahan and de Lorimier (2013)
Stroke	10	National Research Council (1989)	\$21,307	Zorowitz et al. (2009)
Hypertension	20	National Research Council (1989)	\$746	Davis (2013)
Osteoporosis			\$9,891	Blume and Curtis (2011)
Type 2 Diabetes			\$8,038	American Diabetes Association. (2013)
Obesity			\$1,897	Tsai, Williamson and Glick (2011)
Foodborne Illness			\$1,679	Scharff (2012)
Infant Diseases			\$2,354	Lambur et al. (2009)
Low Birthweight			\$20,209	Russell et al. (2007)