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School Milk Pilot Test:

Estimating the Effects of National Implementation

A report prepared for

National Dairy Council â

and the

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CONTENTS

EXECUTIVE SUMMARY

During School Year 2001/02, the National Dairy Council® and the American School Food Service Association sponsored a pilot study to test the effect of measures taken to improve the attractiveness of fluid milk products offered to students in elementary and secondary schools. The School Milk Pilot Test (SMPT) was conducted in 146 schools (99 "test" schools; 47 "control" schools) representing 18 school districts in different parts of the United States. The purpose of this report is to apply the findings of the pilot study in estimating the impact of implementing these measures nationwide.

More specifically, the objectives of this report are to estimate the impact of national implementation on:

- the volume of milk marketed in elementary and secondary schools,
- student participation in school meals programs,
- the number of children benefited by the improved nutrient content of their diets,
- the incidence of major diet-related illnesses as a result of changes in the dietary intake of students,
- changes in health care costs resulting from the reduced incidence of diet-related illnesses,
- Federal child nutrition program costs, and
- the cost of packaging and distributing the new products.

In addressing these objectives, we have drawn on the results of numerous other studies to aid in interpreting the SMPT findings. In doing so, we have sought the most current, most authoritative sources we could find. Sources are identified in the list of references that appears at the end of the report. The several key assumptions that have been required are indicated and their implications noted where they occur in the report. In estimating the relationship between diet and health and the implications of dietary intervention for health care costs, we have been especially dependent on the expanding yet incomplete state of medical and nutrition knowledge.

The major findings of the analysis are as follows:

Impact on Volume of Milk Marketed

If implemented nationally, milk sales are estimated to increase by around 14% in elementary schools and by around 23% in secondary schools. In total, this would result in an additional 62 million gallons of milk marketed annually through schools.

Participation in the School Meals Program

Under national implementation, overall participation in the school meals programs is estimated to increase by about 430,000. Another 2.1 million students who are already participating in the programs but not taking milk as part of their meals would become milk drinkers.

Reductions in the Incidence of Diet-related Illnesses

By adopting and maintaining healthy diets, the 2.6 million students most directly impacted by the changes would be expected during their lifetimes to reduce the risk of six major health conditions – coronary heart disease, type II diabetes, colorectal cancer, osteoporosis, stroke, and hypertension – by 20% to 50%, depending on the condition.

Reductions in Health Care Costs Associated with Diet-Related Illnesses

In adopting healthy diets and lowering the risk of illness as they grow older, these students would lower the direct and indirect costs associated with these conditions by an estimated $0.8 billion to $1.1 billion (present value) per year.

Federal Outlays for School Meal Reimbursement

Associated with increased participation in the NSLP and the SBP would be increased Federal reimbursements and commodity entitlements of about $104 million per year.

Processing, Packaging, and Distribution Costs

Changes in packaging, labeling, and distribution of the upgraded products would add an estimated 2.2¢ to 4.2¢ per unit to the cost of production. Nationally, this would add $162 to $309 million to the cost of producing these products each year. The cooling equipment used in the schools would require investments totaling approximately $276 million. Depreciated over a useful life of 7 years, this would add an additional $39 million per year to cost.

SECTION 1: INTRODUCTION

The per capita consumption of fluid milk by Americans has fallen steadily over the past few decades. The level has fallen by over one-quarter since 1970, according to the USDA. The consumption of fluid milk by school-age children has followed a similar trend. The average per-capita consumption of milk by children age 13-17, for example, fell by over 20 percent between 1996 and 2001.

Declining milk consumption among children has a number of adverse nutritional and health consequences. As the principal source of calcium and a leading source of several other nutrients, dairy products play an especially important role in reducing the risk of a wide range of health conditions including bone fractures, hypertension, osteoporosis, and possibly, obesity. Calcium intake early in life is especially important for attainment of peak bone mass.

The downward trend in milk consumption among school children is being driven by a combination of factors. Inferior product quality, unattractive packages that are difficult to open, poor control of product temperature, and a limited variety of flavors are among the reasons why school milk has a negative image among many students. For processors, the very low margin earned on school milk contracts has discouraged product innovation and marketing efforts. In contrast, suppliers of competing products, particularly soft drinks, have aggressively targeted the school market as a means of establishing brand loyalty among young consumers.

During School Year 2001/02, the National Dairy Council and the American School Food Service Association sponsored a pilot study designed to improve the attractiveness of fluid milk products offered to students enrolled in public schools. The findings from that study (1) provided the basis for the analysis reported in this paper. The purpose of this analysis is to estimate the impact of implementing nationally the measures that were tested in the pilot schools.

In the remainder of this Section, we first describe the purpose of the impact analysis in greater detail. This is followed by a brief description of the methods and sources of information that were used in estimating impacts.

1.1 Purpose

The School Milk Pilot Test (SMPT) was conducted in 146 schools selected from 18 school districts located in different parts of the United States. Of the schools taking part in the pilot, product and merchandising changes were made in 99 "test" schools while the remaining 47 schools served as "control" schools without change from their traditional product offerings. The changes that were introduced in the test schools are described in the next section.

The purpose of this analysis is to use the findings of the pilot study as a basis for estimating the impact of implementing these changes in all public schools participating in the National School Lunch Program (NSLP) throughout the nation. More specifically, the analysis estimates the impact on:

- Total milk consumption in primary and secondary public schools participating in the Federal school meals programs,
- The rate of student participation in these school meals programs,
- The number of children benefited by the improved nutrient content of their diets,
- Potential changes in the incidence of major diet-related illnesses as a result of changes in the nutrient intake of students,
- Potential healthcare cost savings as a result of the reduced incidence of these diet-related illnesses,
- Federal costs associated with changes in participation in the school meals programs, and
- The added costs of packaging, and distributing fluid milk products in the tested forms through the Federal school meals programs.

1.2 Methodology

Results of the pilot study were reported in terms of the volume of milk sales and average daily participation in the school meals programs. These measures provide the basis for this analysis. Prior to making impact estimates, characteristics of the sample were compared to national measures to determine the sample's representativeness. To the extent the sample differed from all schools nationally, adjustments would have been required. As indicated in the Section that follows, sample schools were found to be similar in most respects to all primary and secondary schools.

As the administrating agency for the National School Lunch Program (NSLP) and the School Breakfast Program (SBP), the Food and Nutrition Service (FNS) of the U.S. Department of Agriculture has conducted numerous studies of these programs. The findings of several of these studies were used here. More particularly, they were used in estimating the national impact on school meals participation rates, the quantity of milk consumed, and the dietary consequences of changes in the quantity of milk consumed. Two recent national studies sponsored by FNS (2, 3) have examined the dietary intake of children participating in the school meals programs. An earlier study conducted for FNS (4) estimated the composition of school food acquisitions in SY 1996/97. This study provided a baseline measure of fluid milk utilization by public schools participating in the NSLP. The findings of these studies were supplemented by information from a variety of other sources, as indicated in the references that appear in Sections 3 and 4.

As a first step in estimating the impact of changes in school milk consumption on health care costs, those medical conditions known to be influenced by dietary intervention were identified. Estimates of the effect of dietary intervention on each of the medical conditions were assembled from the literature. Finally, the economic consequences of changes in the incidence of these medical conditions due to dietary intervention were estimated, again based on evidence assembled from past studies.

There is an extensive body of literature reporting on the findings of studies examining the relationship of nutrient intake to major medical conditions. Several types of studies are represented including: observational studies, randomized controlled intervention trials, and prospective longitudinal surveys. Not surprisingly, the techniques and circumstances used in these studies vary widely. We have reviewed past studies that have examined the link between diet and health and have based our estimates of health effects on what we interpret to be the "consensus" findings from this broad cross-section of the medical literature. These sources are identified in the report and in the list of references that appears at the end of the report.

The economic consequences of ill health have received less research attention, though with the sharp increase in healthcare costs, that is beginning to change. There are three separate cost components to be estimated for each condition: a. costs of treatment, b. loss of productivity, and c. costs associated with premature death.

Estimates of these costs were generally obtained from the major national organizations devoted to the treatment of these diseases, e.g. the American Heart Association (5), the American Cancer Society (6), the American Diabetes Association, and the National Osteoporosis Foundation. National healthcare expenditures were obtained from the Centers for Medicare & Medicaid Services (CMS) of the Department of Health and Human Services. Findings from Economic studies by researchers at Georgetown University (7), Harvard University (8), USDA's Economic Research Service (9), and Clark Atlanta University (10), were used in estimating the impact on health care costs.

Most of the estimates appearing in this report are dependent in varying degree on key assumptions. Throughout the report we have sought to identify these assumptions, to document their basis, and to note their implications.

SECTION 2: THE SCHOOL MILK PILOT TEST

Children's diets have undergone major change over the past few decades. There is growing concern among health professionals that children's diets are not as nutritious as they can or should be and that the deficiencies are contributing to poor health or to an increased risk of poor health as adults (11). Children's diets are generally found to be too high in fat, sodium, and added sugars, and to contain too few fruits, vegetables, whole grain, and other foods rich in fiber and calcium.

Changes in beverage consumption by children in recent years have been especially dramatic. These changes largely mirror changes occurring in the overall population. In 1945, for example, the per capita consumption of milk was more than four times that of carbonated soft drinks (12). In 2000, the per capita consumption of soft drinks was more than two times that of milk. Although school meals continue to be a key source of beverage milk in children's diets, the per capita consumption of milk in the nation's schools has fallen sharply. A comparison of school purchases of fluid milk in 1984/85 and 1996/97 found that school procurement of milk had declined 29 percent over the 12-year period, despite an increase in student enrollment (4).

Coincidentally, it is evident that most school-age children are not meeting the recommended levels of calcium intake. The deficit is particularly wide among older children. In 1994/96, only 32 percent of teenage boys and 13 percent of teenage girls were found to have met their calcium requirements (11).

Given the declining rate of consumption of fluid milk and the implications of this for the future health of children, the National Dairy Council and the American School Food Service Association cooperatively designed and sponsored a demonstration of changes designed to make milk in schools more attractive to the students. The demonstration was implemented in 146 elementary and secondary schools in 18 school districts beginning in the fall of 2001. Most of the districts taking part are located on the East Coast, from Massachusetts to Florida, with some representation in the Far West. The absence of data disaggregated by point of service made it necessary to limit some of the analyses to a sub-sample of 117 schools in 15 school districts.[1]

The selection of sample schools and their assignment as "test" or "control" schools was largely dictated by circumstance. School participation in the study was dependent on the cooperation of local milk suppliers. A variety of costly production line changes were required on the part of

[1] Measures of key characteristics of the sub-sample, including share of students approved for free and reduced-price meals, were not materially different from those of the full sample.

some of the processors taking part. This made recruitment for participation in the study particularly challenging and was largely responsible for the geographic make-up of the sample.

Schools participating in the study were also required to make several adjustments. Beyond keeping detailed records of milk sales and providing school-level measures of participation in the school meals programs, they had to make changes in how the milk was stored and merchandised. This included the installation of new coolers and, in some schools, vending machines. The participating schools were also asked to cooperate in several data-collections activities, including three surveys of a sample of over 5,000 students, a survey of the school foodservice directors in each district, and a plate-waste survey in 47 schools during three 2-day periods during the study.

A variety of changes were made in the test schools. Some of these changes were implemented in all test schools while some were implemented in only a portion of them. Changes implemented in all test schools were:

- Three flavor varieties offered (white, chocolate, and a third flavor, usually strawberry).
- Quality of chocolate milk made comparable to retail product.
- Coolers to maintain milk at prescribed temperatures installed.

Beyond these universal changes, a variety of packaging, size, and point-of-sale options were tried in selected schools. They included offering:

- 8-ounce plastic containers on the meal line
- 10-ounce plastic containers on the meal line
- 10-ounce plastic containers a la carte
- 16-ounce plastic containers a la carte
- 16-ounce plastic containers in vending machines

Test schools were assigned to "panels," depending on the nature of the changes that had been made. The distribution of schools by the panel in which they participated is shown in Table 1.

The demonstration was conducted in school year 2001/02. Prior to initiating the test, baseline data were collected for periods of one month or more in 14 of the 18 districts. The test began at different times in different districts, beginning in early November and extending through late February. The test continued in all schools through the remainder of school year 2001/02.

The number of units and dollar value sales by container size and flavor were recorded daily for each school. Separate records were maintained for sales made as part of reimbursable meals and for a la carte sales. No distinction was made between lunch and breakfast, though sales for both were recorded. Per unit sales were converted to ounces and expressed as ounces per 1,000 average daily participation (ADP) in reporting results. This measure was used to standardize results across schools of different sizes and different rates of participation in the meals programs.

Table 1. Number of Schools Participating in the School Milk Pilot Test, by Nature of Change Tested and Elementary/Secondary

Panel	Change	Elementary	Secondary
		Number of schools	
Control	None	18	30
Test 1/3	8 oz. Plastic – meal line	29	-
Test 2	8 oz. Plastic – meal line	-	19
Test 4	8 oz. Plastic – meal line, 16 oz. Plastic – a la carte	-	10
Test 5	8 oz. Plastic – meal line, 16 oz. Plastic – a la carte and vending	-	11
Test 6	10 oz. Plastic – meal line & a la carte	-	13
Test 7	8 oz. Carton – meal line, 16 oz. Plastic – a la carte and vending	-	16
Total		47	99

Source: Roper ASW and Beverage Marketing Corporation

It is assumed that in a national implementation, the changes adopted would vary among schools much as they did in the pilot. Schools would be granted flexibility to adapt the concept to their individual circumstances. Thus, while the mix of changes made in the pilot schools probably would not be duplicated in a national implementation, it provides a reasonable approximation of what would be expected to occur.

To help determine the representativeness of the sample, key characteristics of the sample schools were compared to national averages for all NSLP schools (Table 2). This comparison indicates that the sample schools are very similar to the national averages in nearly all respects. The secondary schools in the sample are somewhat larger in average enrollment than the national average, due to the proportionately greater representation of high schools in the sample. The percentage of enrolled students approved for free and reduced price meals, a key determinant of program performance, was nearly identical.

A comparison of the ethnic composition of schools taking part in the SMPT with the ethnic composition of all public schools is shown in Table 3. Compared to national averages in 1999, white students and black students were somewhat over-represented in the sample while Hispanic students were somewhat under-represented.

Given that study findings are measured in terms of the relative difference between test and control schools, it is important that schools assigned to these two groups be as closely matched as possible so that any differences found can be attributed to the treatment rather than to exogenous influences. A comparison of test and control school characteristics, as shown in Tables 2 and 3, indicates that they are closely matched and that none of the differences that could be statistically compared were found to be significant.

Table 2. Comparison of Schools in the School Milk Pilot Test and all Public Schools Participating in the National School Lunch Program, by Selected Measures, SY 2001/02[1]

Measures	SMPT Schools				All Schools	
	Test		Control			
	Elementary	Secondary	Elementary	Secondary	Elementary	Secondary
Average enrollment	507	930	448	1,080	468	760
Share offering breakfast	83	63	83	71	76[2]	76[2]
ADP: lunch	74	56	77	53	67	45
: breakfast	25	8	27	7	26	13
% free approval	36	27	36	24	39	25
% reduced approval	10	7	7	5	9	6

[1] The 12 California pilot schools are not included due to incomplete information.

[2] Not available by elementary/secondary.

Note: None of the differences between test and control schools were found to be significantly different at the 90 percent level.

Sources: Information for SMPT schools provided by the National Dairy Council. Information for all schools for SY 1999/2000 from (12) and for SY 1998/99 from (2).

Table 3. Comparison of the Ethnic Composition of Schools Participating in the School Milk Pilot Test and Total National Enrollment in Public Elementary and Secondary Schools in the U.S.

Ethnicity	SMPT Schools, SY 2000/01				All Public Elementary and Secondary Schools, Fall 1999
	Test		Control		
	Elementary	Secondary	Elementary	Secondary	
	percent				
White	70.0	61.9	70.9	56.0	62.1
Black	21.4	21.1	22.7	24.0	17.2
Hispanic	6.4	9.7	7.2	9.6	15.6
Asian or Pacific Islander	1.7	8.5	1.5	12.0	4.0
Other	0.9	1.3	1.1	3.0	1.2
Total[1]	100.0	100.0	100.0	100.0	100.0

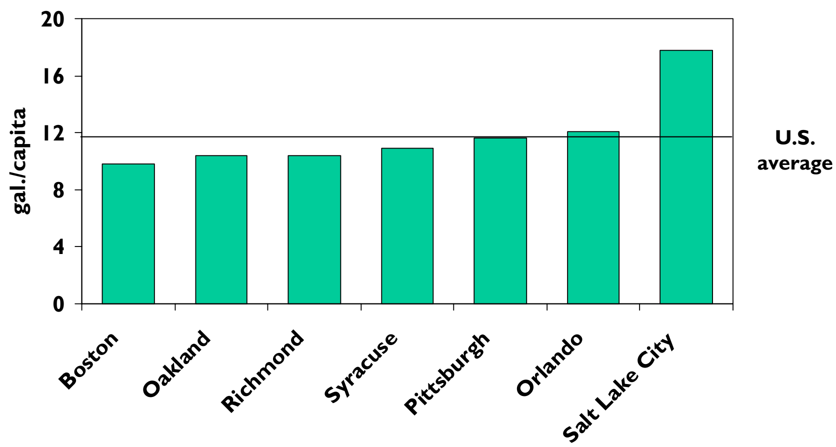
[1] Totals might not equal 100.0 due to rounding and to averaging of percentage shares.

Note: None of the differences between test and control schools were found to be statistically significant at the 90 percent level. For some comparisons the number of observations was too small to support a test of significance.

Sources: Roper ASW and U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics 2001*, February 2002.

A comparison of per capita milk consumption in the markets where the SMPT schools were located indicates that, with one exception, they were all very close to the U.S. average (Figure 1). The exception is Salt Lake City, one of the higher per capita milk consuming markets in the U.S.

Figure 1. Per Capita Consumption in SMPT Markets, 2001



SECTION 3: EFFECT OF NATIONAL IMPLEMENTATION ON SCHOOL MILK CONSUMPTION

3.1 Pilot Test Results

Findings from the pilot study provide the basis for estimating the national impact on school milk consumption. Percentage changes in ADP and in the volume of milk sold per 1,000 ADP between the base period and the test period are summarized in Table 4. As indicated, there were modest differences between control and test schools in ADP. ADP increased slightly more in elementary control schools than in test schools (+2.0% vs +1.2%) and decreased somewhat less in secondary test schools compared to control schools (-1.5% vs –5.9%).

Differences between test and control schools in the volume of milk sales were more pronounced. Differences from 6% to over 30% were evident in both elementary and secondary schools with test schools consistently reporting higher sales per 1,000 ADP. This finding was similar across all test panels.

Table 4. Percent Change in ADP and the Quantity of Milk Sales per 1,000 ADP by Schools Participating in the School Milk Pilot Study

Panel	Change in ADP	Change in milk sales
	(percent)	(percent)
Elementary:		
Control	+2.0	-3.6
Test 1/3	+1.2	+10.3*
Secondary:		
Control	-5.9	+1.9
Test 2	-3.6	+19.8*
Test 4	-0.5*	+12.8**
Test 5	-0.3**	+26.0**
Test 6	-1.7	+34.9**
Test 7	-2.1	+25.5**
Total Test[1]	-1.5**	+25.2**

[1] Weighted average.

* Difference in percent change from control schools statistically significant at the 90 percent confidence level.
** Difference in percent change from control schools statistically significant at the 95 percent confidence level.
Source: Roper ASW and Beverage Marketing Corporation

The combined test school results (with results between test and control schools netted out) indicate that students in the elementary test schools purchased 13.9 percent more milk per 1,000 ADP than students in control schools (i.e. 10.3+3.6 = 13.9) while secondary test school students purchased 23.3 percent more per 1,000 ADP (25.2-1.9 = 23.3).

3.2 Milk in the School Meals Programs

Before estimating the national impact of these measures, a few words of background on the school meals programs and the role of milk in them might be useful. Schools participating in the National School Lunch Program and the School Breakfast Program, collectively referred to in this report as the "school meals programs", are required to serve meals that meet prescribed nutritional standards. For many years, USDA's meal program standards have been designed to deliver a portion of the Recommended Dietary Allowances (RDAs) of the National Research Council.[1] These standards establish goals of providing, on average, one-third of a student's daily nutritional needs at lunch and one-fourth at breakfast. Age appropriate levels of calories, protein, vitamin A, vitamin C, calcium, and iron are included in the standards.

Beginning in School Year 1996/97, under a reform of these programs called the School Meals Initiative, these standards were broadened to include the recommendations provided in the *Dietary Guidelines for Americans*. Their inclusion brought a significant new dimension to the programs. In addition to the RDAs, the new requirements call for meals that emphasize fruits, vegetables, and whole grains, are low in saturated fat and moderate in total fat, and include beverages and foods that moderate the intake of sugars.

The performance of school meals programs in achieving these dietary goals has been periodically studied. With few exceptions, these studies have found that the programs have successfully met the goals associated with the RDAs. However, the School Nutrition Dietary Assessment Study (SNDA-I) conducted in SY 1991/92 found that school meals were not meeting some elements of the Dietary Guidelines, standards that did not exist when the NSLP was developed. In response to these findings, key recommendations in the *Dietary Guidelines for Americans* were incorporated in the NSLP regulations.

Another study (3), based on 1994-96 data, examined the relationship of school meal participation and dietary intake, both in-school and out-of- school. It found that children who participated in the school meals programs had higher mean intakes of food energy and many nutrients, including calcium, phosphorous, magnesium, zinc, thiamin, riboflavin, and vitamins B_6 and B_{12}. The study

[1] The Recommended Dietary Allowances have recently been replaced by a new set of updated standards, the Dietary Reference Intakes (DRIs), though USDA's meal program standards continue to be based on achievement of the RDAs.

also found that school meal participants had higher mean intakes of total fat, saturated fat and sodium than non-participants, though this study too pre-dated adoption of the new standards. A follow-up study, the School Nutrition Dietary Assessment Study II (SNDA-II) conducted in SY 1998/99 after adoption of the new standards, found that school meals had become substantially healthier since the early 1990s. Levels of fat and saturated fat were lower and carbohydrates higher, relative to the caloric intake.

As part of the School Meals Initiative reform described above, schools are required to use one of four prescribed systems in planning their menus. Two of the systems use computerized nutrient analysis and USDA-approved software. The other two systems are food-based in the sense that meals are defined in terms of specific types and quantities of food. Regardless of the menu planning used, all school meals are required to satisfy the RDA requirements and the recommendations in the Dietary Guidelines. The standards vary by meal (lunch/breakfast) and by grade and/or age groupings. The minimum nutrient standards currently in use in school meals appear in Table 5 below.

Table 5. Minimum Nutritional Standards Defined in Current School Meals Regulations

	Grade Groupings	
Lunch	Grades K-6	Grades 7-12
Calories	664	825
Total fat (as % of calories)	30	30
Saturated fat (as % of calories)	10	10
Protein (gm)	10	16
Vitamin A (mcg RE)	224	300
Vitamin C (mg)	15	18
Calcium (mg)	286	400
Iron (mg)	3.5	4.5
Breakfast	Grades K-12 (minimum)	Grades 7-12 (optional)
Calories	554	618
Total fat (as % of calories)	30	30
Saturated fat (as % of calories)	10	10
Protein (gm)	10	12
Vitamin A (mcg RE)	197	225
Vitamin C (mg)	13	14
Calcium (mg)	257	300
Iron (mg)	3.0	3.4

Source: Food Nutrition Service, USDA.

Milk plays a unique role in the NSLP and the SBP. It is the only specified food that must be offered as part of all reimbursable meals, both lunch and breakfast. At a minimum, it must be offered in 8-ounce quantities. Prior to 1994, schools were required to offer whole milk. They are now required to offer types of milk consistent with the types consumed the previous year, provided that types constituting less than 1 percent the previous year don't have to be offered. In SY 1998/99, more than 95 percent of all NSLP menus included two or more types of milk with a median of three options offered (2). In lunch menus, the most commonly offered types were 1% flavored (67 percent), 1% plain (53 percent) and whole plain (50 percent).

As a key component of school meals, milk is an important source of several nutrients. In the SNDA-II study, milk was found to account for 53.9 percent of the calcium, 30.3 percent of the vitamin A, 24.0 percent of the protein, and 20.7 percent of the carbohydrate contained in NSLP served lunches (2).

Beyond serving milk as part of the reimbursable meal, most schools offer it as an a la carte item as well. In SY 1998/99, 92 percent of all schools offered milk a la carte, far more than offered any other food (2). The next most frequently offered foods were juice (44 percent) and cookies (41 percent).

Although milk is offered as part of all school meals, most schools permit their students to decline one or two food items (depending on whether it is breakfast or lunch and depending on the menu planning system in use) and still qualify as a reimbursable meal. Called "offer versus serve", this approach is required for lunches served in high schools but is optional at lower grade levels.

In SY 1996/97, the offer versus serve approach was being used in 85 percent of all NSLP school districts. This means that although milk is always included among the foods offered as part of a school meal, it doesn't have to be accepted and often isn't. In the SNDA-II study (2), it was found that 6 percent of all elementary school lunches and 16 percent of lunches served in secondary schools did not include milk, though it was offered. Findings from the student surveys conducted as part of the SMPT (20), surveys that were conducted among both school meal participants and non-participants, also found that many children do not drink milk with their noon meal at school. The share who reported not drinking milk was: 4th through 6th grades – 29 percent, middle school – 45 percent, and high school – 71 percent.

3.3 Calculating the Impact on Fluid Milk Sales Nationally

The most recent large-scale national study of school food procurement, the School Food Purchase Study, was conducted on behalf of the USDA in SY 1996/97 (4). This study collected procurement data at the school district level. Thus, the national estimates that were derived represent a combined estimate of milk use in both elementary and secondary schools and in both lunches and breakfasts. This corresponds with the methods used in collecting sales data for the SMPT and therefore offers a comparable baseline for estimating national impact.

The School Food Purchase Study estimated national fluid milk purchases in SY 1996/97 of 2,521.9 million pounds. Divided by the number of reimbursable meals (4,560.8 million) served In SY 1996/97 in NSLP unified school districts yields an average of .553 pounds or 8.848 ounces per reimbursable meal. Recalling that the minimum required milk serving is 8 ounces, that some students eating a reimbursable meal do not select milk, and that this is offset in some degree by those students who purchase milk a la carte, this is a reasonable estimate of the average quantity sold per reimbursable meal.[1]

However, this estimate is six years old and therefore out-dated given the continuing decline in the per capita consumption of fluid milk.[2] Extrapolating USDA's per capita consumption measures through 2000, we estimate that per meal sales of milk in schools in 2001/02 were down about 6.6 percent from 1996/97. As a result, the per meal level of milk sale in 2001/02 is calculated at 8.264 ounces. On the basis of USDA's report of 6.032 billion lunches and breakfasts served in SY 2001/02, we estimate that 3,115.5 million pounds of milk were marketed through public schools in SY 2001/02. This is equivalent to about 5.8 percent of total U.S. beverage milk sales in 2001.

Since the SMPT findings are reported separately for primary and secondary schools, the national estimate of school milk sales was converted to the same basis. Several steps were required in making this conversion. Participation rates were multiplied by the share of total enrollment in elementary and secondary schools to calculate the share of total enrollment that had participated. This calculation was made separately for lunch and breakfast using findings from SNDA-II and The School Meals Initiative Implementation Study: Third Year Report (SMI-III). These shares were then used to allocate total meals (lunch and breakfast) by the share that was served in elementary schools and the share served in secondary schools. These shares, multiplied by the national estimate of school milk sales, yield the following breakdown between elementary and secondary schools:

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[1] To the extent purchased milk was used as an ingredient in food preparation, this overestimates the average quantity sold per reimbursable meal for fluid consumption. Other milk products including buttermilk, evaporated milk, condensed milk, nonfat dry milk, and cream have been excluded from this estimate.

[2] Unpublished SIP data collected for Dairy Management, Inc. indicate that per capita milk consumption rose slightly in 2001. However, the most recent USDA estimate (2000) on which this calculation is based shows a continuing drop.

Elementary	3,115.5	X	64.3%	=	2,003.3 mil. lbs.
Secondary	3,115.5	X	35.7%	=	1,112.2 mil. lbs.
Total					3,115.5 mil. lbs.

Applying the rates of growth in milk sales reported for the SMPT schools to these totals yields the following estimated impact:

Elementary	2,003.3	X	13.9%	=	278.5 mil. lbs.
Secondary	1,112.2	X	23.3%	=	259.1 mil. lbs
Total				=	537.6 mil lbs. or 62.4 mil. gal.

SECTION 4: NUMBER OF CHILDREN BENEFITED BY INCREASED SCHOOL MILK CONSUMPTION

In this Section, we examine the nutritional implications of increased school milk consumption. Increased milk consumption can enhance the quality of the diet, thereby affecting consumer health and heath care costs. But to estimate changes in health care costs, we must determine how many children have improved their dietary intake as a result of increased milk consumption. And before we can determine how many were benefited, we must examine the nature of the changes that occurred in the test schools as a result of the SMPT.

Increased consumption of milk at school affects the nutrient intake of students in two ways. First, there is the direct nutritional effect of additional milk in the diets. Second, and potentially more important, is the impact that results from the adoption of a healthier diet overall, not just the increased consumption of milk. While increased milk consumption contributes importantly to the intake of certain key nutrients, thereby lessening the risk of illnesses like osteoporosis and bone fractures, it is the combination of foods that make-up a healthy diet that has the greatest payoff in risk-reduction for a wide range of health conditions. Thus, we are especially interested in the ramifications of increased milk consumption on the overall dietary patterns of the students in these schools.

4.1 Milk as a Source of Key Nutrients

Fluid milk is a rich source of several key nutrients, vitamins, and minerals including calcium, high quality protein, vitamins A, D, and B-12 and riboflavin, phosphorus, magnesium, and zinc. Milk and milk products are the dominant source of calcium in the Nation's food supply, accounting for about 73 percent of the total. Milk and its products also account for about one-third of the total supply of riboflavin and phosphorous and about one-fifth of the total supply of protein, vitamin B-12, zinc, and potassium, 17 percent of vitamin A and 16 percent of the supply of magnesium. Thus, it is a key source of a wide range of nutrients.

As noted earlier, the diets of many school-age children have shortfalls in one or more of these nutrients. Shortfalls in calcium and fiber and excessive levels of total fat, saturated fat, added sugars, and sodium are especially important. Increasing the consumption of low-fat milk contributes importantly to increased calcium intake and, to the extent it substitutes for higher-fat milk, to a lowering of the intake of fat and saturated fat.

4.2 Converting Requirements to a Per Serving Basis

The Institute of Medicine of the National Academy of Sciences recommends an average daily intake of calcium of 800 mg for children age 4-8 and 1,300 mg for children age 9-18. Measured in terms of 8-ounce servings of fluid milk, these recommended amounts are equivalent to 2.6 servings and 4.3 servings, respectively. The study of food intake by school-age children based on 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) data estimated average daily servings of 2.0 for children participating in NSLP and 1.4 for those not participating. Of the 2.0 servings consumed by NSLP participants, 0.8 servings were consumed as part of school lunches while the non-participants in school lunch consumed only one-fourth this level at lunch or 0.2 servings.

In 15 of the 18 school districts taking part in the SMPT, milk sales data were disaggregated by point of sale making it possible to distinguish among sales on the meal line, a la carte sales, and vending machine sales. Again, these are percent changes between the base and test periods. The percent changes in milk sales by point of sale are displayed in Table 6.

Table 6. Percent Change in the Quantity of Milk Sales per 1,000 ADP by Point of Sale in Schools in 15 SMPT School Districts[1]

Panel	Change in milk sales			
	Total	Meal Line	A la carte	Vending
	--------------------percent--------------------			
Elementary:				
Control	-1.6	+2.9	-25.3	n.a.
Test 1/3	+13.0*	+16.7*	-24.3	n.a.
Secondary:				
Control	+3.0	+4.1	-11.7	n.a.
Test 2	+18.4*	+21.6*	-4.0	n.a.
Test 4	+9.5*	+7.0	+88.2	n.a.
Test 5	+37.8**	+15.8**	+10.3	[3]
Test 6	+34.5**	+27.9**	+160.4**	n.a.
Test 7	+29.5**	-0.8	23.8**	[3]
Total Test[2]	+26.5**	+17.7**	+51.4*	[3]

[1] Data for Chesapeake, Pittsburgh, and Oakland schools not included due to absence of data by point of sale.
[2] Weighted average.
[3] Percent change not meaningful due to small base.
* Difference in percent change from control schools statistically significant at the 90 percent confidence level.
** Difference in percent change from control schools statistically significant at the 95 percent confidence level.
Source: Roper ASW and Beverage Marketing Corporation

SMPT sales data can be converted to an 8-ounce serving basis by dividing the reported measures (ounces per 1,000 ADP) by 8,000. Since all children going through the meal line are offered an 8-ounce serving of milk, comparing actual sales to possible sales makes it possible to calculate the share of children who accept milk with their meal. The rates for the test period are as follows[1]:

		Meal line
Elementary	Test schools	95%
	Control schools	86%
Secondary	Test schools	65%
	Control schools	58%

The data appearing under the "meal line" column are particularly revealing. They indicate that 95 percent of the students participating in the meals programs in elementary test schools had milk with their meals, compared to 86 percent in elementary control schools. The comparable shares at the secondary level were 65 percent and 58 percent.

4.3 Linking Increased Milk Consumption to a Healthy Diet

As indicated above, from the standpoint of achieving improved prospects for good health, the relationship of increased low-fat and non-fat milk consumption to the overall diet is critical. Lasting effects require dietary practices that go beyond the increased consumption of a single food, even one as important and nutritious as milk. Thus, before we can make judgments regarding the future health conditions of children as a result of increased milk consumption, it is necessary to consider their overall dietary practices and the implications that increased milk consumption might have for a change in these practices.

Participation in the NSLP and/or the SBP is indicative, though no guarantee, that students are eating a healthy diet. It is no guarantee because, as noted above, most participants have the option to refuse food they don't want. Even when accepted, foods are sometimes not eaten. And meals eaten outside school can be totally unaffected. Nonetheless, there is strong evidence that school meals are nutritious in their offerings and are becoming more so (2). Furthermore, it would appear that students who participate in school meals also consume healthier diets outside school (3, 11, 21). Thus, participation in the school meals program will serve as an indicator of a healthy diet or, at the least, the opportunity to achieve a healthy diet, for purposes of this analysis.

[1] As with the overall meal line comparisons displayed in Table 5, differences among the elementary schools are significant at the 90 percent level while differences at the secondary level are significant at the 95 percent level.

What, then, is the relationship between increased milk consumption and the adoption of a healthy diet? There are two ways to measure changes in this regard. The most direct is to determine what happens to participation in the school meals program. The findings reported earlier (Table 4) indicate a small (-0.8 percent) net decline in participation among elementary school students and a somewhat larger (+4.4 percent) net increase at the secondary level. When changes in participation in just the lunch program were examined, ADP in the test elementary schools increased 1.5 percent while ADP in secondary schools rose by 4.8% (46). While the difference in ADP rates of the test and control schools at the secondary level (including both lunch and breakfast) was statistically significant at the .95 confidence level, differences at the elementary level were not statistically significant. On the basis of these findings, we conclude that little, if any, change in participation could be expected to occur in elementary schools as a result of the measures implemented in the SMPT. This is not surprising given the already high rate of program participation in most elementary schools. Among secondary schools, however, an increase of 4 to 5 percent is expected. Given that about 36 percent of all school meals are served in secondary schools, an overall increase in ADP of 1.5 to 2.0 percent is forecast.

However, increased participation accounted for only a portion of the additional milk sales measured in the pilot. A much larger share of the increase in sales was due to either increased consumption by students already participating in the meals programs or to increased sales outside the program, i.e. through a la carte or vending machine sales. To the extent this increase in sales is attributable to children already participating in the meals programs, it is likely to have resulted in a further upgrading of their diets.

At the elementary school level, the SMPT findings for those schools reporting by point of sale indicate that around 84 percent of the net increase in sales occurred in the meal lines as part of the sale of reimbursable meals with the remaining 16 percent accounted for by increased a la carte sales. Flavored milk accounted for all of the increased usage. Thus most of the increased consumption of fluid milk in the test elementary schools contributed to the further improvement in the diets of children who were already benefiting from participation in the meals programs. To the extent meal participants bought additional milk a la carte, the share was even higher.

An additional improvement in the dietary intake of elementary students is due to a shift away from whole milk and toward low-fat milk. While whole milk sales accounted for only 18 percent of total sales in the test schools in the base period, whole milk sales fell 20 percent during the test. This presumably occurred because flavored milks were only offered in low-fat form. Thus, all additional sales in the elementary schools were of low- or reduced-fat milk, further improving the nutritional profile of the affected students.

At the secondary school level, approximately half (49 percent) of the relative increase in milk sales in the test schools occurred in the meal line with slightly more than half (56 percent) of the additional meal line sales due to an increase in the volume of sales per meal participant. As in the elementary schools, this contributed to a more complete meal on the part of those participating in the meals programs. Unlike the elementary schools, however, most of the increased volume of milk sales in the meal line of the secondary school was of whole milk (due primarily to the influence of one panel of schools that offered their flavored milk in whole milk form). As a result, the additional sales did not contribute to a reduction in the fat content of the milk served in these schools, though low-fat milk was still the milk beverage of choice, accounting for more than two-thirds of total milk sales.

Further contributing to improved dietary intake was a measured reduction in the amount of milk discarded by students. As part of the SMPT, discarded milk containers were collected and the contents weighed from a sample of students in 47 of the participating schools (21 control schools and 26 test schools). This information was collected at three different times during the study, once before the test began and twice afterward.

Findings from this analysis revealed a reduction in the share of milk wasted in test schools relative to control schools of about 18 percent in elementary schools and 26 percent in those secondary schools serving milk in 8-ounce containers. Both differences were significant at the 95 percent confidence level. The magnitude of reduced waste was greater toward the end of the school year than it had been shortly after the test began. It was also found that the share of unopened milk containers fell in test secondary schools (from 3.6% to 1.7%) while rising in control schools.

4.4 Estimating the Number of Children Benefited

To determine the health effect of improvements in children's diets, it is first necessary to estimate the number of children nationally who would benefit from an improved diet as a result of changes in the milk offered in the schools. There are two components to this calculation. First, the increase in meal program participation is estimated. Second, the number of children who were already participating in the program but elected to include milk with their meal when they hadn't before is determined.

The USDA's May 2002 count of the number of children participating in the NSLP was used as the basis for this calculation. As in the estimates of increased milk sales, we have distinguished between elementary and secondary schools by using participation rates, number of breakfasts and lunches served, and enrollment breakdowns obtained from USDA/FNS administrative records or from findings of USDA/FNS–sponsored research. Using the net percentage changes in ADP measured in the SMPT and the estimated number of participants, we estimate that the number of students participating in the school meals programs will increase by about 430,000 nationwide (Table 7), all occurring in secondary schools. As noted above, this is to be expected given that participation rates are already about half again as high in elementary schools as in secondary schools.

The next step is to estimate the number of children who were already participating in the meals programs but who added milk to their meals. To do this we compared the quantity of milk per 1,000 ADP sold on the meal line to the quantity that could be sold if all participants took milk. Since 8 ounces of milk are required to be offered in both elementary and secondary schools and for both breakfast and lunch, the maximum expected quantity would be 8,000 ounces per 1,000 ADP. (An exception is the one test panel in which 10-ounce containers were used on the meal line. Data for this panel was therefore excluded from the calculation.) Using this measure, we estimate the share of meal participants that included milk with their meal and changes in this share between the base period and the test period for both control schools and test schools.

Applying this methodology, it is estimated that more than 2 million elementary and secondary students who were already participating in school meals programs but not drinking milk would start to do so under national implementation (Table 7). Among the test schools, this is reflected in the share of elementary students participating in the meal programs who included milk with their meals rising from 81 percent to 95 percent. Adjusting for a slight increase in share among the control schools, a net improvement of 11 percent is estimated.

The share of secondary school students including milk is somewhat lower than in elementary schools. In the base period, 44 percent of lunch participants in test schools included milk with their meals. During the pilot, test schools experienced a net improvement of 3 percent in the share including milk with their meals.

Table 7: Estimated Change in the Number of Students Participating in School Meals Programs and Including Milk as Part of Their Meal

Source of change	Elementary schools	Secondary schools	Total
Additional participants	no change	430,000	430,000
Existing participants who started including milk	1,833,000	293,000	2,126,000
Total	1,833,000	723,000	2,556,000

There are two cautions to be noted regarding these estimates. First, in estimating the number of additional participants in the meals programs, it is assumed that an increase in ADP equates to an identical increase in the number of students participating in the meals programs. However, by combining lunch and breakfast in a single measure, as in the reported study findings, there is an opportunity for double-counting. On the basis of a review of additional participation data collected at the time of the study, we have concluded that there was little or no double-counting. Not surprisingly, the data indicate that nearly all of the increased participation occurred at lunch rather than breakfast.

Second, in estimating the number of children who were benefited by these changes, we have excluded a la carte and vending machine sales. Since a la carte sales in elementary schools are relatively small (6 percent) and were unchanged in test schools relative to control schools, it is not much of an issue. In secondary schools, however, it accounts for a larger share of sales (13 percent) and experienced notable growth during the test. Since there is no way of determining who is buying milk from these sources or what contribution it is making to the achievement of a healthy diet, they are excluded from the estimate. In doing so we are underestimating the number of children benefiting from increased milk consumption to some degree.

SECTION 5: IMPACT OF IMPROVED NUTRITION ON HEALTH CARE COSTS

The ultimate purpose of a more nutritious diet is improved health. In this section we look at the implications of improved health from an economic viewpoint. More specifically, we look at the impact of improved nutrition on health care costs.

There are numerous reasons to exercise caution in analyzing the impact of improved nutrition on health care costs. While knowledge of the linkages that connect diet and health is expanding rapidly, there is much that remains unknown or poorly understood. And relatively few of the studies conducted to date have traced the effects of improved nutrition from childhood through adulthood. Most of the larger trials and studies cited in this section have been conducted among middle-aged or older adults, those age cohorts in which the more serious health conditions are in greatest evidence. Thus, they offer an imperfect understanding of what to expect from dietary intervention among school-age children.

Future trends in health conditions and in methods of treatment are other areas of uncertainty. We have assumed current incidence rates, outcomes, and methods of treatment. Though it is not possible to foretell their direction or magnitude, changes in each of these dimensions can be expected.

As indicated in the previous Section, we have used the purchase of a reimbursable school lunch, including school milk, as a proxy for the adoption of a healthy eating pattern. While there is evidence that school meal participants have more nutritious diets, including their away-from-school eating, there is no assurance that the new participants and the new milk drinkers will maintain these practices into the future. Neither is it appropriate to ascribe the impacts entirely to increased milk consumption. Milk is but one of several key components of a healthy diet that must be present if the outcomes described here are to be achieved.

For these and other reasons, the analysis presented in this section should be viewed not as a certainty but as a possibility, based on best available knowledge. The ever-growing body of research results and the relatively consistent direction of their findings offer support for the reasonableness of this approach. Furthermore, the magnitude of the costs involved is so large that even estimates at the lower boundary of a wide range can be staggeringly high.

5.1 Introduction

There are three major components to account for in estimating the costs of ill health: (1) direct expenditures for health care; (2) productivity losses resulting from illness; and (3) the cost of premature death. As a component of the national income and product accounts, personal consumption expenditures for medical care were $1,072 billion in 2001 (13). This was the equivalent of 15.3 percent of all personal consumption expenditures in 2001 and is up from 5.1 percent in 1959.

A gradual increase in life expectancy over the past several decades has been a major contributor to improved health. Life expectancy at birth has risen from 68 years in 1950 to 77 years at present. Nearly 5 of the 9 additional years are attributed to reduced mortality from cardiovascular disease while reduced infant mortality accounts for nearly 2 more years.

A recent study by William Nordhaus of Yale University helps put the value of improved health care in perspective (15). He concluded that as "a first approximation, the economic value of increases in longevity in the last hundred years is about as large as the value of measured growth in non-health goods and services." Given the tremendous growth in non-health goods and services that has occurred over this period from the development of such technologies as the airplane, television, atomic energy, the computer, and superhighways, this is a startling finding. It tells us that whatever is responsible for increased longevity, the economic payoff is very, very large.

5.2 Identifying Diet-Related Illnesses

For this analysis, the first step is to identify those threats to health that are diet-related. In the more distant past, these threats were more likely to arise from hunger or malnourishment and the illnesses that resulted from too little nutritious food. It was the evidence of malnourishment on the physical conditions of recruits to the Armed Forces during World War II that gave impetus to adoption of the National School Lunch Act in 1946. Viewed across the broad sweep of the past two centuries, Robert Fogel has argued that improved nutrition resulting from economic growth explains 50 to 90 percent of improved health in developed countries over this period (16). Of course, there are many other influences, particularly in more recent times. Improvements in medical technology and practices have been especially important. So too have been improvements in public information and changes in government programs and policies. David Cutler of Harvard University concludes that about two-thirds of reduced mortality over the past 50 years is due to improved health care with the remaining one-third resulting from behavior changes (8).

While establishing a direct link between the consumption of fluid milk and disease prevention would be interesting, that is well beyond the scope of this study. Furthermore, as noted earlier, diet-related health outcomes are associated with the nutrient makeup of dietary patterns rather than with the intake of particular foods. Thus, it is the combined contribution of all the foods comprising the diet that determines health effects. Our objective, therefore, is to identify the relationship between common, chronic medical conditions and a generally healthy diet, one that includes low-fat dairy products.[1]

A wide variety of techniques have been used in studying the relationship between diet and health. Some studies are based on comparisons of the dietary practices of the individuals taking part. The Coronary Artery Risk Development in Young Adults (CARDIA) study, for example, based its analysis on a detailed 28-day dietary history of each participant (47). In other studies, participants have adopted prescribed diets of varying severity. The diet prescribed in the Dietary Approaches to Stop Hypertension (DASH) study is illustrative (17). The diet used in these trials was rich in fruits, vegetables and low-fat dairy foods and had reduced amounts of saturated fat, total fat, and cholesterol. In these trials, for example, participants on the control diet averaged 0.1 servings/day of low-fat dairy products and 0.4 servings/day of regular-fat dairy products while those on the treatment diet averaged 2.0 servings/day of low-fat dairy products and 0.7 servings/day of regular-fat dairy products.

A review of the literature reporting on results of other controlled trials and observational studies indicates that several of the most common chronic medical conditions are or can be controlled through dietary interventions similar to those prescribed by the results of these studies (9, 26, 27, 39, 40, 42, 43).

These conditions include:

Obesity	Type II diabetes
Hypertension	Osteoporosis
Stroke	Colorectal cancer
Coronary heart disease	

5.3 Estimating the Impact of Health Care Costs

Several steps are required to estimate how an improvement in the diets of 2.6 million school-age children would affect health care costs. In making these estimates, we have reviewed recent studies published in prominent medical and economic journals and by Federal agencies, including the U.S. Department of Agriculture and the Centers for Disease Control and Prevention.

[1] Although we have not attempted to isolate the effects of milk consumption, it is noted that past research has found that milk consumed at lunch appears to serve as a "marker" for overall diets higher in the essential micronutrients of vitamin A, vitamin E, calcium and zinc (21). Furthermore, those children who drink skim milk at lunch have been found to have the lowest overall intakes of energy, percent of calories from total saturated fat, cholesterol, and sodium.

A first step is to determine the relationship between diet and health. More specifically, it is to determine the reduction in incidence of the disease that could be expected from the adoption of a healthy diet. For each of the conditions described in the proceeding section, there is a reasonably firm established connection between its incidence and diet. The magnitude of risk reduction varies among conditions and among studies. With osteoporosis, for example, there is convincing evidence that a healthy diet, one that is rich in calcium, plays an important role in reducing risk of the disease. For other conditions, such as coronary heart disease or stroke, the magnitude of risk reduction is somewhat less, though still important.

Although obesity is a growing national problem that is, in the words of the Surgeon General, of "epidemic proportions," we have not included it in the estimates that appear below. Much of its estimated $117 billion (2000) cost is associated with other conditions, including type 2 diabetes, coronary heart disease, and hypertension (25). In the absence of more detailed information that would have made it possible to avoid double-counting, we have excluded it from our estimates of health care cost-savings. Likewise, in the absence of more detailed information on the relationship of dietary interventions and expenditures for dental care, we have excluded it from the analysis as well.

A review of the literature indicates that estimates of the degree to which the risk of these conditions can be reduced through dietary intervention falls between 20 percent and 50 percent, again depending on the condition (6, 9, 10, 17). For this study, we have used risk reduction rates drawn from federally conducted research. The rates used appear in Table 8 below. They range from a 20 percent risk reduction for coronary heart disease and stroke to a 50 percent reduction in osteoporosis. Whenever choices were required, we have adopted the more conservative option.

A second step in the impact analysis is to identify the prevalence of each condition and the profile of its occurrence by age. Since we will be linking prevalence to health care expenditures, we have defined "prevalence" to include only those cases that have been diagnosed with the condition and are receiving medical care for the condition. It will be recognized that the conditions included in this analyses are typically most prevalent among older people. There are exceptions, of course. Type II diabetes, for example, is increasingly found among young adults. Still, only about 1.7 percent of individuals aged 20-39 are diagnosed with this disease compared to more than 19 percent of those aged 60 and above, according to the latest information from the CDC. And with most of these conditions, occurrence at a younger age is more likely to be associated with non-dietary factors.[1] For example, a high proportion of individuals who die from heart disease before age 55 have been found to suffer from genetic defects (9).

[1] This is not universally true. Type II diabetes, for example, is directly associated with childhood obesity.

Two slightly different techniques have been used in making these estimates. The more conservative approach has been to limit the estimates to those ages at which prevalence of the condition is at its peak. These ages and their associated prevalence rates appear in Table 8. The rates of prevalence range from a low of 2 percent for osteoporosis to a high of 50 percent for hypertension. In the case of osteoporosis, it will be noted that prevalence rates of 13 percent or higher are frequently cited. However, most of these individuals are not receiving medical attention for the condition and therefore are not represented in the cost estimates on which our calculations are based.

Since the dietary intervention occurring among school-aged children will be separated by a number of years from major health care expenditures for these conditions, it is necessary to convert these future expenditures to present value. To do this, we must identify the age at which we would expect these expenditures to occur. On the basis of a review of the age profiles of each condition, we have identified peak prevalence ages ranging from 50 to 65 (Table 8).

The per patient cost estimates that appear in Table 8 represent a combination of the three elements described earlier. That is, they represent a combination of direct medical costs and indirect costs associated with lost productivity and premature death. They are drawn from several different sources including the American Heart Association, the National Cancer Institute, and research conducted by Barefield and by Javitt and Chiang. The per-patient estimates are on an annualized basis. They range form a low of $944 for hypertension (largely for medication) to a high of $18,534 for osteoporosis (dominated by the cost of hip fractures).

Since the medical expenditures for these conditions will not occur for many years, it is necessary to discount the estimates, converting future expenditures to present value. For children now in elementary school, these expenditures are 4 or 5 decades into the future and nearly that far for secondary students. Using a discount rate of 3 percent, we estimate the present value of the health care savings that would be realized through this intervention at about $784.5 million. This is the lower end of the range appearing in Table 8.

For those conditions having more detailed information on prevalence by age cohort, we have made separate estimates for each of five age cohorts and summed the results. These estimates provide the upper limit of the ranges that appear in Table 8. Thus, the adoption and maintenance of healthy diets by 2.6 million school children is estimated to result in savings in health care costs of approximately $0.8 billion to $1.1 billion annually, present value.

Table 8: Estimated Present Value of Health Care Cost Savings of National Implementation of School Milk Pilot Study

Health conditions	Prevalence rate	Age of onset	Risk reduction rates	Per patient cost	Present value, 2002
	(percent)	(years)	(percent)	(dollars)	(mil. dollars)
Coronary heart disease	14	65	20	$8,873	$126.3 – 199.3
Type II diabetes	10	55	30	16,747	343.9 – 473.6
Colorectal cancer	4	65	30	4,464	27.2
Osteoporosis	2	50	50	18,534	147.0
Stroke	7	65	20	10,739	76.6 – 117.3
Hypertension	50	65	25	944	60.0 – 102.7
Total					$781.0 – 1,067.1

Sources: (5, 6, 7, 10, and 22)

SECTION 6: COSTS ASSOCIATED WITH NATIONAL IMPLEMENTATION

There are two sources of cost associated with national implementation of the measures tested in the SMPT. Increased participation in the school meals programs will result in increased Federal outlays to reimburse school districts for the additional meals. A second source of increased cost will result from the additional expenses associated with improved packaging and distribution practices. In this chapter, we estimate the additional costs of each.

6.1 Federal Outlays Associated with National Implementation

As indicated in Section 4, it is estimated that participation in school meals would increase by about 430,000 if these measures are implemented nationally. To estimate the incremental Federal costs associated with the reimbursement for the resulting meals, a number of assumption are required, including:

- The assignment of increased participation by lunch and breakfast
- The assignment of increased participation by free, reduced-price, and full-price meals
- The average number of serving days per school year

For the division by lunch and breakfast, we assume that 90 percent of the increased participation occurs at lunch and only 10 percent at breakfast. Unpublished ADP numbers collected as part of the SMPT and made available by Roper ASW indicate that this is an appropriate relationship. Given that changes in the menu are thought to be more influential in determining lunch than breakfast participation, this split makes sense. The attraction of flavored milks that are more frequently consumed with lunch than with breakfast would also suggest that a large share of the increased participation occurred at lunch.

In assigning meals to free, reduced, and full price, we have used the shares reported by FNS for SY 2001, distinguishing between breakfast and lunch. Thus, the meals are assigned as follows:

	Free	Reduced-price	Full-price
Breakfast	74.5%	8.6%	16.9%
Lunch	46.9%	9.5%	43.6%

It is further assumed that both breakfast and lunch are served 180 days each school year.

Using these assumptions and the per meal reimbursement rates effective for SY 2001/02 (including an entitlement of 15.5 cents/lunch for donated commodities) it is estimated that

Federal outlays would have been about $103.9 million higher due to the increased participation resulting from the SMPT measures (Table 9).

Table 9: Estimated Additional Federal Outlays Resulting from Increased Participation in the NSLP and SBP

	Additional lunches		Additional breakfasts	
Meal type	Meals	Outlays	Meals	Outlays
	(million)	(million $)	(million)	(million $)
Free	32.7	68.3	5.8	6.6
Reduced-price	6.6	11.2	0.7	0.6
Full-price	30.4	6.1	1.3	0.3
Total	69.7	85.6	7.8	7.5

Total additional outlays:

Lunch reimbursement	$85.6m
Breakfast reimbursement	7.5
Donated commodities	10.8
	$103.9m

6.2 Costs for Improved Packaging and Distribution Practices

Offering students a more appealing product has its costs. Compared to the paper cartons that have been used for many years, the plastic containers used in the pilot have higher material, labeling, and processing costs.

On the basis of interviews conducted with milk processors participating in the pilot, researchers from Beverage Marketing Corporation concluded that the new products cost an additional 5.4¢ to 7.4¢ per container to process and package, compared to the traditional product. The container accounted for about one-third of the incremental cost with the remainder due to labeling, additional labor requirements, and slower line speeds.

Recognizing that some of the incremental costs experienced during the pilot were due to start-up and that efficiencies could be realized through further modifications in the materials and techniques being used, processors were asked to estimate the potential cost-savings that would result from these changes. In combination, it was estimated that processors could reduce the incremental cost by 50 percent or more. With these efficiencies in place, BMC estimated that the new products would add 2.2¢ to 4.2¢ to the cost of production.

To estimate the national impact of this cost increment, it is necessary to estimate the number of units of fluid milk that would be sold through the school meals program following adoption of the new merchandising measures. Using the estimates derived in Chapter 3, we convert the estimated national sales (3,653 million pounds) to 8-ounce serving units (7,306 million units). Applying minimum and maximum estimates of incremental cost yields a range in added processor costs of $160.7 million to $306.9 million.

Equipment installed in the test schools also contributed importantly to the outcome and would be a required investment for national implementation. This included expenditures for coolers, display cases, and vending machines. In total, 120 pieces of equipment were installed in 97 schools at a cost of $408,950. With their smaller enrollments, elementary schools required fewer pieces and less expensive equipment, on average. Elementary schools averaged 1.8 pieces of equipment per school at an average cost of $1,385 per piece. For secondary schools, the comparable requirements were 2.9 pieces at an average cost of $1,728 per piece.

Applying these averages to the total number of public schools participating in the National School Lunch Program in School Year 1999/2000 yields the following estimate:

elementary – 50,140 schools X 1.8 pieces X $1,385 =	$125.0m
secondary – 27,104 schools X 2.9 pieces X $1,728 =	$135.8m
other[1] – 5,954 schools X 1.8 pieces X $1,385 =	$14.8m
	$275.6m

Assuming an average useful life of 7 years and a straight-line depreciation of the expenditure, the estimated annual cost of the required equipment is approximately $39.4million.

[1] "Other" schools have grade configurations that do not conform to the definition of either "elementary" or "secondary," e.g. schools with K-12. Since their average enrollment is only about two-thirds the average enrollment of elementary schools, we have assumed equipment requirements similar to those of elementary schools.

SECTION 7: SUMMARY AND CONCLUSIONS

The analysis reported in this paper is based on findings of the School Milk Pilot Test, a demonstration study jointly sponsored by the National Dairy Council and the American School Food Service Association. In this pilot, a national sample of elementary and secondary schools and their suppliers adopted a variety of measures designed to improve the attractiveness of the fluid milk served to the students in these schools. Of the 146 schools taking part, 99 served as "test" schools and the remaining 47 as "control" schools. The purpose of the analysis is to estimate the impact of implementing these measures nationally.

Information regarding student participation in the meals programs and the quantity of milk sales in the pilot schools was gathered daily throughout most of school year 2001/02. A comparison of findings for "test" and "control" schools revealed a net improvement of 4.4 percent in program participation in test schools at the secondary level. Differences in program participation among elementary students were not statistically significant.

The quantity of milk sold (adjusted by level of participation) increased measurably in both elementary schools (+13.9 percent) and secondary schools (+23.3 percent). Projected nationally, these rates of increase would result in an additional 62 million gallons of fluid milk marketed in schools each year.

It was found that children's diets were affected by the test in different ways. Some children were attracted to participate in school meals programs who hadn't before. Some children who were already participating in the school meals programs but weren't drinking milk with their meals were prompted to become milk drinkers. And, finally, some children remained outside the school meals programs but increased their consumption of milk through a la carte or vending machine purchases.

On the basis of the SMPT findings, it was estimated that participation in the school meals program would increase by about 430,000 students if the test measures were adopted nationwide. No measurable change in the rate of participation among elementary school students was found. A somewhat larger number of students who were already participating in the meals programs (over 2.1 million) would be attracted to the consumption of milk as a result of the actions taken to enhance the image and quality of the product.

Though most of the health consequences of children's dietary patterns do not become evident until the individual reaches middle-age or older, the economic impact associated with poor diets can be very large. Those influences that are known to be diet-related were identified and the literature was searched for evidence of the effect of dietary intervention on these conditions.

There is accumulating evidence that a dietary intervention that contributes to a lasting improvement in eating habits can have a large payoff.

To estimate the dimensions of this benefit, the health-care cost savings associated with the reduced incidence of six common illnesses for the 2.6 million children that would be directly affected by these changes were calculated. The annual savings, measured in present value dollars, were estimated to range between $0.8 billion and $1.1 billion. While this estimate is based on the most authoritative evidence available, it is necessarily dependent on assumptions and fragmentary evidence. It should therefore be considered an approximation of what would occur.

There would also be additional costs resulting from national implementation of these measures. Increased participation in the school meals programs would increase Federal outlays for meal reimbursements by around $104 million. Milk processors would incur additional costs for packaging, labeling, and product improvements. Depending on the extent of the changes required, these costs would range between $161 million and $307 million. Finally, additional coolers, display cases, and vending machines would be required in the schools. The annual depreciation charge for this equipment would be about $39 million. In total, it is estimated that these costs would be in the $300 million to $450 million range.

REFERENCES

1. Roper ASW (2002). *School Milk Pilot Study: Sales Test*, September 2001– June 2002, Dairy Management Inc. and American School Food Service Association, Unpublished.
2. Fox, M.K., M.K. Crepinsik, P. Cornor, et al. (2001). *School Nutrition Dietary Assessment Study – II: Final Report*, Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service.
3. Gleason, P. and C. Suitor (2001). *Children's Diets in the Mid-1990s: Dietary Intake and Its Relationship with School Meal Participation*, Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service.
4. Daft, L., A Arcos, A. Hallawell, et al. (1998). *School Food Purchase Study: Final Report*, Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service.
5. American Heart Association (2002). *2002 Heart and Stroke Statistical Update*.
6. American Cancer Society (2001). *Cancer Facts and Figures 2001*.
7. Javitt, J.C. and Y.P. Chiang (1995). "Economic Impact of Diabetes" in Maureen Harris, ed. *Diabetes in America*, National Institute of Diabetes and Digestive and Kidney Disease, NIH.
8. Cutler, D. (2001). *Why Has Health Improved*, Harvard University, Public Economics Seminar, September 24, 2001.
9. Frazão, E. (1999). "High Costs of Poor Eating Patterns in the United States" in Elizabeth Frazão, ed. *America's Eating Habits: Changes and Consequences*, USDA, Economic Research Service.
10. Barefield, E. (1996). "Osteoporosis-Related Hip Fractures Cost $13 Billion to $18 Billion Yearly," *Food Review*, USDA, Economic Research Service.
11. Lin, B.H., J. Guthrie, and E. Frazão (2001). "American Children's Diets Not Making the Grade," *Food Review*, USDA, Economic Research Service.
12. Daft, L., S. Abraham, B. Wilbraham (2002). *The School Meals Initiative Implementation Study: Third Year Report*, Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service.
13. U.S. Department of Commerce, Bureau of Economic Analysis (2002).
14. U.S. Department of Health and Human Services, Centers for Medicare and Medicaid Services (2002).
15. Nordhaus, W. (1999). "The Health of Nations: The Contribution of Improved Health to Living Standards," Yale University, sponsored by the National Science Foundation.
16. Fogel, R. (1994). *The Relevance of Malthus for the Study of Mortality Today: Long-Run Influences on Health, Mortality, Labor Force Participation, and Population Growth*, National Bureau of Economic Research, Historical Paper No. 54.
17. Appel, L. et al. (1997). "A Clinical Trial of the Effects of Dietary Patterns on Blood Pressure," *The New England Journal of Medicine*, Vol, 336: 1117-1124.

18. Wang, G. and W. Dietz (2002). "Economic Burden of Obesity in Youths Aged 6 to 17 Years: 1979 – 1999," *Pediatrics*, Vol. 109 No. 5.
19. Buzby, J. et al. (1996). *Bacterial Foodborne Disease: Medical Costs and Productivity Losses*, USDA, Economic Research Services, AER No. 741.
20. Beverage Marketing Corporation (2002). *School Milk Pilot Test: Enhancing School Milk*, preliminary draft, September 10, 2002, prepared for DMI and ASFSA.
21. Johnson, R., C. Panely, and M. Wang (1998). "The Association Between Noon Beverage Consumption and the Diet Quality of School-Age Children," *The Journal of Child Nutrition and Management*, 22 (2).
22. Beckles, G. and P. Thompspn-Reid, eds. (2001). *Diabetes and Women's Health Across the Life Stages: A Public Health Perspective*, U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.
23. U.S. Department of Agriculture, Food and Nutrition Service (2002). *National Date Bank.*
24. U.S. Department of Education, National Center for Education Statistics (2002). *Projection of Education Statistics.*
25. U.S. Department of Health and Human Services (2001). *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity,* Office of the Surgeon General, Public Health Service.
26. Burghardt, J. et al. (1993). *The School Nutrition Dietary Assessment Study: School Food Service, Meals Offered, and Dietary Intakes*, Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service.
27. Tuomilehto, J. et al. (2001). "Prevention of Type 2 Diabetes Mellitus by Changes in Lifestyle among Subjects with Impaired Glucose Tolerance," *The New England Journal of Medicine*, Vol. 344:1343-1350.
28. National Institute of Diabetes & Digestive & Kidney Diseases (2001). *Diet and Exercise Dramatically Delay Type 2 Diabetes: Diabetes Medication Metformin Also Effective.*
29. Pereira, M. et al. (2002). "Dairy Consumption, Obesity, and the Insulin Resistance Syndrome in Young Adults" *The Journal of the American Medical Association*, Vol. 287, No. 16.
30. Massey, L. (2001). "Dairy Food Consumption, Blood Pressure and Stoke," *Journal of Nutrition*, Vol. 131: 1875-1878.
31. Nieves, J. et al. (1995). "Teenage and Current Calcium Intake Are Related to Bone Mineral Density of the Hip and Forearm in Women Aged 30-39 Years," *American Journal of epidemiology*, Vol. 141, No.4.
32. Wyshak, G. (2000). "Teenaged Girls, Carbonated Beverage Consumption, and Bone Fractures," *Archives of Pediatrics & Adolescent Medicine*, Vol. 154: 610-613.
33. Heaney, R. (2000). "Calcium, Dairy Products and Osteoporosis," *Journal of the American College of Nutrition*, Vol. 19, No. 2: 835-995.
34. Calvo, M. (2000). "Dietary Considerations to Prevent Loss of Bone and Renal Function," *Nutrition*, Vol. 16, Numbers 7/8: 564-566.

35. Chapuy, M. et al. (1992). "Vitamin D_3 and Calcium to Prevent Hip Fractures in Elderly Women," *The New England Journal of Medicine*, Vol. 327: 1637-1642.
36. Dawson-Hughes, B. et al. (1997). "Effect of Calcium and Vitamin D Supplementation on Bone Density in Men and Women 65 Years of Age or Older," *The New England Journal of Medicine*, Vol. 337: 670-676.
37. Murphy, S. et al. (1994). "Milk Consumption and Bone Mineral Density in Middle Aged and Elderly Women," *British Medical Journal*, Vol. 308: 939-941.
38. Baron, J. et al. (1999). "Calcium Supplements for the Prevention of Colorectal Adenomes," *The New England Journal of Medicine*, Vol. 340: 101-107.
39. Lipkin, M. (1985). "Effect of Added Dietary Calcium on Colonic Epithelial-Cell Proliferation in Subjects at High Risk for Familial Colonic Cancer," *The New England Journal of Medicine*, Vol. 313: 1381-1384.
40. Sacks, F. et al. (2001). "Effects on Blood Pressure of Reduced Dietary Sodium and the Dietary Approaches to Stop Hypertension (DASH) Diet," *The New England Journal of Medicine*, Vol. 344, No.1.
41. Simons-Morton, D. et al. (1997). "Nutrient Intake and Blood Pressure in the Dietary Intervention Study in Children," *Hypertension*, Vol. 29, No. 4.
42. Bucher, H. et al. (1996). "Effects of Dietary Calcium Supplementation on Blood Pressure," *Journal of the American Medical Association*, Vol. 275, No. 13.
43. Conlin, P. et al. (2000). "The Effect of Dietary Patterns on Blood Pressure Control in Hypertensive Patients: Results From the Dietary Approaches to Stop Hypertension (DASH) Trial," *American Journal of Hypertension*, Vol. 13: 949-955.
44. McCarron, D. et al. (1984). "Blood Pressure and Nutrient Intake in the United States," *Science*, Vol. 224.
45. Davies, K. et al. (2000). "Calcium Intake and Body Weight," *The Journal of Clinical Endocrinology & Metabolism*, Vol. 85: 4635-4638.
46. Beverage Marketing Corporation (2002)."School Milk Pilot Test: Enhancing School Milk," Dairy Management Inc. and the American School Food Service Association, Unpublished, September 16, 2002.
47. National Institutes of Health (1985). "CARDIA Protocol: Nutrition," NUT1-22.