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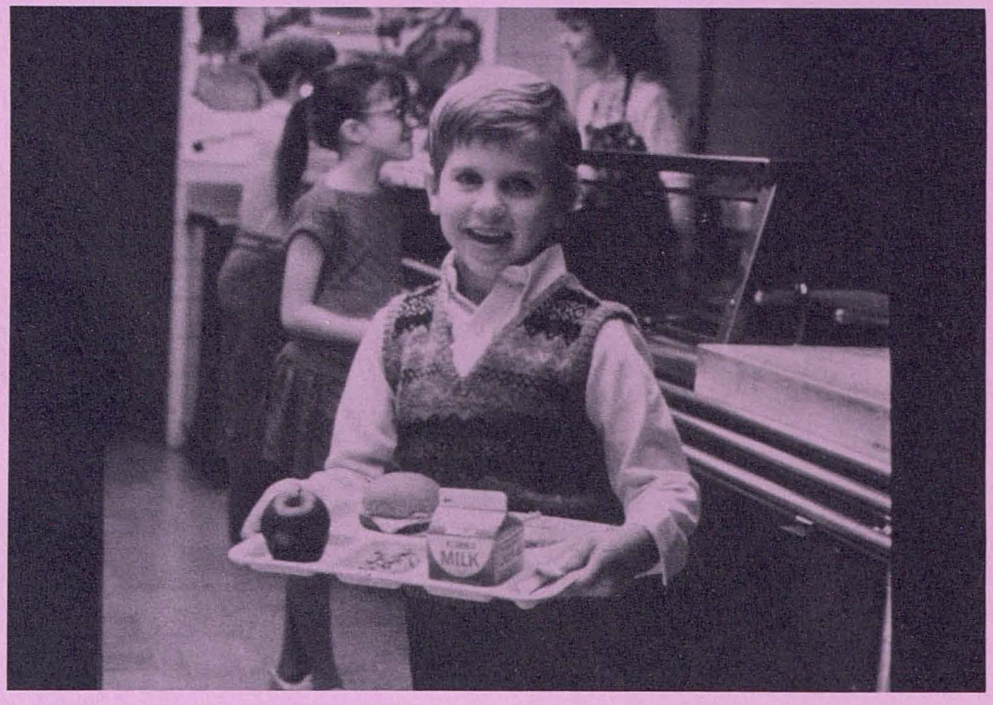
Determinants of Milk Use in the Public Schools of Pennsylvania



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DETERMINANTS OF MILK USE IN THE PUBLIC SCHOOLS OF PENNSYLVANIA

Blair J. Smith and Jack J. Kirkland[1]

INTRODUCTION

The dairy industry has long promoted the idea of making milk available in public schools, both in the United States and in many other developed countries of the world as well. That they are supported by the general public in this matter is evidenced by the presence of free or reduced-price milk in the public schools of many countries today. In 1982, for example, sales of fluid milk in schools were estimated at 7.0, 15.2, and 6.2 percent of all milk sales in Belgium, Japan, and the United States, respectively [1]. In all three of these countries school milk sales were subsidized with public funds.

Presumably, public support of school milk schemes is motivated out of concern for the nutritional well-being of school children. The general public (and the dairy industry) seems to believe that higher milk consumption in our public schools is preferable to lower levels of consumption. The purpose of this research is to identify factors which may explain differences in the levels of consumption of milk in the public schools of Pennsylvania.

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RELATED STUDIES

A study of the quality of school milk and the patterns of milk consumption in 271 public schools (195 elementary, 36 middle, 40 high) in Connecticut was conducted throughout the 1978-79 school year [2]. Although several measures of quality were established, no attempts to relate quality to levels of consumption were reported. Preferences for type of milk among the students in the public schools studied were reported. Strong preferences for chocolate over whole white milk were found within all categories of schools where both products were offered. Elementary and middle school students were found to prefer chocolate over white in the ratio of about 2.6 to 1.0, but this ratio was only about 1.5 to 1.0 among high school students. An analysis of milk waste was included in the study, and it was found that a higher proportion of whole white than chocolate was wasted.

In the fall of 1983 researchers at Cornell mailed a questionnaire, focusing on school milk, to every one of the 709 public school districts in New York [3]. The results they reported are based on a usable response rate of 29 percent. Average daily consumption was 0.84 half pints per student in the 1982-83 school year. A negative correlation between average daily consumption of milk and number of students in the district was discovered. No significant relationships were found between average daily consumption and (a) chocolate milk's share of total beverage sales, (b) the price of whole white milk, or (c) the price of chocolate milk. Among the responding school districts, 72 percent offered chocolate milk for lunch. Presumably

(although this was not made explicit in the report) 100 percent of the districts offered whole white milk. On a volume basis, chocolate milk accounted for 37 percent of all milk beverage sales, and whole white accounted for 44 percent. The remainder was comprised of skim and low fat milks. If chocolate had been offered in all the school districts, sales of chocolate most likely would have exceeded sales of white milk on a per student basis.

In the spring of 1987, a survey was sent to cafeteria managers in 12,000 schools in eight southeastern states under the sponsorship of the Southeast United Dairy Industry Association [4]. Completed questionnaires were received from 2,161 schools. Some key findings pertinent to our study are:

(a) Virtually all of the schools participated in the National School Lunch Program, and 82 percent of the students in those schools ate lunch in the school's cafeteria. The "offer vs. serve" program was operative in 63 percent of the elementary schools, 88 percent of the middle schools, and 95 percent of the high schools.

(b) The actual quantities of milk beverages consumed were not reported. Percentages of schools offering the several different milk products were provided. The frequencies at which students chose particular products were determined only for "any milk product" (84%) and for "any chocolate product" (74% of the 84% choosing milk). The preference for chocolate does seem to be very strong, but there is no direct way of comparing chocolate milk sales to sales of any of the other products because actual volumes by type of product were not provided.

DATA

Two principal sets of data serve as the basis for the analysis reported in this article. One was provided by the Pennsylvania Department of Education (PDE), the other was obtained by way of a direct mail survey of Pennsylvania public school district food service directors.

The PDE provided the following for each of Pennsylvania's 500 school districts for the 1986-87 academic year:

> Average Daily Attendance
> Numbers of School Breakfasts and School Lunches Served
> Numbers of Lunches Served Free or at Reduced Prices
> Racial-Ethnic Composition of the Student Body
> Mailing Labels for the District Administrative Offices, and
> Names of the District Food Service Directors.

The primary survey instrument was mailed out on October 15, 1987. The Total Design Method of Dillman [5] was followed except that a certified letter for the final mailing was not used. By the end of December 1987, following several reminders, 443 completed questionnaires had been returned for a response rate of 88.6 percent. Ultimately, 413 of these were determined to be usable and serve as the basis for our analysis.

RESULTS

Key Characteristics of School Lunch and Milk Programs

It was found that all respondent districts had a school lunch program, 15 percent had a school breakfast program, and 19 percent participated in the special milk program. Chocolate milk was available to students in 78 percent of the elementary schools in the reporting districts. However, in 27 percent of those school districts where chocolate milk was available at the elementary level, there were restrictions imposed as to frequency of offering (days per week) and/or numbers of cartons students were permitted to purchase with any one meal. The average number of different types of products offered was 3.3 per school district. Virtually all the districts (98.6 percent) reported offering an unflavored lowfat or skim product, as required for participation in the National School Lunch Program. Either a whole or lowfat chocolate product, or both, were offered in one or more schools in 97 percent of the reporting districts. How many individual schools within each district offered a chocolate-flavored milk was not determined.

Table 1 provides additional detail regarding the types of product available to students. In the final column there are estimates of what the overall preferences for each product would be if they were available in every school district. Table 2 shows the characteristics of school districts with respect to several key variables. These variables, along with others to be discussed later, were used in the multivariate analyses reported in the next section of this report.

Table 1: Share of Milk Sales by Product Type and Prevalence of Product Offering in Pennsylvania Public School Districts.

Product Type	Actual Share of Sales (% of total milk sales)	Prevalence of Offering (% of school districts)	Hypothetically Extended Share of Sales (% of total milk sales)[a]
Unflavored milk:			
Whole	26.9	90.0	17.9
2% lowfat	10.7	67.2	9.5
1% lowfat	1.1	7.7	8.3
Skim	3.2	55.5	3.6
Chocolate Flavored Milk:			
Whole	15.6	42.6	22.0
Lowfat	42.5	65.8	38.7
Total	100.0	b	100.0

[a] The numbers in this column are derived by dividing Actual Share of Sales by Prevalence of Offering and scaling the resulting figure to sum to 100. They are, roughly, the shares that each type of product would be expected to command were they all to be offered in all school districts. A key assumption here is that students in schools not now receiving any particular product would consume that product in the same relative quantities as those students who are in schools that do already offer that product.

[b] The sum here is considerably greater than 100 because of multiple offerings of types of products.

Table 2: Key Major Characteristics of Pennsylvania's Public School Districts

Characteristic	Values		
	Average	Minimum	Maximum
LUNCH = Percent of students participating in the school lunch program	59.8	18.9	89.0
FREE = Percent of lunches served free or at reduced prices	31.9	1.3	96.0
OFFER = Percent of elementary schools on "offer vs. serve"[a]	83.0	0.0	100.0
DRINKS = Percent of school districts serving non-milk beverages during lunch	63.4	b	b
URBAN = Percent urban (1980 census definition)	55.0	0.0	100.0
ATTEND = Average daily attendance (numbers of students)	3,038	256	161,708
PRICE = Price charged students for milk, cents per half-pint	23.1	5.0[c]	35.0[c]
MILK = Half pints of milk purchased per student per day	0.73	0.1	1.9

[a] The alternative to "offer vs. serve" is simply "serve." In the former case, the student makes his/her own food selections. In the latter case the student merely takes what is placed on his/her tray by the food service worker.

[b] Percentages are not relevant here. The school district simply either did or did not make drinks other than milk available during the lunch period.

[c] Prices ranged from 5 to 35 cents for all products except 1% lowfat which ranged from 15 to 30) and whole chocolate (which ranged from 0 to 35).

Multivariate Analysis

The key dependent variable of interest was milk consumption per student per day (MILK). The MAXR variant of the stepwise regression model [6] was used to sort through the variables hypothesized to have explanatory usefulness. Early in the analysis, it became evident that the variable explaining the most variation in level of milk consumption was rate of student participation in the school lunch program (LUNCH). Attention was then directed toward explaining variation in LUNCH before returning to the initial, key variable of interest, MILK.

Participation in the School Lunch Program (LUNCH).

The results of the analysis which focused on LUNCH are summarized in Table 3. All the coefficients have signs that confirm they are related to LUNCH in the expected manner. The dominance of URBAN in the estimating equation is evident in the relative sizes of the student's t-values. In fact, URBAN was the first variable to enter the stepwise regression, and immediately accounted for 23 percent of the variation in LUNCH. After the other four variables had entered, the R-square increased to only 0.27, thus explaining only an additional four percent of the variation in the percent of students participating in a district's school lunch program (LUNCH).

Most of the coefficients (with the exception of PRICE and URBAN) are relatively small in comparison to the mean values for the variable included in the equation. This is evident from the figures in the last column of Table 3. For example, in order to increase participation in

Table 3: Statistics from the Equation Used to Explain Participation in the School Lunch Program (LUNCH)

Variable[a]	Statistics			
	Regression Coefficient	Mean Values	Student's t-value[b]	Change needed to Increase LUNCH one percent[c]
Intercept	72.55954	-	19.239	-
FREE	0.07201	31.9	2.348	+13.9
OFFER	0.03870	83.0	2.665	+25.8
PRICE	- 0.30347	23.1	-2.028	-3.3
ATTEND	- 0.00011	3,038	-1.755	-8,728
URBAN	-0.19761	55.0	-9.433	-5.1

Total number of observations -- 382
F - value for the analysis of variance -- 27.4[d]
R - square -- 0.27

[a] As defined in Table 2.

[b] All coefficients are statistically significant at the ten percent probability level or less.

[c] The change in the independent variable needed to increase the dependent variable by one percent (from 59.8 to 60.8 percent, for example, at the mean)

[d] Significant at the 0.0001 probability level.

the school lunch program (LUNCH) by one percent, the percent of lunches served free or at reduced prices (FREE) would need to be increased by 13.9 percent. This would require FREE to go from 31.9 percent, its mean value, to 45.8 percent. It probably is not possible to increase FREE to this degree in a short period of time within a given school district. Nevertheless, the range of FREE within the 382 school districts in the sample is 1.3 to 96.0 percent, implying a difference in LUNCH among these districts of 6.8 percent [(96.0 - 1.3) ÷ 13.9] attributable to FREE.

Similar interpretations can be applied to the other explanatory (independent) variables. A brief discussion about PRICE (price charged students for milk, cents per half-pint) is in order. PRICE is an important explanatory variable for the MILK (half-pints of milk drunk per student per day) equation reported in the next section of this article. As used in the present equation (LUNCH), MILK is a proxy for, or indicator of, school lunch prices. Unfortunately, data on school lunch prices were not obtained in the school survey, so the actual nature of the correspondence between school milk prices and school lunch prices could not be established. We would expect school lunch participation to vary inversely with school lunch price, all other things being equal.

Milk Consumption per Student per Day (MILK)

The results of the model finally chosen to explain MILK are summarized in Table 4. As previously mentioned, LUNCH was a very strong explanatory variable for MILK. Table 4 shows an R-square of 0.27 for the three variable model. The dominance of LUNCH in the final model is attested to by the fact that the R-square was 0.24 after just the first variable (LUNCH) was incorporated into the model. Thus, the addition of PRICE and DRINKS did not add much to the explanatory power of the model. Nevertheless, the signs of their coefficients are as expected, and they are statistically significant at low levels of probability.

The figures in the final column of Table 4 are another way of illustrating the importance and potential impact of variation in the independent variables on the level of MILK. In Table 2 it is shown that LUNCH ranged from 18.9 to 89.0 percent in the sample school districts. This is a range of 70.1 percent, and implies a potential difference in MILK of 0.62 half-pints between the school district with the lowest level of LUNCH and the one with the highest level of LUNCH [(70.1 $\div$ 11.3) x (0.1)]

Table 4: Statistics from the Equation Used to Explain Milk Consumed per Student per Day (MILK)

Variable[a]	Statistics			
	Regression Coefficient	Mean Values	Student's t-value[b]	Change needed to increase MILK 0.1 half-pints[c]
Intercept	0.42960	-	-	-
LUNCH	0.00889	59.8	9.853	+ 11.3
PRICE	- 0.00892	23.1	- 3.071	- 11.2
DRINKS	- 0.04369	0.63	- 1.972	c
Total number of observations			-- 382	
F - value for the analysis of variance			-- 46.3[d]	
R - square			-- 0.27	

[a] As defined in Table 2

[b] All coefficients are statistically significant at the five percent probability level or less.

[c] The change in the independent variable needed to increase the dependent variable by 0.1 half-pints (from 0.73 to 0.83, for example, at the mean). Since DRINKS is a zero-one variable, the coefficient for drinks tells us that in those school districts where drinks other than milk are available during the school lunch period, students drink 0.04 fewer half pints of milk each day.

[d] Significant at the 0.0001 probability level.

Although reducing the price of milk (PRICE) would be expected to increase milk consumption, the potential is not great because prices would have to be cut almost in half to generate just a 0.1 half-pint increase in MILK. To stop offering other drinks at lunch would not seem to show much promise either, because to do so would be expected to increase milk consumption by only 0.04 half-pints.

DISCUSSION

Results are presented on the basis of entire school districts, not individual schools or individual students. Among the 500 public school districts in Pennsylvania, the number of school buildings ranged from 1 to 256. Thus, there is a rather high degree of aggregation in the data in most cases, and the overall explanatory power (R-squares) of the estimating equations are rather low. Because of the large number of observations fairly high levels of significance for the relationships tested were found, however, and the signs of the regression coefficients were in accordance with prior expectations.

The data on milk sales by type of product (Table 1) show a clear and strong preference for lowfat chocolate.[2] The least preferred milk product would seem to be unflavored skim milk. National school lunch rules, as of the 1987-88 school year, require the offering of a whole milk (flavored or unflavored) and a white lowfat or skim milk beverage (or buttermilk), in order to be eligible for subsidies from state and federal funds. If a school cafeteria is limited to serving only two milk beverages, one of them, of course, must be whole milk (either white or chocolate). For the second milk beverage, it is clear white

skim milk would lose out to the 1 percent and 2 percent lowfat white products, if a school's goal is to maximize milk consumption by public school students. A slight preference for the 2 percent product is indicated in Table 1, but further analysis is required before it can be asserted with confidence 2 percent would be the best choice for the second milk beverage. One-percent milk might have the advantage of being the better compromise between whole milk (3.25% butter fat) and skim milk (less than 0.5% butter fat). Preference for skim milk and one percent milk might increase if they were fortified with added non-fat milk solids to improve their flavor, but little of either fortified product is currently being bottled in Pennsylvania. The fact remains-- a lot of school districts offer skim milk (mostly unfortified), and there are very few takers. If there is the opportunity to offer three products, there is no doubt the third product ought to be lowfat chocolate, again assuming a goal of maximum milk consumption on a per student basis.

The multi-variate analysis showed clearly that participation in the school lunch program (LUNCH) was the primary determinant of milk consumption (MILK). LUNCH, on a district to district basis, varied from 18.9 to 89.0 percent, with 59.8 as the mean rate of participation (Table 2).[3] MILK, on the other hand, ranged more widely, from 0.1 to 1.9 half-pints per student per day, with a mean of 0.73 half-pints (Table 2).[4] There was no way to separate milk drinkers into those who ate the school's lunch from those who didn't, since milk was made available on an a-la-carte basis in all the districts. If all the milk purchased was assumed to be attributable only to school lunch

participants, however, the average rate of consumption would be 1.2 half-pints, with a range of 0.1 to 3.0 half-pints per student.

As shown in Table 3, the way to increase LUNCH is to increase FREE and OFFER, and to decrease PRICE, ATTEND, and URBAN.[5] Of course, ATTEND and URBAN are largely dependent on size and location of the school district, and these factors are outside the control of school administrators. In the present case, they simply help explain variation in LUNCH. Local school administrators may not have much control over FREE, either, as the criteria for eligibility for free or reduced price lunches are established elsewhere. If the price of milk (PRICE) is an adequate proxy for the price of school lunches generally, then reducing the price of school lunches would clearly increase LUNCH. Not many food service supervisors are likely to feel there is a lot of remaining unexploited opportunity there, however. The final, remaining variable, OFFER (percent of elementary schools on "offer vs. serve"), is a variable that would seem to be clearly under the control of local school district administrators. Although the mean value of OFFER is already high at 83.0, its range is from 0 to 100 (Table 2). This certainly implies a potential for increasing LUNCH within the districts with low levels of OFFER.

Aside from finding ways to increase LUNCH as a way of increasing MILK, changing two other variables, both largely under the control of local school district administrators, may be considered. The most direct one, of course, is PRICE. But the predicted effect would be small. To increase MILK by only 0.1 half-pints would require a reduction in price of 11.2 cents (Table 4). This would be roughly

equivalent to cutting the price of milk in half, on average (from 23.1 to 11.9 cents). The other variable that might be manipulated to increase MILK is DRINKS (the availability of non-milk beverages during the school lunch period). Nevertheless, the analysis shows that even if those districts that do offer competing beverages were to cease doing so, an increase in MILK of only 0.04 half-pints per student per day would be expected to take place.

Again, for emphasis, a word of caution. The data on which all the preceding analysis is based are highly aggregated. Thus, much of the variation that exists among individual schools is masked. Since this variation is masked, the potentials for both increasing LUNCH and MILK within any particular school can only be highly generalized, as they have in this report. Further analysis of the present data is contemplated and will be reported in other publications. Also, individual school visits will later be conducted in an attempt to better quantify the variation that does exist from school to school.

SUMMARY

The specific purpose of the survey reported here was to determine and explain differences in levels of milk consumption among Pennsylvania public school districts. A mail survey to all 500 Pennsylvania school district food service directors resulted in 413 usable returns. This information, along with certain key data from the Pennsylvania Department of Education, form the basis for the findings and conclusions reported in this article.

The key variable of ultimate interest was the number of half-pints

of milk consumed per student per day (MILK). This variable ranged in value from 0.1 to 1.9, with 0.73 for a mean. Multivariate analyses of the data showed that participation in the school lunch program (LUNCH) was by far the most important "explainer" of MILK (accounting for 24 percent of the variation). In turn, the percent of the people living in the county in which the school district was located who were defined to be urban in the 1980 census of population was by far the most important "explainer" of LUNCH (accounting, also, for 24 percent of the total variation).

Other variables whose regression coefficients were statistically significant and of the right sign in the equation for LUNCH were: percent of lunches served free or at reduced prices; percent of elementary schools on "offer vs serve"; price of milk (as a presumed proxy for price of the school lunch), and; average daily attendance in the school district. The addition of all four of these variables increased the multiple correlation coefficient (R^2) by only four percent, however, bringing to 27 the percent of total variation explained by the entire estimating equation.

Other variables in the MILK equation that were statistically significant with the anticipated sign were: the price of milk, and; whether or not other drinks were available during the school lunch period. Again, but strictly by coincidence, the addition of these two variables increased R^2 only to 0.27, an increase in the explanatory power of the equation of only three percent.

It is clear the milk beverage of first choice, where offered, is lowfat chocolate. It is even clearer the milk beverage least desired

by students, where offered, is white skim milk. Either 1% or 2% lowfat white milk should be used to fulfill the requirement for a lowfat or skim white product, if a goal is to increase milk consumption in public schools. Federal regulations now require that whole milk be offered (beginning with the 1987-88 academic year) in addition to a white lowfat or skim product. Thus, in order to offer lowfat chocolate, the school cafeteria must have the capacity to handle at least three different milk products. If such capacity does not exist, the new school lunch milk requirement effectively prevents offering the milk beverage most desired by public school students.

Because data were obtained and analyzed on the basis of entire school districts, much of the variation in the key variables of interest may have been obscured. Additional analyses of the present data are contemplated. In later research, data will be obtained from individual schools in an attempt to further advance our understanding of what drives the consumption of milk in the public schools of Pennsylvania.

FOOTNOTES

[2] Hankin, et al. [2] also showed there was a strong preference for chocolate over white when both products were offered. A similar preference can be inferred from the data in Boynton and Bandler [3]. A strong preference for chocolate was apparent, too, in Lenox [4].

[3] The mean rate of participation in the school lunch program in the eight southeastern states included in the Lenox study [4] was reported to be 82 percent.

[4] Average daily consumption per student was estimated to be 0.84 half pints in Boynton and Bandler [3].

[5] It was reported in Boynton and Bandler [3] that ATTEND and MILK were negatively correlated, which agrees with our findings here. It was also asserted that neither the price of whole white or chocolate milk were significantly related to MILK. We found a significant negative relationship between MILK and PRICE, but it was, of course, quite small.

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