

A pilot study to observe nutrition-related behaviors associated with lead poisoning risk among urban preschool children

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Abstract

Research shows that 48% of the children living in Newark, New Jersey suffer from elevated blood lead levels due to high doses of lead in their immediate environment.(1) Calcium, vitamin C, and iron, as well as engagement in certain behaviors, e.g. frequent hand washing, decreased hand to mouth activity, etc., are potentially viable means of decreasing lead absorption in children. An analysis of plate waste to determine the consumption of the aforementioned nutrients; and, assessment of engagement in said behaviors, was conducted at nine Head Start sites in Newark, as was an assessment of the food planned and offered to the children at these sites. Although the average amount of calcium, vitamin C, and iron, planned and offered, across the nine sites met the goal of 67% of the Reference Daily Intake (RDI), children in five of the nine sites consumed an inadequate amount of each nutrient for lead poisoning prevention. Teacher practices were found to greatly impact nutrient consumption, as well as children's engagement in pertinent behaviors.

Purpose

The purpose of this research was to:

- Examine dietary and other precautionary behaviors that influence lead poisoning risk reduction for children at Head Start; and
- Develop recommendations for future data collection at Head Start regarding these variables.

Background

Approximately 48% of the children age 2-8 years old, living in Newark, New Jersey suffer from lead poisoning.(1) Lead poisoning in children can result in: learning disabilities, hyperactivity, decreased muscle and bone growth, and behavioral problems. Numerous attempts have been made to remove lead from the environment, however the presence of lead in northeastern urban communities is so pervasive that lead exposure is inevitable for children residing in these areas.

Research suggests that lead poisoning risk can be reduced by increased intake of certain nutrients in the diet, and engagement in precautionary behaviors. These nutrients and behaviors are listed in Table 1.

Table 1. Nutrients and behaviors that reduce risk for lead poisoning

Nutrients	Behaviors
■ Calcium ²	■ Reduced hand to mouth activity ¹
■ Vitamin C ²	■ Frequent hand washing ³
■ Iron ²	■ Provision of a clean, dust-free environment ³
	■ Frequent meals and snacks

The Newark Preschool Council's Head Start Program provides childcare to approximately 25% of Newark's 22,118 children, aged 3-5 years. Monday through Friday these children spend 7.5 hours per day at Head Start, where they receive two meals and one snack. Teachers and staff strongly impact children's actions(4), therefore a comprehensive behavioral assessment at Head Start, or any similar facility, should not only include evaluation of the children's behaviors, but of the teachers' and staffs' as well.

Methods

To assess the children's diets, as well as precautionary behaviors for reducing lead poisoning risk, the following were examined:

- The amount of calcium, vitamin C, and iron intended for children's consumption according to the menu planned by Head Start administration;
- The amount of calcium, vitamin C, and iron actually offered by Head Start teachers and staff;
- The amount of calcium, vitamin C, and iron consumed by Head Start children;
- The children's behaviors, e.g. frequent hand washing, decreased hand to mouth activity, etc.; and
- Teacher and staff practices that encouraged or discouraged consumption of pertinent nutrients and/or engagement in precautionary behaviors.

A questionnaire was developed for assessment of the variables to be evaluated at the nine Head Start sites that were to be examined. To evaluate the menu plan and corresponding nutrients, monthly menus were obtained from the Head Start administration. The nutrient content of the foods included in the menu was then calculated using the Nutritionist V software package.

At the Head Start sites, researchers conducted a before-and-after plate waste analysis by measuring the amount of food offered and subtracting the amount remaining, thereby determining both the quantity of food offered, and the actual amount of food that was consumed by the children. Questionnaires regarding

children's hand to mouth activity, frequency of hand washing, and teacher practices that influenced these behaviors, as well as children's consumption of calcium, vitamin C, and iron were completed based on the researchers' observations.

Results

Head Start requires that children participating in the program consume breakfast, lunch, and an afternoon snack at the site they attend; however, this regulation is not strictly enforced, which impacts the nutrition that children would otherwise be guaranteed as part of their participation. As is evidenced in [Table 1](#), not all children at full-day facilities are present for breakfast and/or their snack, as parents sometimes drop them off late or pick them up early. Further, of those children present, not all consume the meals and snacks offered.

Table 2. Number of children present at each meal (N) compared to the number of children who actually ate the meal (N').

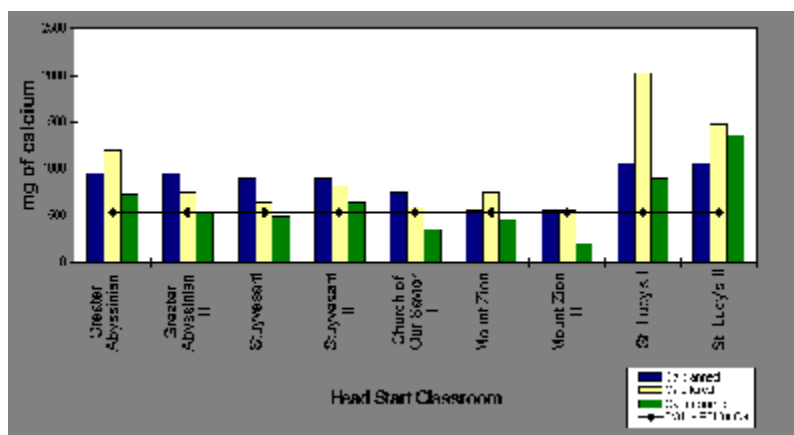
Site	Breakfast			Lunch			Afternoon Snack ⁺		
	N	N'	%	N	N'	%	N	N'	%
Greater Abyssinian I	11	7	64	14	14	100	11	8	73
Greater Abyssinian II	11	10	91	17	17	100	17	15	88
Stuyvesant I	19	19	100	19	19	100	19	16	84
Stuyvesant II	17	17	100	16	16	100	15	14	93
Church of Our Savior I*	14	11	79	17	14	82	9	5	56
Mount Zion I	14	11	79	15	14	93	12	12	100
Mount Zion II*	11	5	45	6	5	83	6	6	100
St. Lucy's I*	5	5	100	5	5	100	10	7	70
St. Lucy's II	8	7	88	9	9	100	7	6	86
Total	110	92	84	118	113	96	110	89	81

Notes: + it is specified that the children recorded ate their snack in the class because a number of children took their snack home and we are unable to determine how much of their snack was consumed, if any at all. * indicates split day classrooms.

Calcium

As seen in Figure 1, the amount of calcium planned and offered met or exceeded 536 mg, 67% of the 800 mg DRI, in all nine sites over the two-week period. The average amount of calcium planned was 853.6 mg $\pm$ 188.7 mg and offered was 980.4 mg $\pm$ 495.8 mg. Children in 5 of the 9 Head Start sites consumed an inadequate amount of calcium, averaging 630.9 mg $\pm$ 340.8 mg.

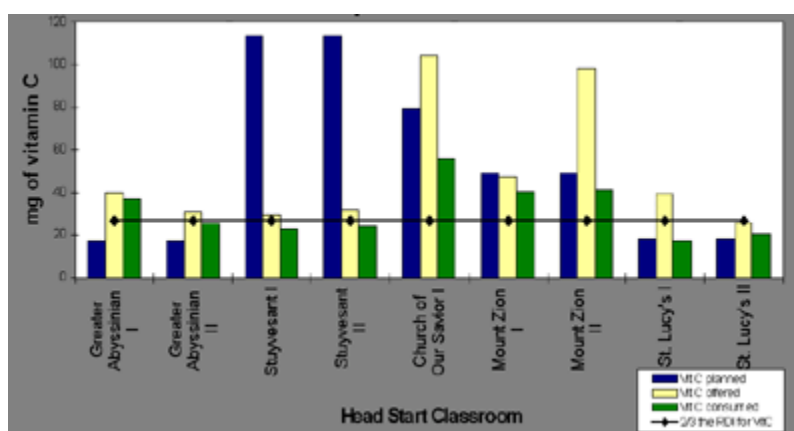
Figure 1. Amount of calcium in milligrams (mg) planned, offered to, and consumed by Head Start children compared to 67% of the Recommended Daily Intake (RDI).



Vitamin C

The amount of vitamin C planned averaged 52.9 mg * 40.3 mg, and did not meet 67% of the 40 mg DRI in 4 of the 9 sites (Figure 2). However, Head Start teachers and staff offered an adequate amount of vitamin C in 8 of the 9 sites, averaging 49.7 mg * 30.1 mg. An insufficient amount of vitamin C was consumed by children in 5 of the 9 sites, with an average of 31.7 mg * 12.5 mg.

Figure 2. Amount of vitamin C in milligrams (mg) planned, offered to, and consumed by Head Start children compared to 67% of the Recommended Daily Intake (RDI).

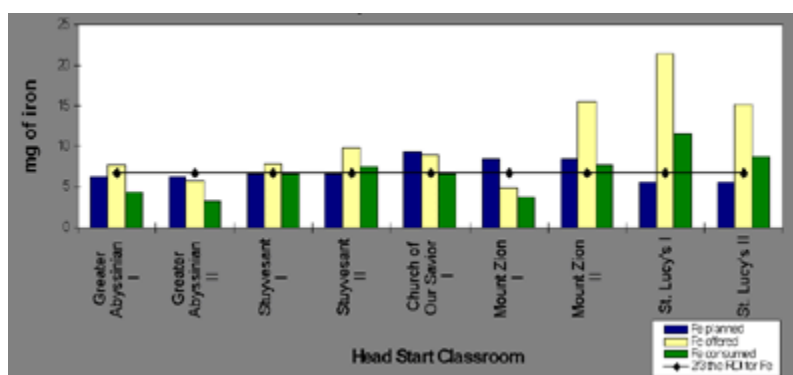


Iron

An inadequate amount of iron was planned by Head Start administration in 6 of the 9 sites, averaging only 7.0 mg * 1.4 mg, of the 6.7 mg needed (Table 4). Likewise, teachers and staff did not offer an adequate amount of iron in 7 out of 9 sites, with an average of 10.8 mg * 5.4 mg per child. Finally, children's consumption of iron did not meet 67% of the DRI in 5 of the 9 sites, averaging 6.6 mg * 2.7 mg.

Figure 3. Amount of iron in milligrams (mg) planned, offered to, and consumed by Head Start children compared to 67% of the Recommended Daily Intake (RDI). Table

3



As seen in Table 3, a variety of teacher and staff behaviors resulted in an increased or decreased consumption of calcium, vitamin C, and iron among the preschool children.

Table 3. Teacher and staff practices that influenced calcium, vitamin C, and iron consumption among preschool children

Increased consumption	Decreased consumption
- Initiated the serving of each food - Enforced the rule that requires children to eat their breakfast, lunch and snack at Head Start - Were actively engaged in the meal, i.e. paid attention to the children, sat with the children, etc. - Offered adequate amounts of each food - Placed food within arms reach of the children - Required all children to sit at the table, even if they claimed they were not hungry	- Left children to initiate the serving of their own food - Excused children from eating their breakfast, lunch, and snack at Head Start

- Required children to finish their milk before they could eat dessert
- Verbally encouraged consumption
- Encouraged children to "try everything"
- Sat away from the table and socialized with each other or paid little attention to the children
- Made inadequate amounts of each food available
- Placed food in the center of the table, out of arms reach of the children
- Excused children who were not hungry from sitting at the table and allowed them to read books or play with other toys during mealtime

Discussion

Some studies have been designed to analyze the dietary practices of Head Start children, however, they did not:

- Compare the amount of nutrients provided by the menu to 67% of the DRI for each nutrient, an amount minimally adequate for lead poisoning prevention, or
- Observe behaviors specific to nutritional practices that help reduce lead poisoning.

Head Start requires that children attending full day programs must consume their breakfast, lunch, and one snack at the facility. While children were generally present for breakfast, as is evident in [Table 1](#), about 84% of the children present at breakfast did not actually consume the meal. This was due to several factors including children's

consumption of breakfast prior to arriving at Head Start, arriving late to the classroom, and teachers not requiring all children to sit at the table and eat breakfast. However, 96% of the 118 children consumed lunch at Head Start. Although the consumption of lunch was more strongly mandated by teachers and staff, split day afternoon classrooms experienced a situation similar to breakfast, wherein many of the children arriving to the afternoon class had eaten lunch prior to arriving at Head Start. Finally, the consumption of afternoon snack was often interrupted by parents coming to pick up their children, resulting in an average of only 81% of the children consuming their snack at the sites. Teachers and staff allowed the children to bring their snack home with them, however our research was not able to determine the amount of snack these children actually consumed.

There were several food items that appeared on the menu whose presence positively or negatively influenced the amount of pertinent nutrient consumption. Calcium intake was increased by offering milk, cheese, or other dairy products. Calcium intake decreased when: juice was served in competition with milk and when the amount of calcium offered did not meet the amount planned. Vitamin C intake was increased by offering pineapple juice and orange juice. Iron intake was increased by offering more meat at lunch than the amount planned, and by offering additional meat at lunch.

As is apparent in [Table 3](#), several teacher and staff behaviors resulted in adequate consumption of vitamin C, calcium, and iron. One of the most effective behaviors was the teacher mandating that every child consume each meal served. In classrooms where children were allowed to read books or play during mealtime, decreased nutrient consumption resulted.

Hand to mouth activity, which can result in increased intake of lead-containing dirt, was observed among several children in each classroom. Teachers were rarely seen discouraging this behavior. Hand washing, however, was greatly encouraged in the majority of the classrooms. Children were brought to the bathroom to wash their hands before every meal and sometimes again at the conclusion of the meal. Having sinks located in the classroom resulted in more frequent hand washing.

Teachers and food service staff indicated the following food allergies among the children studied: juice, milk, peaches, and acidic food. However, overall food consumption was not greatly affected by these allergies, as only one child exhibited each allergy.

Conclusion

More attention should be given to research and recommendations for the planning, offering, and consumption of menu items in Head Start facilities. At present, menus are planned using only the Child and Adult Care Food Program (CACFP) guidelines for menu planning, which are based on a specified number of servings for foods from each of the food groups. Analyses of actual nutrient content of the menus created

should be required. To increase the likelihood of sufficient vitamin C and calcium consumption, pineapple and orange juice should be served more often, and consideration should be given to serving calcium-fortified juices. To increase calcium consumption while remaining compliant with CACFP guidelines, it would be practical to replace the fruit juice served at breakfast with a fruit serving other than juice. This substitution would lessen the tendency of juice consumption to displace milk consumption.

Food served by site teachers and staff should be consistent with the menus planned to increase the likelihood of adequate consumption of calcium, vitamin C, and iron. Additionally, the rule that requires all children to participate in each meal should be enforced and education should be done with parents to ensure that they understand the significance of this mandate. Because the staff plays such a large role in the children's eating behaviors, both the teachers and food service staff should receive education regarding their role in decreasing lead poisoning risk among children.

Further research is needed to determine how the present teacher and staff behaviors in Head Start classrooms compare to those outlined in the Head Start policy manual. It would also be interesting to observe the behaviors of the children in the fall, when they are adjusting to the program, compared to their behaviors in the spring. A more definitive protocol for data collection should be determined to guarantee the most accurate and consistent results possible, and additional classroom observations are necessary to further examine variables identified in this study.

Focus groups should be conducted with Head Start teachers and food service staff to obtain their insights regarding the most feasible methods for implementing practices found to reduce children's risk of lead poisoning in the Head Start classroom. Also, interviews should be conducted with Head Start administration to determine possible areas for policy change in the classroom.

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