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# Micronutrient Supplement Decreases Diarrhea and Respiratory Morbidity in Rural Honduran Children.

Laura Feeney<sup>1</sup>, Amy Paxton-Aiken<sup>1</sup>, Kerri Kruse<sup>1</sup>, Jeffrey E. Heck<sup>1</sup>, Richard Buten<sup>1</sup> and Gregory A. Reinhart<sup>2</sup>

<sup>1</sup>Shoulder to Shoulder, Asheville, NC; <sup>2</sup>The Mathile Institute for the Advancement of Human Nutrition\*, Dayton, OH



## ABSTRACT

Diarrhea and acute bronchitis are among the top 10 diagnoses among children 84 months and younger in the southern Intibucá region of Honduras. Micronutrient deficiencies, particularly of iron and zinc, likely contribute to this high rate of morbidity. This study investigated the relationship between micronutrient supplementation and diarrhea and acute bronchitis morbidity. Children (n=2,686) from six municipalities in Intibucá, ages 6-60 months at study initiation, received the supplement Chispuditos® daily for 12 months. Chispuditos is a corn and soy-based beverage fortified with 21 vitamins/minerals including iron (12 mg/ serving) and zinc (9 mg/serving). Number of clinic visits at two main health centers with a diagnosis of diarrhea or acute bronchitis was collected for all children under 84 months. Monthly incidences of diarrhea and acute bronchitis were reduced by 46% (p<.01) and 21% (p<.20) respectively for the intervention period compared to the 12 months prior. Monthly incidences of diarrhea and acute bronchitis were reduced by 78% (p<.01) and 73% (p<.01) respectively for the intervention period compared to children 0-84 months in the same region that did not receive Chispuditos. These results support a relationship between micronutrient supplementation and decreased diarrhea and acute bronchitis morbidity in a community based setting.

## RESEARCH OBJECTIVE

This study evaluated the effects of a fortified corn/soy beverage mix, Chispuditos®, on morbidity, anemia and linear growth in young Honduran children in southern Intibucá.

## INTRODUCTION

Diarrhea and pneumonia are among the leading causes of mortality among children under 5 in developing countries such as Honduras. Deficiencies of iron, zinc and vitamin A have been shown to result in greater susceptibility to these illnesses. In the poor, rural region of Intibucá, Honduras, diets are limited in quantity and variety, resulting in deficiencies and malnutrition. Bronchitis, upper respiratory infection, cough and diarrhea are among the top 10 diagnoses among young children in this region.

Table 1.

Measures of malnutrition in young children in Intibucá

Malnourished (Weight-for-Age Z-score <-2)	7% <sup>2</sup>
Stunted (Height-for-Age Z-score <-2)	30% <sup>3</sup>
Anemic	38%-40% <sup>1</sup>
Vitamin A deficient	18% <sup>4</sup>

## METHODOLOGY

Through the MANI 2 program ("Mejorando la Alimentación de los Niños de Intibucá") children (n=2686) from six municipalities in Intibucá, ages 6-60 months at the start of the intervention, received the micronutrient supplement Chispuditos® daily for twelve months in 2010-2011. Children, ages 6-72 months at the start of the intervention, from the same geographical areas who did not receive Chispuditos® were used as a comparison group.

Table 2.

Chispuditos® micronutrient levels per daily serving

Chispuditos® Formulation			
Micronutrient	Quantity	Micronutrient	Quantity
Zinc	9 mg	Copper	0.3 mg
Iron	12.5 mg	Vitamin D <sub>3</sub>	5 mcg
Folic Acid	160 mcg	Vitamin E	5 mg
Iodine	90 mcg	Calcium	200 mg
Vitamin A	250 mcg	Phosphorus	150 mg
Vitamin C	40 mg	Magnesium	40 mg
Vitamin B <sub>12</sub>	0.9 mcg	Selenium	17 mcg
Vitamin B <sub>1</sub>	0.5 mg	Manganese	0.17 mcg
Niacin	6 mg	Biotin	8 mcg
Vitamin B <sub>2</sub>	0.5 mg	Pantothenic Acid	1.8 mg
Vitamin B <sub>6</sub>	0.5 mg		

Monthly incidence of diarrhea, acute bronchitis, cough and upper respiratory infection were calculated using patient records from two regional medical centers. Hemoglobin and height data were collected three times for all children enrolled in the MANI 2 program.

Monthly incidence was compared for the year prior to and year of the intervention using the Student's T-test. A difference-in-difference analysis was used to compare the monthly incidence for the year prior to and year of the intervention for children in the treatment and comparison group.

## RESULTS

Morbidity for all diseases decreased in the year of the intervention among children who received Chispuditos®. For diarrhea, acute bronchitis and upper respiratory infection, the decrease in morbidity was greater when compared to children in the region who did not receive Chispuditos®. Hemoglobin and height increased more among children who received Chispuditos® than those that did not.

Figure 1. Cough

During the year of the intervention, there were 32.7 fewer cases per month (a 61% decrease, p<.01) among the treatment group. Compared to the untreated, incidence decreased by 49% (p<.01).

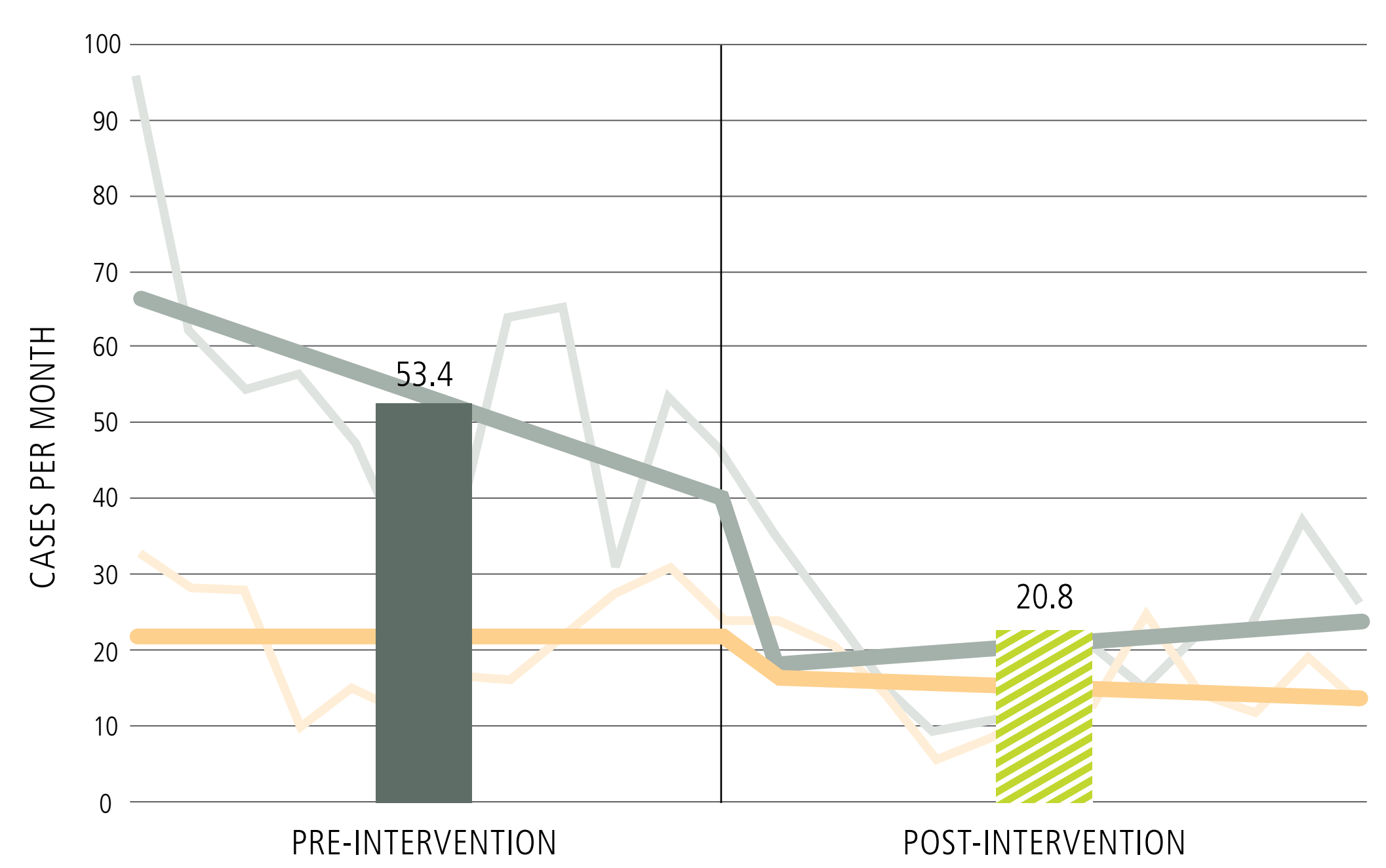
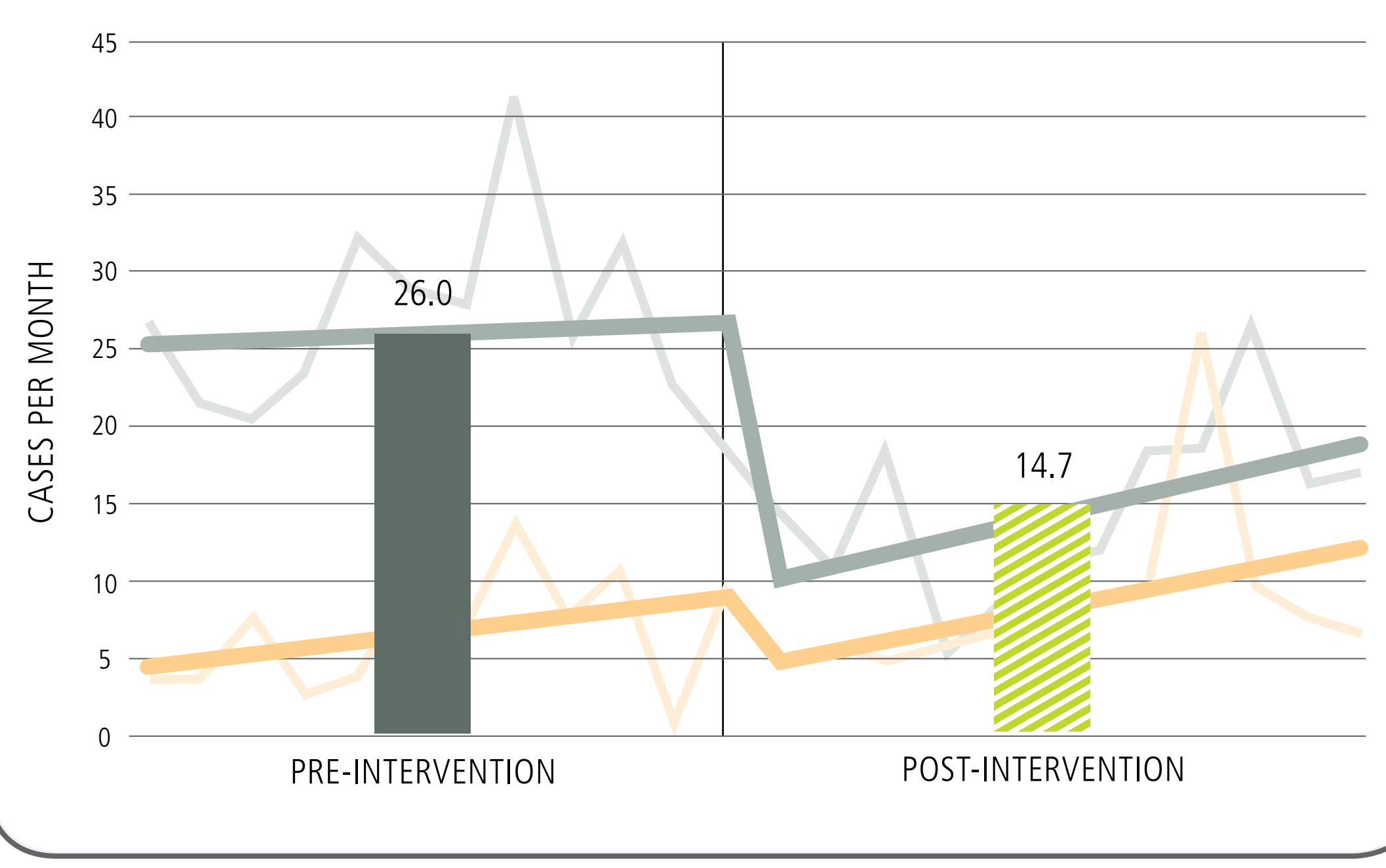


Figure 3. Diarrhea

During the year of the intervention, there were 11.3 fewer cases per month (a 43% decrease, p<.01) among the treatment group. Compared to the untreated, incidence decreased by 50% (p<.01).



Legend:  
Intervention Group (grey line), Intervention Trendline (grey bar), Control (black bar), Comparison Group (orange line), Comparison Trendline (orange bar), Intervention (hatched bar)

Figure 2. Upper Respiratory Infection

During the year of the intervention, there were 5.5 fewer cases per month (a 37% decrease, p<.05) among the treatment group. Compared to the untreated, incidence decreased by 49% (p<.05). During the year of the intervention, there were 32.7 fewer cases per month (a 61% decrease, p<.01) among the treatment group. Compared to the untreated, incidence decreased by 49% (p<.01).

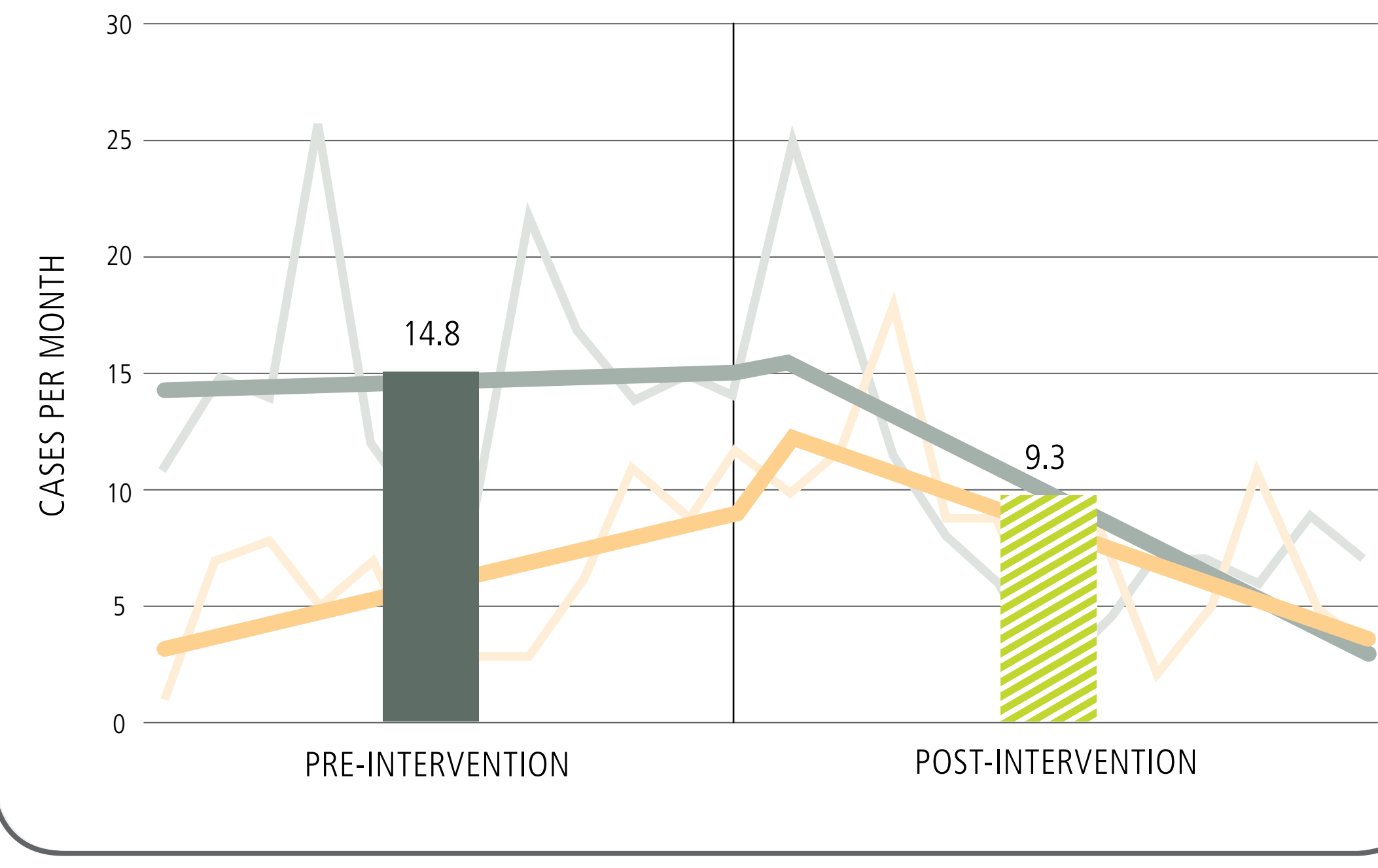
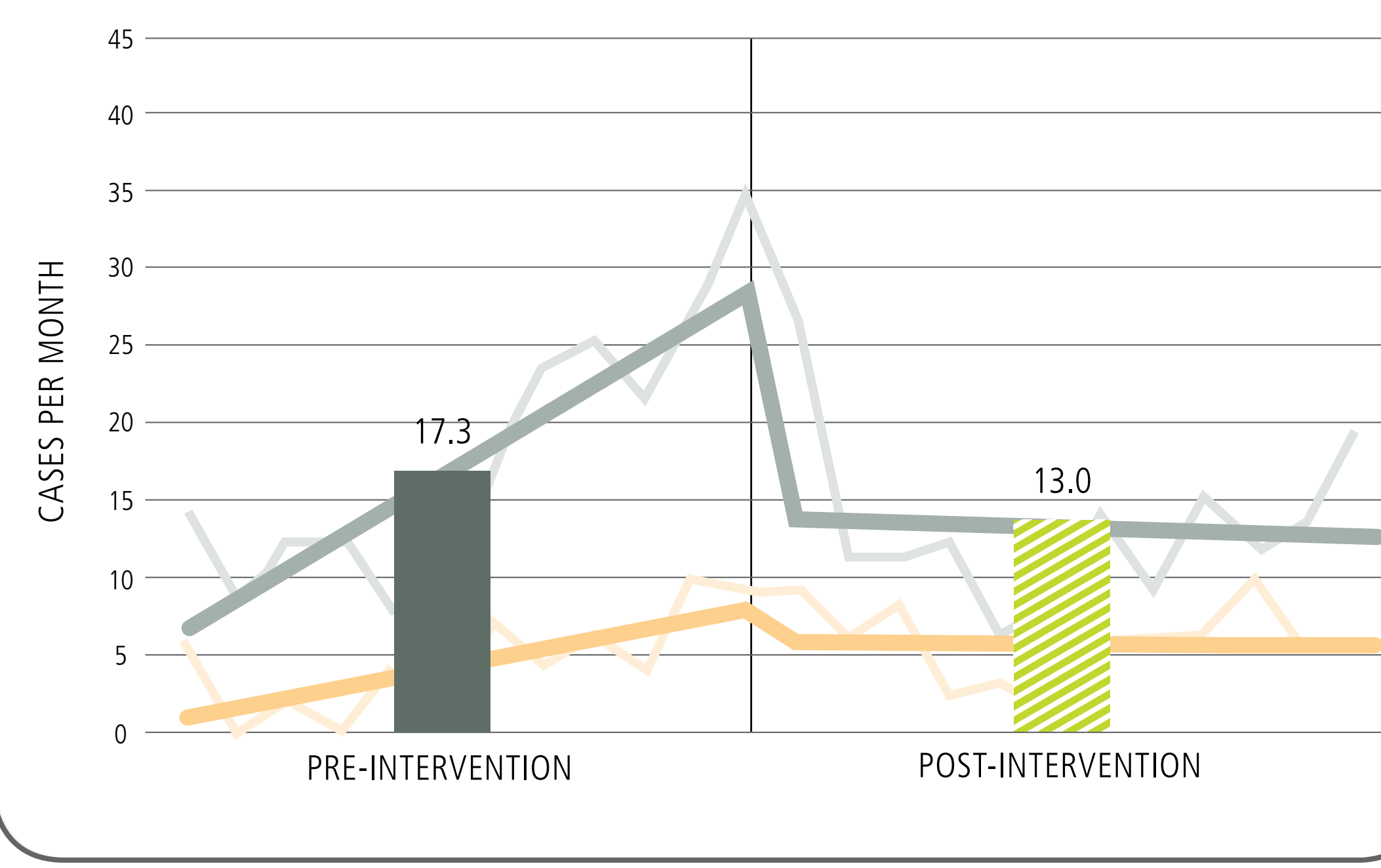


Figure 4. Acute Bronchitis

During the year of the intervention, there were 11.3 fewer cases per month (a 43% decrease, p<.01) among the treatment group. Compared to the untreated, incidence decreased by 50% (p<.01).



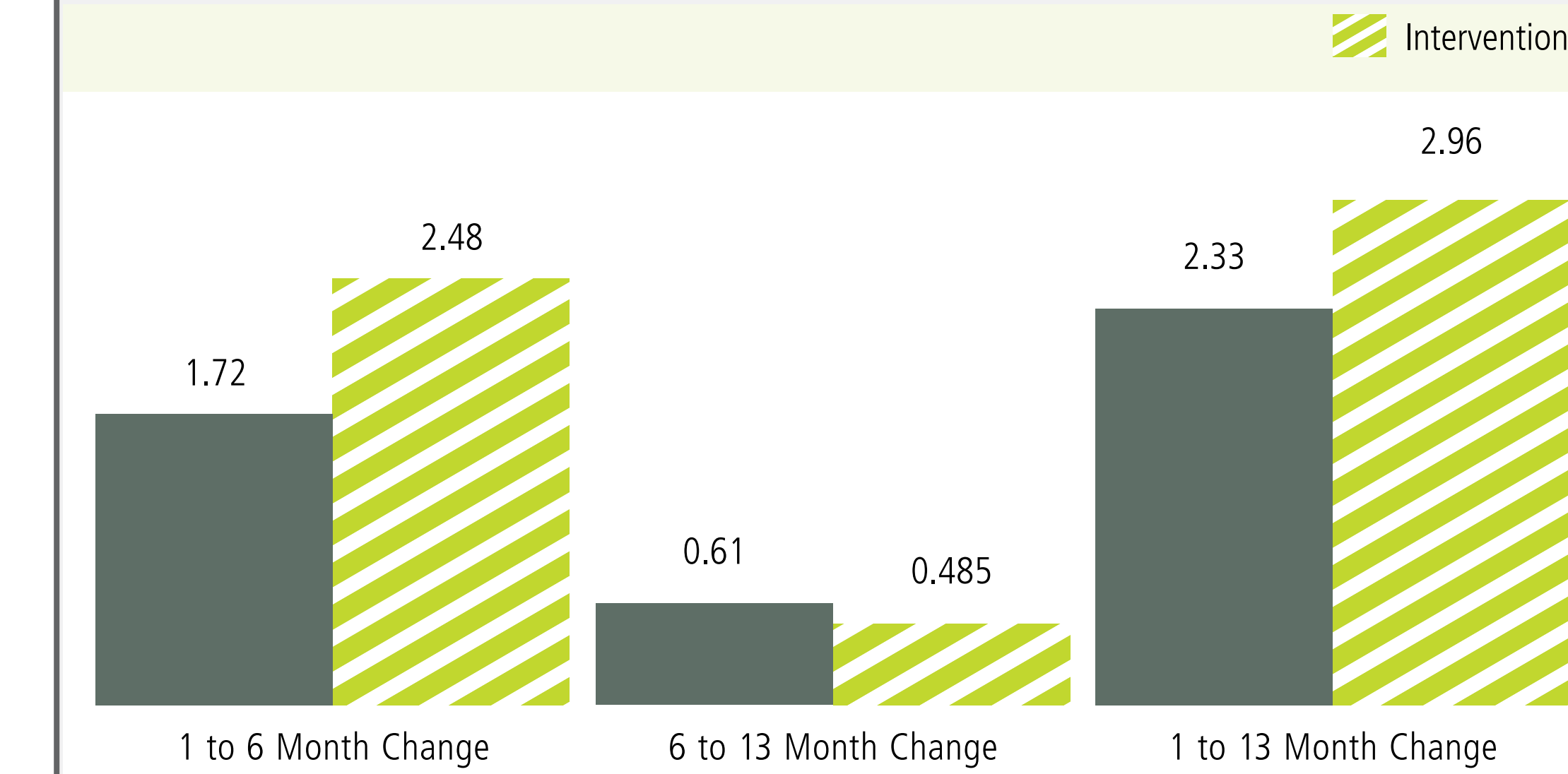
## ANEMIA

Provision of Chispuditos was associated with a rapid increase in hemoglobin for children whose hemoglobin was low at baseline. For children severely anemic at baseline (hemoglobin<10 g/dL, n=85), the magnitude and velocity of hemoglobin increase was higher among the intervention group. Mean hemoglobin level in the Intervention group increased 0.53 g/dL more than the control group after 6 months (p<.10), and 0.36 g/dL more after 13 months (p<.05). Mean increases were adjusted to control for baseline and socioeconomic factors. Results were similar but not statistically significant for children who were anemic at baseline (hemoglobin<11).

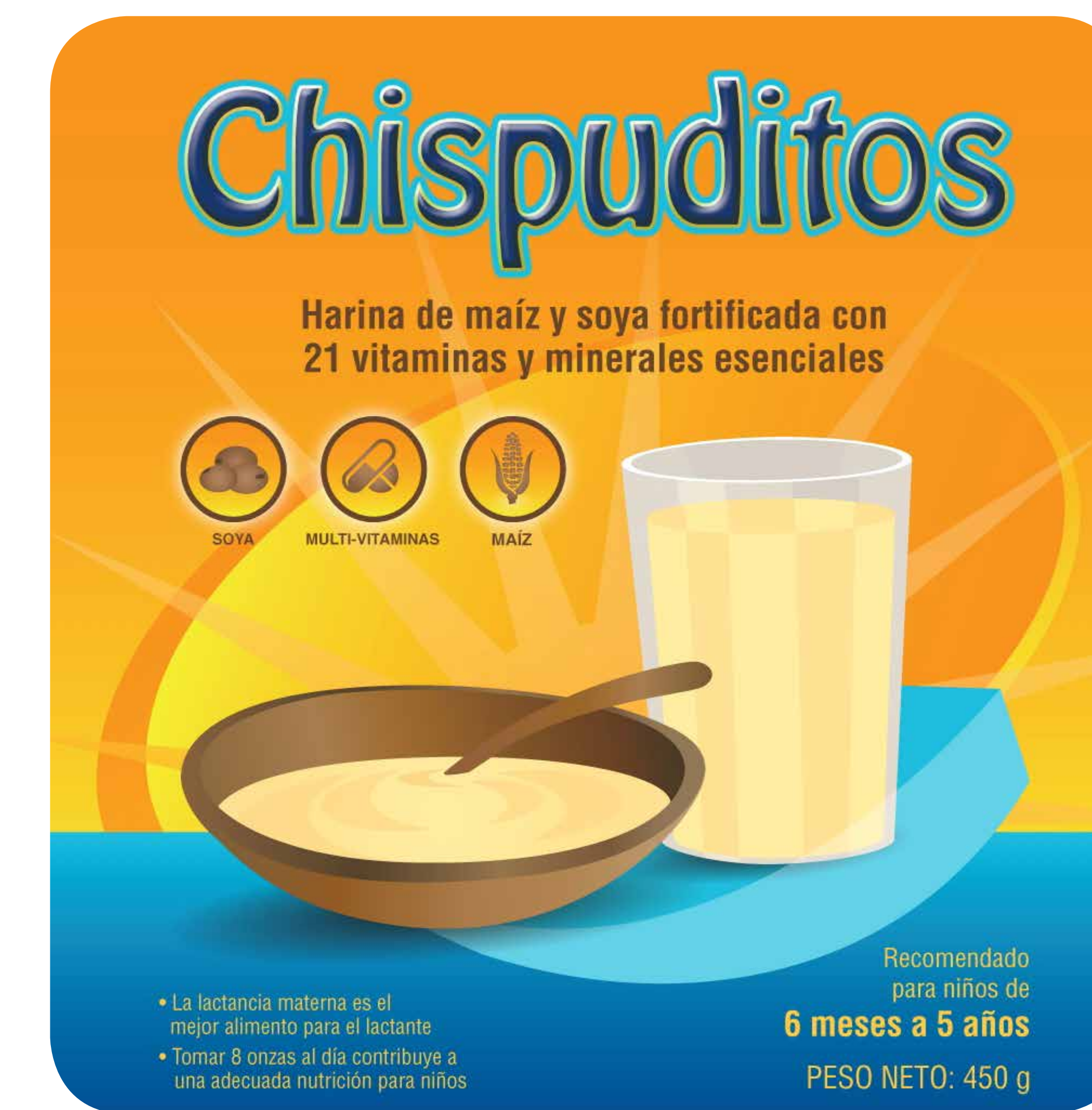
Table 3.

Hemoglobin (g/dL), Hg<10 at baseline	Control (n=26)	Intervention (n=59)
Month 1	9.32	9.20
Month 6	11.04	11.68
Month 13	11.65	12.16
Month 1 to Month 6 Change	1.72	2.48
Month 1 to Month 13 Change	2.33	2.96

Figure 5. Increase in Hemoglobin g/dL Hgb<10 at baseline



\*The Control and Intervention groups for hemoglobin and height data are not directly comparable to the Comparison and Treatment groups for morbidity. MANI 2 included a randomized controlled trial component. The Control group (n=268) received vouchers for milk and sugar; the Intervention group (n=326) received vouchers for milk and sugar as well as Chispuditos.



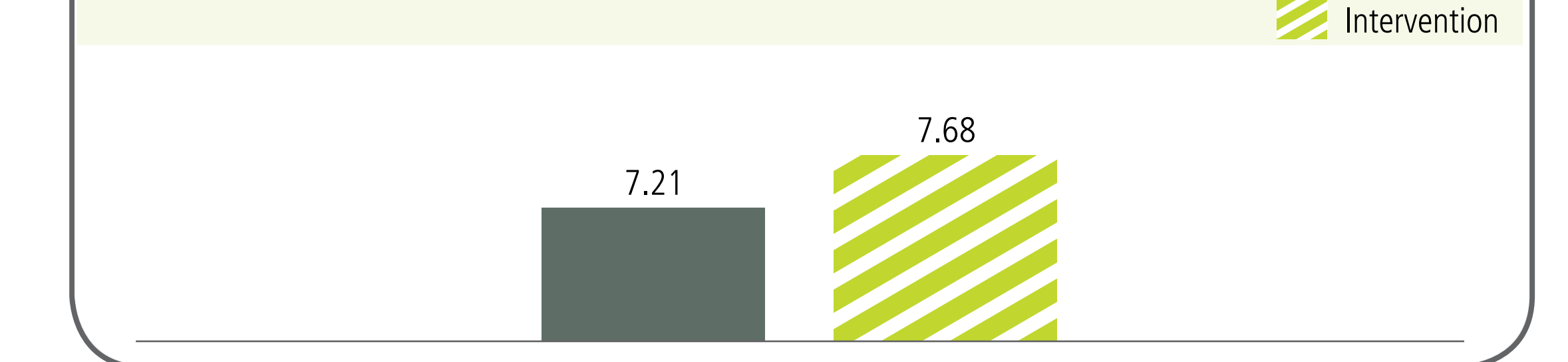
## LINEAR GROWTH

Provision of Chispuditos was associated with increased linear growth. After controlling for baseline height, demographic and socioeconomic factors, the intervention group grew 0.33cm more than the control group over twelve months (p<.01).

Table 4.

Average Height (cm)	Control	Intervention
Month 1	87.97	86.50
Month 6	91.25	89.69
Month 13	95.17	94.18
1 to 6 Month Change	3.28	3.19
1 to 13 [ ] Annual Change	7.21	7.68

Figure 6. Annual linear growth (cm)



## CONCLUSIONS

1. Provision of the fortified corn/soy beverage mix Chispuditos® was associated with a significant decrease in the incidence of diarrhea and respiratory illnesses, an increase in hemoglobin among anemic children, and an increase in linear growth among children in southern Intibucá, Honduras.
2. A supplement such as Chispuditos® that provides iron, zinc, vitamin A and other essential micronutrients may be a cost-effective and culturally acceptable preventive treatment that could play an integral role in public health interventions.
3. Further research is necessary to determine the effect of micronutrient supplementation on other child health and wellness outcomes and on overall health care costs.

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## CONTACT INFORMATION

Greg Reinhart: greinhart@mathileinstitute.org  
Jeff Heck: jeff.heck@mahec.net

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