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GUYANA'S HINTERLAND COMMUNITY-BASED SCHOOL FEEDING PROGRAMME

MINISTRY OF EDUCATION / WORLD BANK

IMPACT EVALUATION
2007-2009

Latin America and the Caribbean Region
The World Bank

Report prepared by:
Suraiya Ismail, Public Health Nutritionist, Director, Social Development Inc.
Christian Borja-Vega, Economist, The World Bank
Angela Demas, Senior Education Specialist, The World Bank
Edward Jarvis, EFA-FTI Program Coordinator, Guyana Ministry of Education

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Abbreviations

BMI	Body Mass Index
DMP	Daily Meal Programme (India)
EFA-FTI	Education for All - Fast Track Initiative
FPD	Food Policy Division
GDP	Gross Domestic product
GoG	Government of Guyana
GPRS	Guyana Poverty Reduction Strategy
HAZ	Height for age z score
NAS	National Assessment Scores
NCERD	National Centre for Educational Resource Development
NCHS	National Centre for Health Statistics (USA)
R1	Round 1 Survey (baseline)
R2	Round 2 Survey (midterm)
R3	Round 3 Survey (final)
SDI	Social Development Inc
SF 0	Schools where no feeding had started by Round 3 (control schools)
SF 1	Schools where feeding had starting by Round 3 (treatment schools)
SFP	Community-based School Feeding Program
SPSS	Statistical Package for the Social Sciences
WB	World Bank
WFP	World Food Program
WHO	World Health Organization

Acknowledgements

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To the above persons and to anyone else who contributed in any way to the successful implementation of the study but whose names we cannot now remember, we would like to extend our sincere thanks and gratitude for your inputs in this exercise which seeks to improve access by pupils to quality primary education by attending to their nutritional needs.

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Executive Summary

Guyana's Hinterland Community-Based School Feeding Program (SFP) began in 2007 with the objective of building more community participation in schools and improving children's human development outcomes, such as student enrollment and attendance, nutritional status and learning outcomes. In addition, the program supports improvement of schools' organization of primary level in Regions 1, 7, 8 and 9. In order to participate in the program, schools and their associated communities are required to submit school feeding proposals, undergo training in basic financial bookkeeping, food hygiene and nutritious meal preparation, using locally produced foods whenever possible. Communities must also ensure school kitchens meet the requirements and guidelines of the Ministry of Health, ensuring an adequate safe-water supply. To evaluate the program, the Government of Guyana and the World Bank collected survey data from schools, students, teachers and parents in three rounds 2007, 2008 and 2009 in Regions 1 and 7. This report shows the findings and impacts of SFP using all survey rounds.

Regions 1 and 7 are characterized by high poverty levels and agricultural labor intensity. Both factors highlight the potential of organizing SFP around local producers, so that a regular supply of low-cost food can be guaranteed to the local schools and children living in precarious conditions. Seventeen of the sixty-four schools participating in the impact evaluation are in Region 7, and the rest are in Region 1. Randomization for the selection of comparison groups was not achieved, due to the participation rules. However, sample selection correction methods were used to correct for observable and unobservable biases.

The conceptual framework to evaluate the SFP addresses the following questions:

Quantitative

- Has the hinterland school feeding program had a positive impact on students' enrollment, attendance, learning outcomes, and nutritional status?
- Has the program provided a safety net against food price increases or shocks?

Qualitative

- Has the program led to improvements in students' classroom participation and behavior, school performance, and parental participation in school activities?
- Has the program improved diets of households as well as food frequency intakes?

The following findings are separated by topic:

Enrollment and Attendance Findings

- The total increase in enrollment observed in three rounds of survey data equals 338 students. Around 53 percent (178 students) of the observed change in enrollment between 2007 and 2009 can be attributed to the SFP.
- In percentage terms, the treatment group increased enrolment by 16 percent between 2007 and 2009, while for the control group enrolment declined 7.5 percent.
- SFP increased average attendance by 4.3 percent between 2007 and 2009.

Nutritional Status Findings

- Control schools showed consistently higher levels of stunted children because i) treatment schools enjoy better economic conditions (selectivity) and / or ii) because control groups may have a higher proportion of Amerindian children, who have, in turn, consistently higher levels of poverty.
- Children in treatment areas grow 0.8 centimeters more compared to children attending schools without school feeding. Children at risk of wasting in the treatment group improved their Body Mass Index (BMI) between 1.07 to 1.34 standard deviations compared to the control group.
- The SFP contributed to preserving frequency of food consumption and diet diversity, particularly in a period of food price volatility. The lowest food diversity scores with relatively large variability are seen when children in the household do not receive a school meal, and when the household hosts an extended family, regardless of whether the household head is employed or not.

Students' classroom behavior and school performance

- Almost two-thirds of head teachers and class teachers consistently noted that the behavior of students changed positively with the SFP. However, this perception declined in each survey round.
- Survey data showed that SFP schools had higher levels of class participation. Students' of disconnect and distraction from classroom activities showed lower incidence in treatment schools. Average student participation in control schools declined compared to increases shown in treatment schools over the period of 2007 to 2009. Student disconnect in classroom activities showed a reduction in treatment schools and a relative increase in control schools.

Academic Performance by Students

- These impacts are expected to manifest in the longer-term measured through nationally standardized test-scores. However, in Round 3 there is already evidence that the treatment group is beginning to perform better than the control group in English, math and social studies. This last subject showed higher scores in treatment groups than control groups, although this test was only applied to 6^{th} graders.
- Using Propensity Score Matching techniques (PSM) to correct for differences in students' characteristics, showed significant impacts in Math and English. Social studies showed modest impacts. Reading and Science showed non-significant impacts.

Parental/Community Participation

- Survey data shows that parents are actively participating in cooking, cleaning and serving meals. Other important activities in which parents participate are food provision and commercialization.

- An important contribution of the program is to actively engage communities and parents in the school feeding program. Parents and school teachers showed high levels of involvement in fund raising and other activities that improve the quality of the program.

Household Diets

- The diet of rural and Amerindian communities often lacks nutrient diversity. In poor and Amerindian communities diets are low in vegetables, fruits and dairy products. Treatment areas kept the frequency of consumption relatively steady. During the food price shocks the gap in food consumption frequency and diet diversity between control and treatment groups increased substantially.

Food Prices Shocks and SFP as a Safety Net

- SFP implementation coincided with a period of uncertainty and high volatility in food and agricultural commodities prices. A daily meal to children living in a poor household represents a safety net mechanism by keeping household's purchasing power relatively constant from adverse food prices shocks. An increase in food prices harms the spending capacity of households which in turn affects food consumption, nutritional intake and poor nutrition outcomes.
- On average, before the food prices shocks a household in control areas consumed US$2.40 less per month on food, compared to treatment areas. During and after the food prices shocks control areas consumed US$9.00 less per month worth on food. Control areas would have 150 more children at risk of falling into poverty, compared to treatment areas, before the food price shocks. During and after the food price shocks 510 more children in control areas would be at risk of falling deeper into poverty.
- The financial returns of the SFP can be substantial if it expands. It can also bring a safety net mechanism to regions with economic adversities. Compared to other large-scale programs SFP has a relatively low cost per child enrolled.

The evaluation findings and the experiences of the SFP raise a number of important issues that need the attention of the Ministry of Education:

- Although attendance was indeed better in treatment schools, absenteeism remains a serious concern. More than 59 percent of all children included in the evaluation were absent for at least one day in the two weeks preceding the survey application. Of those children, more than 22 percent gave labor of some kind as a reason for their absence. Labor included care of younger siblings, work on the farm or at their homes.
- A further 6.6 percent of children with absences in the two weeks preceding the survey were absent because of the household's economic condition: no food, no uniform, no cash or no stationery. Interestingly, of those who gave lack of food as the reason for absence, all children except one attended control schools where no lunch was offered.

- The short-term hunger which occurs if a child receives an inadequate breakfast and/or has a long and arduous journey to school, is a major contributor to poor classroom behavior and academic achievement (see Annex 3). Single parents were least likely to offer a full breakfast to their children. An important finding of the evaluation was that students attending treatment schools were significantly less likely to receive a full breakfast. Are parents of treatment school children withholding a full breakfast because they know the child will receive a substantial lunch? If this is indeed the case, then the training offered by the school feeding program needs to stress the importance of an adequate breakfast, even when a full lunch is to be offered at noon.
- Sustainability of the community-based school feeding program when external funding ends is an issue for urgent attention. A formal consultation with SFP communities to garner their opinions of the program and ideas for sustainability produced actionable items and recommendations, some of which have been implemented and others require government attention. When considering the obvious educational and nutritional benefits of the Program, the Government should take into account the important role of the Program in providing a safety net, as well as aspects that address poverty in hinterland communities. Thus, for example, the Program offers guaranteed markets to farmers for their produce and employment for women as cooks.
- While the SFP is a cost-effective program, the Ministry may wish to consider ways by which the Program's costs may be maintained or reduced so as to increase the likelihood of sustainability. These include establishing school gardens to provide produce for the meals, encouraging home gardens, seeking partnerships with the private sector, and finding ways in which the school kitchens could be used on weekends and during school holidays to raise funds through small business enterprises. These are possibilities that have been discussed with community members and could be explored further.

Finally, the SFP's achievements with regard to improving community participation in school activities can make a key contribution in finding solutions to many of the challenges faced by the Ministry of Education for service delivery and quality education in rural, remote areas.

1 Introduction

1.1 Guyana and its people

Guyana is situated on the north eastern shoulder of South America, bordering Suriname on the East, Venezuela on the West, and Brazil on the South and Southwest. Its population of approximately 700,000 persons consists of five main ethnic groups: East Indian, African, Amerindian, Chinese and European. The majority of the population (97%) lives in the urban and rural coastal areas and in communities bordering Guyana's major rivers. The remaining 3 percent of Guyana's population, largely the Amerindians who are the indigenous population of the country, live in the hinterland which consists of rainforest, savannah, deep riverine and mountainous topography. Much of the country's agricultural produce is cultivated in rural areas because of the presence of rich alluvial soil.

Administratively, Guyana is divided into ten regions. Regions 1, 7, 8 and 9 constitute the hinterland regions and are inhabited largely by Amerindians, although some Amerindian communities are also found in other regions.[1] Many of the communities in the hinterland regions are small and remote, and access to these communities is difficult. The country's capital, Georgetown, is located on the coast in Region 4.

The three main ethnic groups (East Indian, African and Amerindian) of Guyana present different patterns of malnutrition. In particular, the Amerindian population generally presents a much higher prevalence of chronic malnutrition (stunting) and a lower prevalence of acute malnutrition (wasting). The few studies available indicate that malnutrition among Amerindian children is linked to deficiencies in key micronutrients which are probably caused by lack of diet diversity rather than general food insecurity. These issues are discussed in further detail in Annex 2 (Nutrition Notes).

1.2 Guyana's educational system

Guyana's post-independence educational development included the expansion of access to education from the pre-primary to the university level. However, many factors militated against the Government's achieving the goal of providing quality education to all of its citizens. The topography of Guyana and the remote location of segments of the population in the hinterland regions created a major challenge for good quality service delivery. Children from many of the most remote communities travel for up to two hours by boat or a combination of land and river to reach their schools.

Most of the larger educational institutions are found on the populous coastland, thus requiring greater budgetary allocations. This resulted in the educational service offered on the coastland

[1] Many Amerindian communities are now communities of mixed ethnicities.

being of a higher quality than that offered in the interior (hinterland). The Ministry of Education, with the assistance of bilateral and multilateral agencies, has attempted to grapple with the issue of providing equitable and quality education to all, as is articulated in its Education Strategic Plan, 2008-2013.

Primary school, where attendance is compulsory, provides six years of education (Grades 1 – 6). Academic performance at the primary school level is assessed in Grades 2, 4 and 6. Performance at the Grade 6 level (with a small contribution from the Grade 4 assessment) determines which, if any, secondary school the child is to attend.

2 Education for All – Fast Track Initiative (EFA-FTI): Program description

Guyana was one of the first of seven countries to apply for funding from the Education for All Fast Track Initiative (EFA-FTI)[2]. Their proposal for covering the period 2003 to 2015 was endorsed by the donor partnership in November 2002 and awarded US$12.0 million in 2004 to cover the first three years of implementation. The aim of the funds is to assist the government in its effort to reach the EFA-FTI goals for primary education by 2015. This first allocation of funding helped to design, launch and maintain the community-based school feeding program which is a sub-component within Guyana's overall EFA-FTI program. In 2008, upon successful execution and progress, Guyana's EFA-FTI program was re-endorsed and received funding for another three years for a total amount of US$32.5 million.

2.1 Program rationale and components

Guyana's EFA-FTI program encompasses three initiatives:

- Initiative I - Improving the Quality of the Teaching Force in the Hinterland;
- Initiative II – Enhancing the Teaching/Learning Environment in Primary Schools; and
- Initiative III – Strengthening School and Community Partnerships.

These three main initiatives are consistent with Guyana's Poverty Reduction Strategy (GPRS), the National Development Strategy, the Education Strategy Development Plan and the EFA-FTI goals for primary education, all of which seek to achieve quality education and produce a literate and numerate society.

Guyana's Hinterland Community-Based School Feeding Program (SFP) is a key sub- initiative of Initiative III. The objectives of the SFP include building more community participation in schools, and improving school attendance, school performance and the nutritional status of primary school children in Region Nos. 1, 7, 8 and 9. Implementation of Guyana's SFP for these

[2] The Education For All – Fast Track Initiative is a global initiative supported by donor partners, and it is now known as the Global Partnership for Education (GPE).

four hinterland regions began in 2007. In order to participate in the program, schools and their communities are required to submit project proposals, undergo training in basic bookkeeping, food hygiene and good food handling practices, basic nutrition and nutritious meal preparation. Communities that prepare their own meals on premises are also required to ensure that school kitchens meet the requirements and guidelines of the Ministry of Health, passing certifications and providing a safe and adequate water supply.

2.2 The impact evaluation of the community-based school feeding program

In 2007, the Ministry of Education, with funding and technical assistance from the World Bank, began the impact evaluation of the SFP in Regions 1 and 7. The first survey round covering 64 schools was conducted in June 2007, the second in May / June 2008 and the third and final round in May / June 2009. At the start of the evaluation, five schools had started school feeding, but no more than a month before data collection for the first survey round. By Round 3, nineteen schools were providing school meals in the two regions.

This report presents the final results of the three surveys (2007, 2008, and 2009) of the impact evaluation of the SFP in hinterland areas. Additional details of the impact evaluation methods are presented in Annex 4.

Given the evaluation design and they way in which the SFP was structured, full randomization for the allocation of the SFP to treatment and control groups was not achieved. Treatment and control groups arose largely from a process of self-selection. Preparatory activities of the SFP comprised three phases of activities prior to the provision of grants to establish community-run kitchens in schools.

The first phase included a promotion campaign and awareness-raising sessions with parents, teachers, village councils, and other members of communities. Overall this phase enjoyed high levels of participation from school and community members. During phase 2, training was provided to elaborate a proposal to request grants in order to create the conditions for food preparation, agricultural production, financial management and administration of the school feeding program. A standard template for proposals was developed by the EFA-FTI team which was used during the training to allow communities to become familiar with the contents and structure their proposals with ease. The sessions were carried out with school representatives and community members interested in implementing the SFP in their communities. This phase was very important because it led to the production of a quality proposal to access funding for the provision of school meals. In parallel, phase 3 included a certification of cooks and the facilities essential to launch the program. Without certification, the SFP could not start.

While the process through which schools and communities were enabled to submit proposals was open and on a rolling basis, it could have created selectivity into the comparison groups. This selectivity biases impact estimators. In particular, because phase 2 involves schools' proposal submission as a prerequisite to the time when a school enters into the program, it may result in better organized schools entering more rapidly while less organized schools take longer to reach approval and ultimately the grant. Thus, school and community characteristics play a role in the timing of program entry. Intuitively, the characteristics that may affect this sample selection have to do with observed and unobserved attributes of the schools and communities, as well as regional and sub-regional characteristics. Thus, it was essential to incorporate the sample selection bias correction in the regression analyses. An aspect that also may bias results relates to the student's absence when the survey was applied. If this aspect modified the sample substantially it will bias impacts particularly in the educational performance outcomes (e.g. students did not report their scores).

2.3 Context and Locations of treatment and control schools

The surveys conducted to evaluate the community-based school feeding program were applied in Regions 1 and 7 in Guyana. Barima-Waini (Region 1) is located in the northwest of the country. It covers an area of 20,339 km² with a population of around 26,000 inhabitants in 2007. It borders the Atlantic Ocean to the north, the region of Pomeroon-Supenaam to the east, the region of Cuyuni-Mazaruni to the south and Venezuela to the west. Major settlements include the regional capital Mabaruma, Port Kaituma, Matthew's Ridge, Morawhanna, Towakaima, Koriabo, Hosororo, Arakaka and Moruca. Barima and Waini are the two main rivers that flow through the densely forested and sparsely populated region.

Region 1 is ethnically diverse and has a low population density. The region is predominantly forested highland, bordered at the north by a narrow strip of low coastal plain. Both the region's two main rivers impede transportation access so many households depend upon subsistence agriculture. Many schools do not have electricity, and lack of other social facilities, which combined with the high cost of living, makes education inaccessible for many children. Other than agriculture, Region 1 communities are engaged in fishing, mining and logging activities.

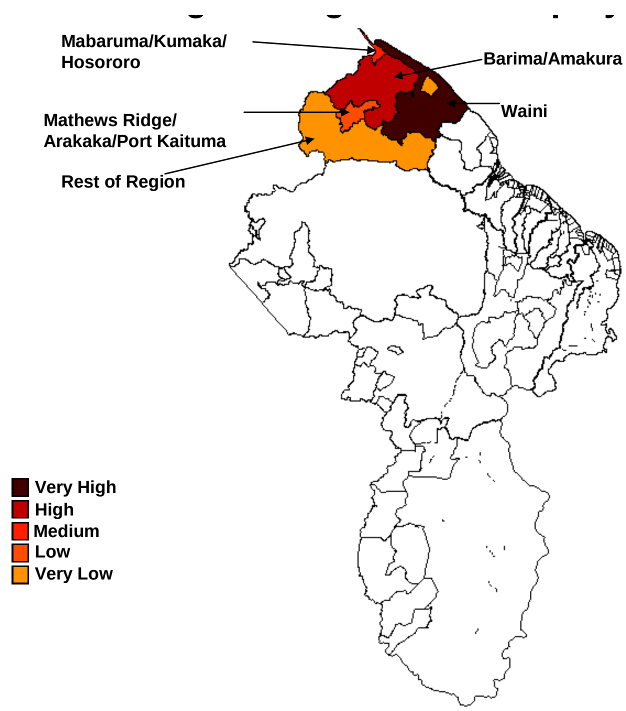
Region 7 is Cuyuni-Mazaruni which borders the Barima-Waini, Essequibo Islands-West Demerara and Pomeroon-Supenaam to the north, the region of Upper Demerara-Berbice to the east, the region of Potaro-Siparuni and Brazil to the south and Venezuela to the west. Its capital is Bartica. Other major settlements include Issano, Isseneru, Kartuni, Peters Mine, Arimu Mine, Kamarang, Keweigek, Imbaimadai, Tumereng and Kamikusa. Region 7 covers an area of 47,213 km² with a population of almost 18,000 people according to the last estimates of the Statistics Bureau in 2007.

Region 7 is also ethnically diverse and has the lowest population density in the country. The population in this area consists mainly of Amerindians and Coastlanders who work as miners, and Government employees (public servants). The Regional Administration's main office is at Bartica and a subsidiary office is located in Kamarang in the Upper Mazaruni. The inhabitants of Region 7 villages are engaged in subsistence agriculture, mainly ground provisions, cassava and peanuts. In addition to agriculture, many communities are engaged in logging and mining and, to a lesser extent, fishing.

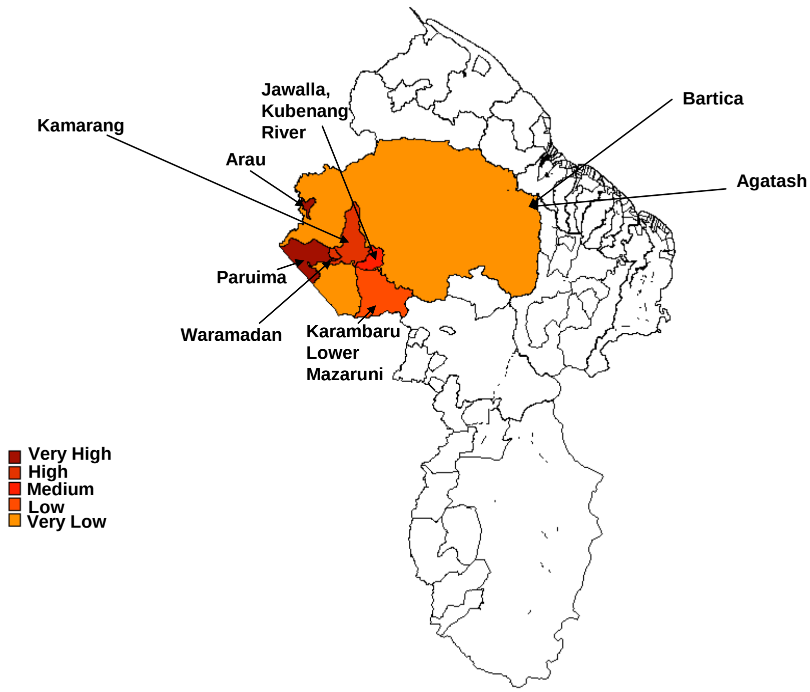
The distribution of agricultural intensity of subsistence farming in Regions 1and 7 is shown in Maps 1 and 2. Region 1 has high agricultural intensity in its northeastern sub-regions. The southern sub-regions have lower agricultural intensity owing to facilitation of trade and households’ engagement in the home-based manufacture of non-agricultural products. In Region 7 employment in agriculture is highest in Bartica (its capital) located in the far east of the region and in the Kamarang district, predominantly of seasonal crops and rotational agriculture of tropical fruits and grains.

The agricultural intensity profile of Regions 1 and 7 is important to the communities’ ability to organize the SFP around local producers, so that a low-cost supply of food can be guaranteed to the schools’ kitchens.

Map 1: Region 1 Agricultural Employment Intensity



Map 2: Region 7 Agricultural Employment Intensity

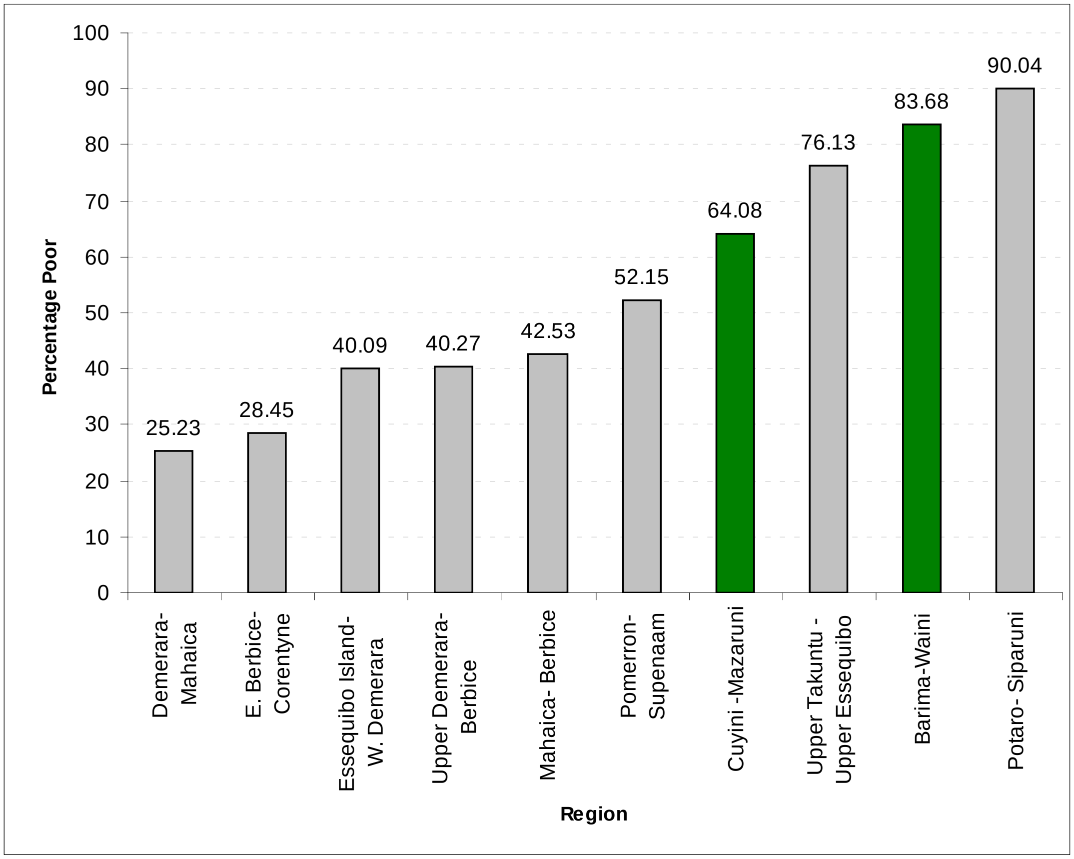


Source: Bureau of Statistics, Guyana and Ministry of Agriculture. 2006.

Regions 1 and 7 are characterized by high poverty levels as shown in Figure 1. Although regions 1 and 7 contain only 2.8 and 2.2 percent of the country's population respectively, more than half of their populations are below the poverty threshold. Both regions also have a large proportion of children who do not attend school or attend irregularly or who leave school with an incomplete education[3]. Low rates of access to education have reinforced the vicious circle of poverty in the last years, particularly in regions 1, 7, 8 and 9. The SFP provides poor households in remote rural areas with an incentive to send their children to school and save the cost of a daily meal, which in some cases represents a considerable proportion of disposable income.

[3] See Guyana's Poverty Assessment. World Bank. 2006.

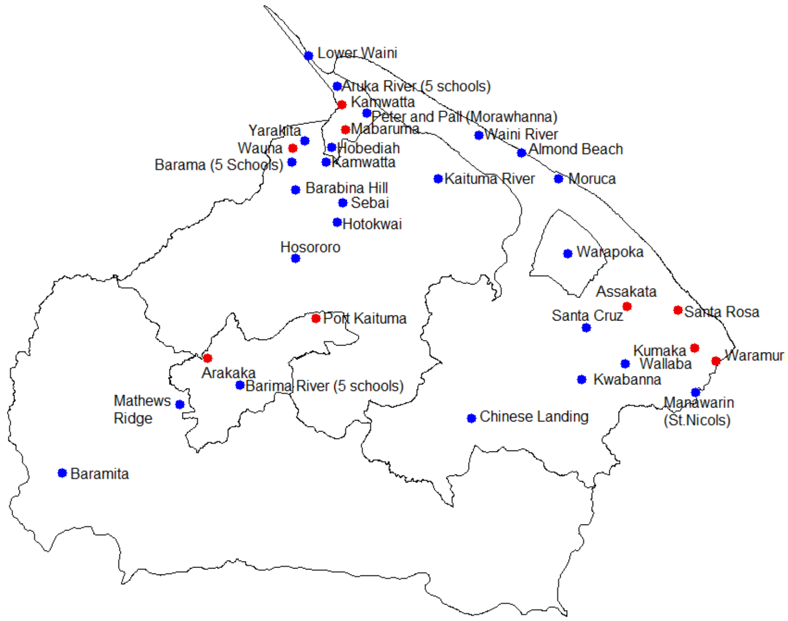
Figure 1: Poverty in Guyana, by Region



Source: Own estimates using Household Budget Survey data 2006

Seventeen of the sixty-four schools participating in the impact evaluation are in Region 7, and the rest are in Region 1. The 21 schools that had started providing school meals by Round 3 are designated treatment schools, while the rest served as the control or comparison group. Further details of the treatment and control groups are given in Section 3.3. The full list of schools is provided in Annex 1. Map 3 shows the locations of the treatment and control schools in Region 1. For each treatment school there are two to four control schools in each cluster. The location of the treatment group is located in the eastern and northern sub-regions, which are characterized by high agricultural intensities.

Map 3: Region 1 Location of Treatment and Control Schools



Treatment schools
Comparison schools

Map 4: Region 7 Treatment and Control Schools Location

Treatment schools
Comparison schools

Map 4 shows the location of the treatment and control groups in region 7. Region 7 has a lower population density than Region 1 and high dispersion of its communities across the whole region. The central part of Region 7 has very few communities so all treatment and control schools are located in the east (Bartica) and in the west.
Although Region 7 has far fewer schools than Region 1, Region 7 has demographic, social and economic indicators representative of Guyana's hinterland regions. The geographic distribution of schools in treatment and control schools is fairly even in both regions. Nevertheless, the sample of schools in Region 1 was distributed over a wider range of geographical coverage than Region 7 in order to gain statistical representativeness.

3 Methodology

3.1 Study design

All state primary schools in Regions 1 and 7 that had not started providing school meals by the start of the third term of the 2006 – 2007 school year were included in the impact evaluation. These 64 schools were assigned to treatment and comparison groups according to whether they had or had not started school feeding by the end of the second term of the 2008 – 2009 school year. Some schools had only single-grade classes, others only multi-grade classes, and the remainder had a mix of single and multi-grade classes.

Three survey rounds were conducted, during May and June of 2007, 2008 and 2009. In Round 1 (baseline), information was gathered on Grades 2, 3 and 4; in Round 2, on grades 2, 3, 4 and 5; and in Round 3 on grades 2, 3, 4, 5 and 6. A grade was added each year to enable the impact evaluation to follow and include the original students as they progressed to the next grade level. These students made up the longitudinal group. The impact evaluation design did not entail a randomized assignment of treatment and control groups, for reasons elaborated in Section 2.2. As a result of the self-selection process, some characteristics at baseline for control and treatment groups were dissimilar (see section 4.1). The impact analysis tried to correct for selectivity in the treatment and control group assignment, but selectivity cannot be addressed fully using correction techniques.

Table 1 shows control and treatment school enrollment and dates of entry into the SFP. The dates of entry of schools vary depending upon the submission of proposal and completion of training phases to obtain certification for the start of school feeding. Surveys were stratified in six clusters to gain internal validity. Representativeness was achieved at the regional level.

Table 1: Enrollment and Date of Entry to Comparison Groups by School

REGION 7

Cluster and School		2007	2009	SFP status (until Round 3)	
		Round 1	Round 3	Group	Date of entry
Cluster 1: Lower Mazaruni					
1	Agatash	99	102	Treatment	May 15 2007
2	Batavia	65	68	Control	Sept 10 2009
3	Butukari	13	25	Control	NA
4	Karrau Creek	40	26	Control	Sept 10 2009
5	St. John the Baptist	665	610	Control	Sept 10 2009
6	Wineperu	64	41	Control	NA
8	Itaballi	147	152	Treatment	March 23 2007
9	72 Miles	67	72	Treatment	June 21 2007
10	Two Miles	175	181	Treatment	June 21 2007
11	St. Anthony’s (Bartica)	532	545	Treatment	May 18 2007
12	Kartabo	63	65	Treatment	March 23 2007
13	Holy Name	163	169	Treatment	June 21 2007
14	St. Mary’s	56	45	Treatment	May 18 2007
Cluster 2 Middle Mazaruni					
15	St Martin	76	83	Control	Sept 10 2009
16	St Martin’s Annex	59	78	Treatment	June 1 2008
17	Kurupung	68	54	Treatment	Feb 4 2008
18	Isseneru	57	58	Treatment	Feb 4 2008
REGION 1					
Cluster 4 Matarkai					
21	Port Kaituma	849	943	Treatment	June 4 2007
22	Arakaka	119	126	Treatment	June 10 2007
23	Baramita	90	103	Control	Sept 10 2009
24	Matthews Ridge	214	226	Control	Sept 10 2009
25	Sebai	119	136	Control	Sept 10 2009
26	Falls Top	48	37	Control	NA
Cluster 5 Mabaruma					
27	Almond Beach	40	34	Control	Sept 10 2009
28	Aruka Mouth	72	76	Control	NA
29	Barabina	126	132	Control	NA
30	Black Water	38	39	Control	NA
31	Hobedia	89	95	Control	NA
32	Hosororo	343	346	Control	Sept 10 2009
33	Hotoquai	124	114	Control	NA
34	Kamwatta (Mabaruma)	70	53	Control	NA
35	Lower Kaituma	37	50	Control	NA
36	Lower Waini	16	54	Control	NA
37	Mabaruma	584	579	Treatment	June 9 2007
38	Peter & Paul	65	47	Control	NA
39	Sacred Heart	116	119	Control	NA
40	St. Anselm’s	96	91	Control	NA
41	St. Anthony’s	98	85	Control	Sept 10 2009
42	St. Cyprian’s	47	55	Control	NA
43	St. Dominic’s	34	38	Control	NA
44	St. John’s	53	28	Control	Sept 10 2009
45	St. Margaret’s	72	80	Control	NA

Cluster and School		2007	2009	SFP status (until Round 3)	
		Round 1	Round 3	Group	Date of entry
46	St. Mary's	26	15	Control	NA
47	St. Ninian's	97	72	Control	NA
48	Unity Square	18	22	Control	NA
49	Wauna	499	597	Treatment	Jan 14 2008
50	Yarakita	203	207	Control	Sept 10 2009
67	White Water	136	143	Control	NA
Cluster 6	**Moruca**				
51	Assakata	77	73	Treatment	June 4 2008
52	Kamwatta (Moruca)	249	222	Treatment	June 4 2008
53	Karaburi	260	246	Treatment	Dec 3 2007
54	Kokerite	100	86	Control	NA
55	Kwebana	178	203	Control	Sept 10 2009
56	Santa Cruz	65	90	Control	Sept 10 2009
57	Santa Rosa	633	700	Treatment	June 4 2007
58	St. Bede's	37	53	Control	NA
59	St. Nicholas	446	468	Control	Sept 10 2009
60	Wallaba	30	29	Control	Sept 10 2009
61	Waramuri	344	340	Treatment	June 4 2008
62	Warapoka	138	157	Control	Sept 10 2009
63	Kokerite Annexe	18	21	Control	NA
64	Father's Beach	34	92	Control	NA
65	Chinese Landing	28	31	Control	NA
66	Waramuri Annex	148	143	Control	NA

Note: Kokerite annex is now considered part of Kokerite school. The total number of schools adds up to 64. No schools were surveyed in Cluster 3. Schools that began school feeding after Round 3 were kept in the control group. Source: SFP

3.2 Survey instruments

Five questionnaires were used in the surveys:

<u>Head teacher questionnaire</u>: collected information on the school, on parental participation in school-related activities, and on the head teachers themselves, including their academic and professional qualifications, and their views on the impact of school feeding on student attendance and behavior. School-level average attendance was added in later.

<u>Class teacher questionnaire</u>: were completed by class teachers of the grades covered in each survey round, these questionnaires gathered information on grades taught and the numbers enrolled in each grade, numbers of repeaters, the teacher's academic and professional qualifications, and their views on the impact of school feeding on student attendance and behavior.

<u>Class observation</u>: conducted in each participating grade by the enumerators, these recorded classroom conditions (state of desks, number of books), numbers of students present, subjects taught, methods of teaching, signs of participation in class activities, and signs of disconnect from class activities.

Parent questionnaire: administered to up to ten parents per school by the enumerators, to gather information on the household's socio-economic and demographic data, on participation in school-related activities, access to services and amenities, access to schools (distance and mode of travel), and frequency of consumption of specific food groups.

Student data form: used to record the student's date of birth, attendance, weight and height, family literacy and composition, access to schools (distance and mode of travel), selected household possessions, and breakfast consumption. National assessment scores were added later as they became available from the Ministry of Education. Student data forms were completed for all students present on the survey day in one class of each grade covered in survey rounds.

Minor adjustments and additions were made to the questionnaires after Rounds 1 and 2.

3.3 Training and fieldwork

Enumerators from Regions 1 and 7 were trained prior to each survey round. The training took the form of presentations by training officers, demonstrations, role playing and question and answer sessions. Role play was used to practice the administration of the parent questionnaire. The measurements of weight and height were practiced at local primary schools, and a standardization exercise was conducted to identify weak measurers. Topics covered included:

- Purpose of the exercise
- How to conduct an interview / meeting
- Weighing and measuring children.
- Correct use and care of the equipment
- How to complete the questionnaires
- How to conduct focus groups
- Logistics and fieldwork instructions.

Fieldwork was carried out by the trained enumerators during a period of four to five weeks in the third term of each school year. In addition to administering questionnaires, weighing and measuring children, observing classes and arranging for the completion of head teacher and class teacher questionnaires, enumerators conducted focus group discussions in each community in which the school was located.

3.4 Data management and analysis

Data were coded, and then entered into computer files by trained data entry clerks using EpiInfo 6. A system of duplicate data entry followed by validation of the two entries and corrections where necessary was employed. National assessment scores (NAS) were entered later, when these were available.

After data entry, validation and correction, epidemiological and nutrition indicators were calculated in EpiInfo. EpiInfo and SPSS-Macro use the new WHO reference standards which is needed to calculate the nutrition indicators, height for age and body mass index (BMI) for age (see Annex 2, Nutrition Notes).

Basic analyses were done using SPSS v12.0. An initial frequency was run prior to further analysis. Data analysis involved simple frequencies and distribution statistics, and bivariate analyses (chi square tests, t-tests, analysis of variance and linear correlation). A p value less than 0.05 was used to define statistical significance. More elaborate regression analyses were carried out using STATA v10. Details of these analyses are given in Annex 4.

3.5 The samples

Table 2 gives the number of schools and students included in treatment and comparison groups by region. Details of the number of questionnaires and data forms achieved at each survey round are shown in Table 3.

Table 2: The samples by region and school feeding status in Round 3 (2009)

School feeding status	Data	Region		Totals
		Region 1	Region 7	
Comparison schools	No. of schools	37	6	**43**
	No. of students	1968	255	**2223**
Intervention schools	No. of schools	10	11	**21**
	No. of students	1038	616	**1654**
Totals	**No. of schools**	**47**	**17**	**64**
	No. of students	**3006**	**871**	**3877**

Source: Own estimations using Guyana IE surveys, 2007-2009

Table 3: The samples in all rounds

Categories	Number in category			# of schools/communities with no data		
	Round 1	**Round 2**	**Round 3**	**Round 1**	**Round 2**	**Round 3**
Schools	64	62	58	-	2	6
Head teachers	64	61	58	-	3	6
Teachers	112	140	162	7	3	3
Class observations	105	172	170	5	3	2
Parents	581	583	569	0	2	0
Food frequencies	580			1		
Students – total	2430	3006	3877	0	2	0
No assessment scores:				8	9	5
No anthropometry:				4	3	0
	Number of students with Tests					
	Round 1	**Round 2**	**Round 3**			
Grade 2	776	907	933			
Grade 3	842	676	809			
Grade 4	773	792	776			
Grade 5	N/A	612	617			
Grade 6	N/A *	N/A **	742			

**Note: 39 Students without test data*
*** Note: 19 students without test data*
Source: Own estimations using Guyana IE surveys, 2007-2009

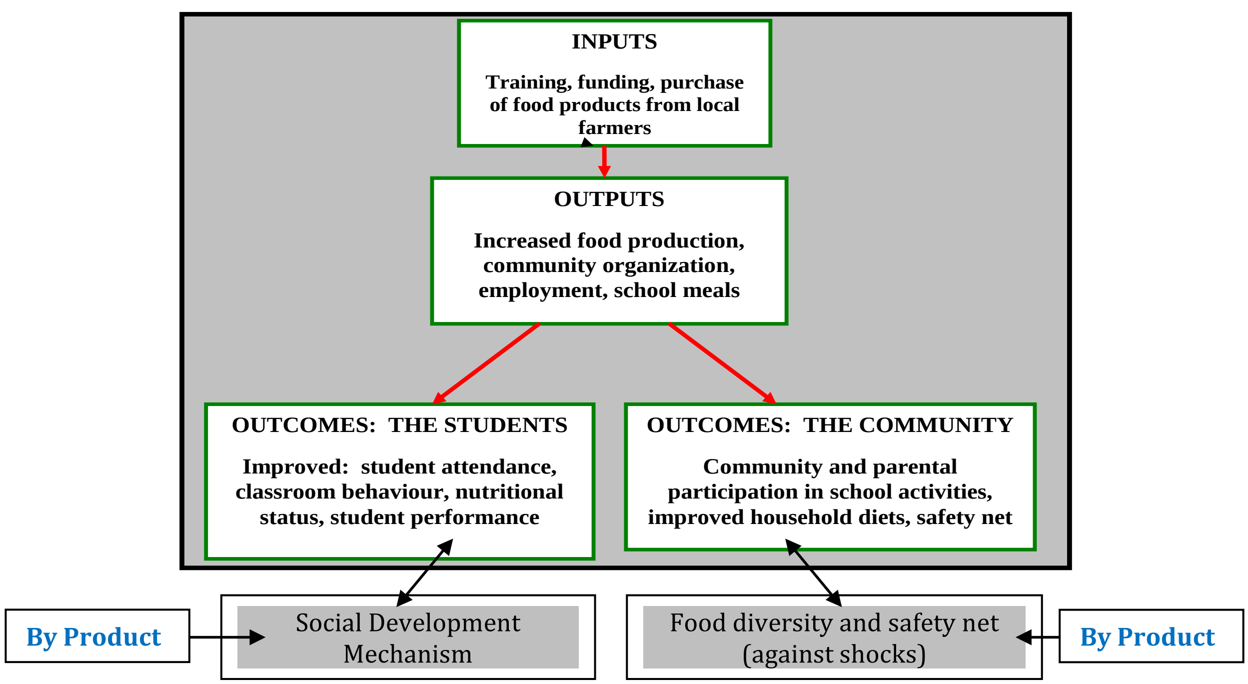
4 Descriptive Statistics and Impact Estimation

Section 4.0 begins by qualitatively and quantitatively describing the data gathered, by survey round and by group (treatment and control), as appropriate (Sections 4.1 and 4.2) cross-examines comparison group composition and outcomes at the individual and community level, respectively. Section 4.3 concludes by presenting the results of the impact analysis, summarizing the results obtained with different estimation methods.

Figure 2 illustrates the conceptual (logic) framework for the school feeding program. This section addresses the following questions:

- Has the hinterland school feeding program had a positive impact on students' attendance, nutritional status, classroom behavior and school performance?
- Has the program encouraged parental participation in school activities?
- Has the program improved diets of children and household members?
- Has the program provided a safety net against food price increases?

Figure 2: Guyana's hinterland Community-Based School Feeding Program: conceptual framework



4.1 Outcomes: The students

4.1.1 School attendance

School attendance is an important outcome indicator to assess the impact of a school feeding program. We obtained both school-level and individual-level attendance data. We also asked head teachers and class teachers whether they had noticed any change in attendance since school feeding had started (Table 4). Most respondents agreed that school feeding was associated with increased attendance, although head teachers in Round 3 had a relatively lower rate of positive perception[4].

Table 4: Perceived impact of school feeding – attendance

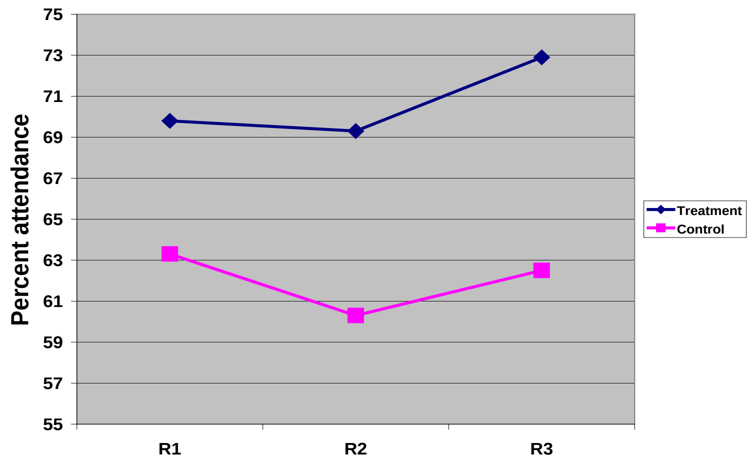
Factor	Percent of respondents		
	Round 1	Round 2	Round 3
Increases attendance			
Head teacher agrees	87.3	72.1	57.9
Class teacher agrees	84.2	90.8	80.4

Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 3 shows mean school-level attendance by treatment and control groups for each school year covered by the impact evaluation. Between round 1 and round 3 (school years 2006-07 and 2008-09) mean attendance fell marginally in the control groups, but rose in the treatment schools. Figure 3 illustrates the school-level differences between comparison groups in attendance rates, which can certainly bias the impact estimators. However, both groups show similar trends.

[4] One possible explanation may be due to unawareness of SFPs presence in schools by new or incoming head teachers that began to work by the time round 3 was conducted.

Figure 3: School-level mean percent attendance by survey round and group



Source: Own estimations using Guyana IE surveys, 2007-2009

Table 5 provides information on individual-level attendance by survey round and by group. At baseline, full attendance (all days) is fairly similar and the difference between the comparison groups widens as time progresses. In addition, low attendance rates (<50%) between comparison groups is quite similar at baseline. Given that low attendance rates are relatively large and affect comparison groups unevenly, the impacts could by biased by selectivity in the sample of children. This issue is addressed in Section 4.3.

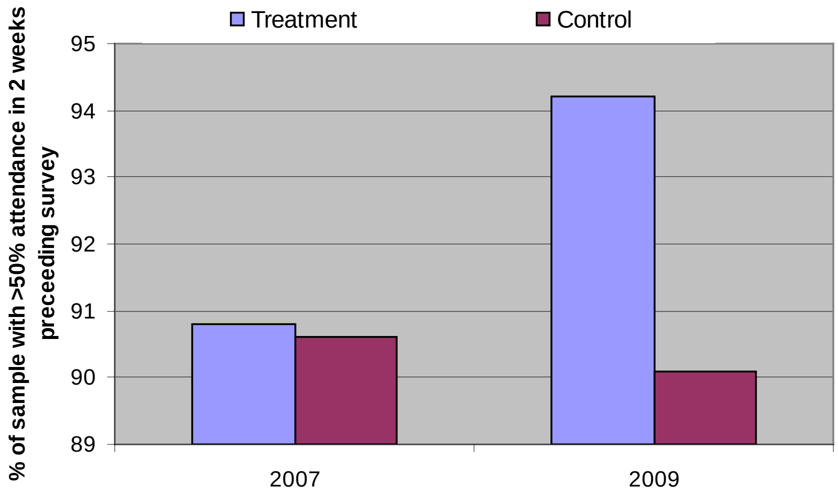
Table 5: Attendance in two weeks preceding survey day

Attendance (% of days present)	Percent of students					
	Round 1		Round 2		Round 3	
	Control	Treatment	Control	Treatment	Control	Treatment
< 50%	9.2	9.1	15.0	13.1	9.8	5.8
50 – 70	17.9	12.8	21.3	19.3	17.2	13.1
70 – 90	28.0	25.8	34.0	32.8	29.7	33.6
90 - <100	20.6	25.4	8.1	10.0	7.9	7.0
Present all days (100%)	24.3	26.8	21.6	24.8	35.4	40.6

Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 4 illustrates the percent of the sample with high attendance in the two weeks preceding the survey, for Rounds 1 and 3, by treatment and control groups. The figure shows that while the percent fell slightly for the control group, it rose sharply in the treatment group. This change in the sample of students reinforces the point that selectivity can become an issue when estimating impacts.

Figure 4: Percent of sample with >50% attendance in two weeks preceding survey day, by survey round and group



Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 5 is a flow chart describing the individual-level absence data collected for the survey day and the two weeks preceding the survey day, in Round 3. Table 6 gives the reasons for absence in Rounds 2 and 3 for the two weeks preceding the survey day. In both rounds around 20 percent of students were kept at home to provide labor for the family: housework, farm work or child care. In Round 2, 72 children (3.7%) were absent for economic reasons (no food, no money, no uniform, no stationery). The figure rose to 127 (6.6%) in Round 3. All children except one who stated they were absent because of lack of food in Round 3 were from the control schools where no lunch was provided. Because the survey did not capture child employment and detailed information about reasons for absence it is not possible to control for the bias with observed characteristics.

Figure 5: Sample for Round 3 - absence and reasons for absence

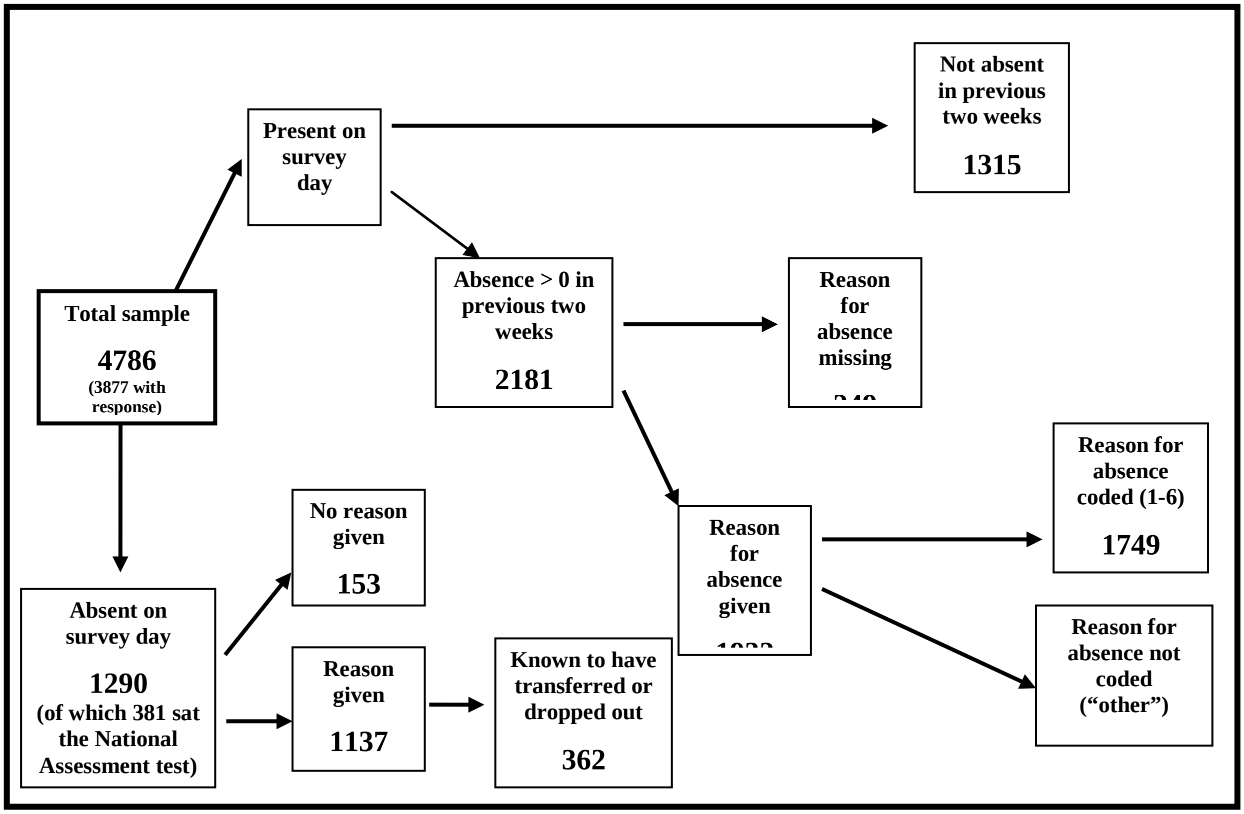


Table 6: Reasons for absence in two weeks preceding survey day

Reason	Round 2 No. of respondents	Round 2 Percent of respondents	Round 3 No. of respondents	Round 3 Percent of respondents
Illness	976	50.6	1111	57.5
Climate	233	12.1	26	1.3
House or farm work	227	11.8	251	13.0
Care of younger sibling	148	7.7	181	9.4
Transportation	143	7.4	112	5.8
No food	32	1.7	68	3.5
Other reasons (see below)	169	8.8	183	9.5
Total	**1928**	**100**	**1932**	**100**
Other reasons for absence:				
Uniform dirty or wet, no footwear, boots wet	*33*		*53*	
Traveling, out of village	*17*		*45*	
Didn't want to go, too late to go	*16*		*30*	
Attend funeral or wedding, visit relative, run errand	*14*		*9*	
Child doesn't know, parent decision	*14*		*26*	
School tour	*13*		*0*	
Parent absent, mother ill, injured or died, domestic problem	*10*		*14*	
Recreation	*9*		*0*	
No exercise book, no stationery	*4*		*4*	
No finance	*3*		*2*	
Teacher was absent	*2*		*0*	
Tide	*2*		*0*	

Source: Own estimations using Guyana IE surveys, 2007-2009

4.1.2 Students' nutritional status

It is well-accepted that poor linear growth (stunting) can be the result of a number of factors, largely related to the environment, socioeconomic factors and education. Nutrition, infections and mother-infant interactions have been cited as 'environment' factors having the greatest influence on child's growth (Waterlow & Schürch, 1994). Other authors (Martorell et al, 1988) highlight the link between stature and poverty. In the context of nutrition, poor stature is associated with diets of poor quality, namely that are deficient or marginal in micronutrients or protein rather than in energy. Specific micronutrients mentioned in various studies include zinc, calcium and vitamin A, but there may be others that have not yet been studied. Skoufias et al. (2009) estimated income elasticities in rural Mexico for a variety of macro- and micro-nutrients, showing positive elasticities for vitamins (A,C) and calcium. The authors used fixed-effects and instrumental variables to correct from biases resulting from measurement errors associated to the outcome variable.

While breastfeeding practices and mother-infant interactions are generally excellent in Amerindian communities in Guyana, diets are often monotonous and low in vegetables, dairy products, proteins, legumes and fruits. A study conducted in Regions 8 and 9 compared the stature of children of two tribes: the Wapishana in Region 9 and the Patamona in Region 8 (Dangour, 2001). The Wapishana villagers were substantially wealthier and had access to a more diverse diet than the Patamona villagers, who lived in relatively remote areas. The study found that Wapishana children were on average more than 3 cm taller than their Patamona counterparts.

The descriptive statistics on stunting and wasting indicators based on Guyana's Community-Based School Feeding Program surveys reiterate findings of earlier studies: high levels of stunting and a low prevalence of wasting (less than 3%). The results show that even at baseline, the prevalence of stunting (height-for-age less than -2 z-scores) was slightly higher in control schools (20%) than in intervention schools (17%). By the third round of the evaluation (2009), the prevalence of stunting had fallen by nearly three percentage points among intervention children, and risen by more than three percentage points among the children attending control schools. The differences in the prevalence of stunting between the two groups had thus risen from four percentage points in 2007 to ten in 2009. Table 7a highlights differences between coastal and hinterland regions in key health and nutrition indicators.

Table 7a: Guyana's health indicators for coastal and hinterland regions

Indicator	Coastal regions	Hinterland regions
Prevalence of stunting (<5yrs; <-2 SD)	8.7%	22.7%
Prevalence of wasting (<5yrs; <-2 SD)	9.7%	3.7%
Prevalence of anemia (<2yrs; <11g/dl)	63.5%	74.6%
Low birth weight (<2500g)	18.6%	24.2%
Infant mortality (per 1000 live births)	38	52
Under–five mortality (per thousand)	47	68

Sources: Multiple Indicator Cluster Survey (Guyana 2006); Evaluation of the Basic Nutrition Program (Social Development Inc, Guyana 2009).

Table 7, and Figures 6 and 7 show the information on one of the key outcome indicators, the students' nutritional status. Annex 3 provides a brief discussion of these indicators and the relevant cutoffs used to estimate the impacts on children at risk.

In Amerindian communities stunting levels are high. If data on ethnicity had been gathered on SFP's surveys, we would have seen even higher levels of stunting among children of Amerindian descent, when compared to the non-Amerindian children living in these communities. Thus, for example, Guyana's Basic Nutrition Program found a prevalence of almost 31 percent of stunting among Amerindian children aged 12 – 24 months and 12 percent among children of other ethnicities living in Amerindian communities.[5] A study of nursery school children reported a prevalence of 26.6 percent stunting among Amerindian children aged 4 – 6 years.[6]

Table 7 and Figure 6 show that even at Round 1, stunting was a much greater problem among students attending the control schools: 20.9 percent were stunted or severely stunted in the control group, as compared to 14 percent in the treatment schools. There are three possible explanations for this finding: either treatment schools were in more organized communities with better economic conditions (selectivity), or treatment schools had a higher proportion of non-Amerindian children, or a mixture of both situations.

Table 7: Nutritional status of students

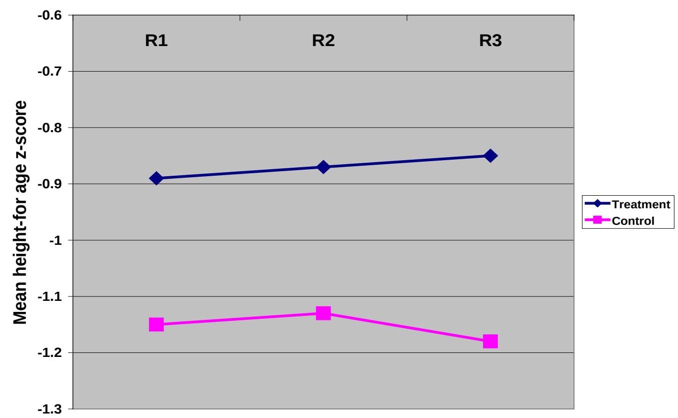
Indicator*	Levels of nutritional status	Percent of students					
		Round 1		Round 2		Round 3	
		C	T	C	T	C	T
1. Height for age	Not stunted	42.9	53.1	44.3	53.4	42.6	54.0
	At risk of stunting	36.2	32.8	35.2	32.5	34.2	32.9
	Stunted	17.6	12.4	17.1	12.9	18.9	11.5
	Severely stunted	3.3	1.7	3.3	1.2	4.3	1.6
2. Body Mass Index (BMI) for age	Not wasted	89.0	84.7	85.8	84.6	89.7	84.6
	At risk of wasting	9.1	12.5	11.2	13.2	9.0	13.6
	Wasted	1.6	2.3	2.1	1.9	1.1	1.6
	Severely wasted	0.2	0.5	0.9	0.2	0.2	0.2

Source: Own estimations using Guyana IE surveys, 2007-2009

* See Annex 2 (Nutrition Notes) for an explanation of these indicators
Not stunted / wasted: > -1.0 s.d.;
At risk of stunting/wasting:-1.0 to -2.0 s.d.;
Stunted / wasted:-2.0 to -3.0 s.d;
Severely stunted / wasted: < -3.0 s.d.

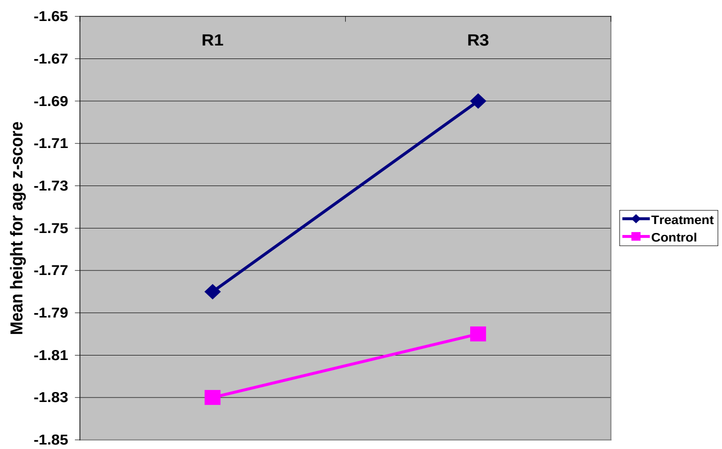
[5] S. Ismail and T. Roopnaraine. The impact evaluation of the GoG / IDB Basic Nutrition Program: Integrated report (July, 2009)
[6] Food Policy Division, Ministry of Health, Guyana. Nursery school Sentinel site surveillance report (February, 2010)

Figure 6: Mean height for age z-scores by group and by survey round



Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 7: Stunted and severely stunted children -
Mean height for age z-scores by group at survey rounds 1 and 3



Source: Own estimations using Guyana IE surveys, 2007-2009

The difference between control and treatment schools in relation to stunting continued in rounds 2 and 3. However, Figure 6 shows that while the mean height-for-age fell slightly for children attending control schools, it rose among children attending treatment schools. Figure 7 illustrates the differences of the school feeding on children who were stunted or severely stunted at Round 1. As found in all other studies (see footnotes 3 and 4), the prevalence of wasting in Amerindian communities is lower than in the coastal communities of Guyana.

4.1.3 Students' academic performance

Guyana's Ministry of Education assesses school performance of children in Grades 2, 4 and 6. In Grades 2 and 4, mathematics, English and Reading are the assessed subjects, and for Grade 6, Mathematics, English, Science and Social studies are assessed. These National Assessment

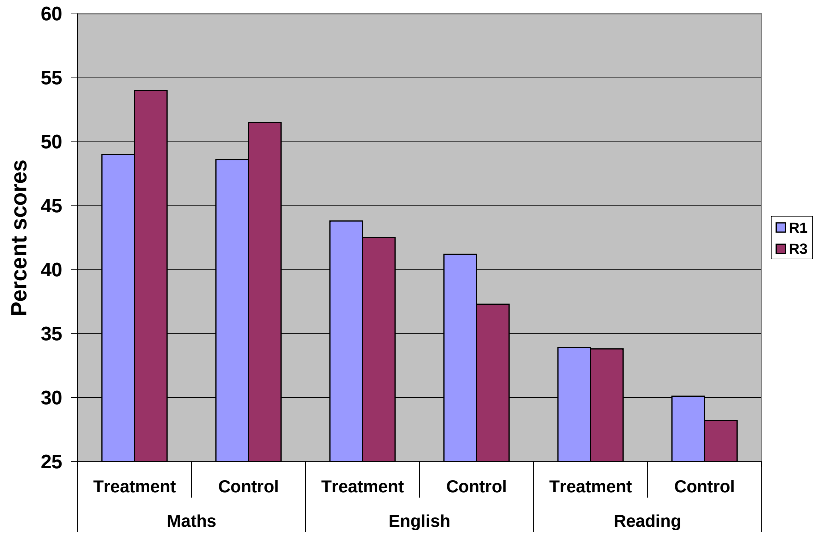
Scores (expressed as percentages) are presented in Tables 8 and 9. Figure 8 shows results for Grades 2 and 4 by group, for survey rounds 1 and 3.

Looking at significant differences in the descriptive statistics (average scores) between treatment and control groups in the three survey rounds, we find the following:

- Mathematics: no significant differences between groups in any grade or survey round;
- English: no significant differences at either baseline (Round 1) or Round 2, but the treatment schools perform significantly better at round 3 in all grades;
- Reading: in Round 1, the control group performs better than the treatment group for grade 4, but there is no significant difference in the performance of grade 2 children. In Round 2 there are no significant differences in either grade, but by round 3, performance is significantly better in both grades among children of the treatment schools;
- Science: no significant differences between groups;
- Social studies: the treatment school children perform better than the control school children.

In short, it would appear from these basic analyses that while virtually no differences between the treatment and control groups existed at Round 1 (except for Grade 4 reading when the control group did better), by Round 3 the treatment group is performing better than the control group in English, reading and social studies. The impact of SFP on educational attainment outcomes (subject scores) used matching to balance individual and household characteristics between comparison groups in order to explore causality. The results in section 4.3.4 are only estimated for the Average Treatment Effect of the matched groups, so that generalized impact results cannot be drawn from this exercise.

Figure 8: National Assessment Scores: Grades 2 and 4 by group and survey round



Source: Own estimations using Guyana IE surveys, 2007-2009

Table 8: Grades 2 and 4 - National Assessment Scores (expressed as percentages)

	Maths			English			Reading		
Grade 2	**Round 1**	**Round 2**	**Round 3**	**Round 1**	**Round 2**	**Round 3**	**Round 1**	**Round 2**	**Round 3**
% of students scoring zero	4.3	0.5	5.3	3.7	0.3	5.6	19.7	8.4	23.7
Mean % score ± SD	48.8 ± 22.4	55.9 ± 22.5	52.5 ± 25.9	42.4 ± 21.7	44.3 ± 19.3	39.4 ± 21.6	32.0 ± 25.9	38.8 ± 25.7	30.5 ± 28.6
Median of % score	50	56	54	41	44	36	26	37	22.9
Grade 4	**Round 1**	**Round 2**	**Round 3**	**Round 1**	**Round 2**	**Round 3**	**Round 1**	**Round 2**	**Round 3**
% of students scoring zero	1.1	0.3	4.7	1.6	0.2	4.1	7.1	5.6	12.9
Mean ± SD	42.5 ± 22.4	43.2 ± 20.3	38.0 ± 21.7	39.2 ± 19.1	41.9 ± 18.8	38.0 ± 21.9	47.5 ±27.5	52.5 ± 27.5	46.9 ± 30.8
Median	40	42	36	40	40	34	49	57	51.4

Source: Own estimations using Guyana IE surveys, 2007-2009

Table 9: Grade 6 - National Assessment Scores (expressed as percentages) – Round 3

	Maths		English		Science		Social Studies	
	C	**T**	**C**	**T**	**C**	**T**	**C**	**T**
% scoring zero	0	0	0	0	4.6	4.4	3.7	4.8
Mean ± SD	58.7 ± 10.7	60.1 ± 12.2	58.8 ± 12.4	60.9 ± 13.0	57.9 ± 14.0	59.6 ± 14.4	61.2 ± 13.5	63.7 ± 16.3
Median	59.2	61.2	59.6	61.6	59.2	61.2	61.5	65.0

Source: Own estimations using Guyana IE surveys, 2007-2009

4.1.4 How students behave

Both head teachers and class teachers of schools where school meals were offered were asked if they had noted any change in the behavior of the students (Table 10).[7] While the majority responded that behavior did change, the proportion of head teachers giving this response was highest in Round 1 while the proportion of class teachers was highest in Round 3.

Table 10: Perceived impact of school feeding - behavior

Factor	**Percent of respondents**		
	Round 1	**Round 2**	**Round 3**
SFP Changes behavior?			
Head-teacher agrees	87.3	60.7	63.2
Class-teacher agrees	72.5	83.2	83.3

Source: Own estimations using Guyana IE surveys, 2007-2009

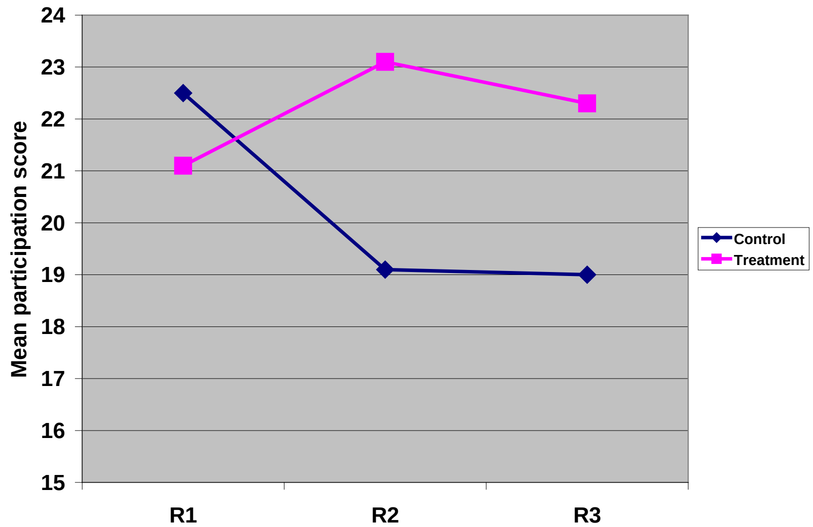
Details of classes observed by the enumerators are provided in Annex 5: grades observed, subjects taught and methods of teaching used (Table A5-3), the state of the desks, number of books, class enrolment and number of students present (Table A5-4).

A primary objective of the class observation exercise was to record the numbers of children who demonstrated signs of active participation in classroom activities, and the numbers of students who showed visible signs of disconnect with these activities. The results of this exercise are presented in Table 11. Since improved class participation is a key outcome indicator for the impact of school feeding, results are separated by treatment and comparison groups for each round.

Participation and disconnect scores were calculated for each observed class using the percentage of children in class who showed the sign, then calculating the mean disconnect and participation scores for classes in treatment and control schools. Figures 9 and 10 illustrate these findings. Figure 9 shows that, while the mean participation score for treatment schools was lower than that for control schools in Round 1, by Round 3, treatment schools had substantially higher mean scores. The reverse is seen in Figure 10 for disconnect scores: in control schools, the mean fell marginally from 5.3 to 4.7, the fall in treatment schools was substantially greater, from 6.8 to 2.1.

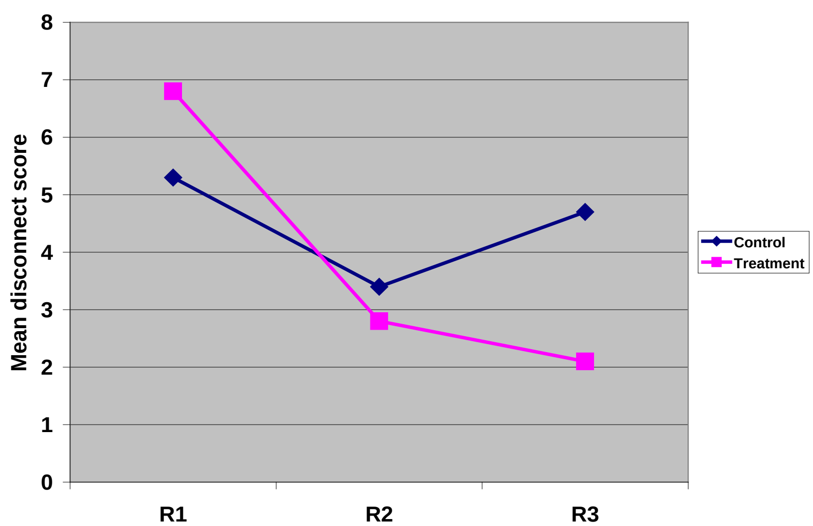
[7] For the teachers' survey, they reported meals that were not necessarily offered exclusively through the Ministry of Education's EFA – FTI Program. In some cases, other meals could have been provided by NGOs or religious organizations as well.

Figure 9: Mean participation scores by survey round and group



Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 10: Mean disconnect scores by survey round and group



Source: Own estimations using Guyana IE surveys, 2007-2009

Table 11: Class participation and signs of disconnect

Observation	Categories	Respondents as percent of children present						Percent of classes with zero responders					
		Round 1		Round2		Round 3		Round 1		Round 2		Round 3	
		C	T	C	T	C	T	C	T	C	T	C	T
1. Answered when asked		53.8	50.4	47.9	50.9	41.9	49.8	15.9	7.1	14.1	9.6	21.0	12.3
2. Demonstrated willingness to participate by:	Raising hands	19.8	21.8	16.4	19.1	15.4	22.0	46.0	26.2	44.4	37.0	47.6	20.0
	Standing	6.9	5.7	5.1	12.8	10.2	10.5	73.0	69.0	68.7	53.4	62.9	44.6
	Leading in group	8.8	6.2	6.4	9.3	8.1	7.0	76.2	61.9	71.7	64.4	66.7	63.1
3. Responded when prompted		36.7	25.5	25.1	27.6	27.5	20.9	19.7	9.5	22.2	16.4	30.5	23.1
		Respondents showing sign as percent of children present						Percent of classes with <u>no</u> children showing sign					
		Round 1		Round2		Round 3		Round 1		Round 2		Round 3	
		C	T	C	T	C	T	C	T	C	T	C	T
4. Signs of disconnect	Resting heads	4.4	6.2	1.7	1.9	4.0	1.8	76.2	54.8	82.8	79.5	70.5	75.4
	Sleeping	0.7	0.1	-	-	0.4	0.2	96.8	97.6	100.0	100.0	96.2	96.9
	Showing fatigue	4.2	5.8	4.0	4.1	5.6	2.3	79.4	54.8	71.7	74.0	71.4	76.9
	Unrelated activity	11.9	14.5	8.0	5.0	8.8	4.0	58.7	28.6	59.6	67.1	54.3	67.7

Source: Own estimations using Guyana IE surveys, 2007-2009

4.2 Outcomes: The communities

4.2.1 Parental participation in school activities

To establish and sustain a successful school feeding program, the EFA-FTI requires active participation by the community. In preparation, community members are asked to submit a proposal, undertake training, and raise funds and provide labor for the building of the school kitchen. Once the provision of meals starts, community farmers are required to provide commodities for the meals; local cooks provide nutritious meals; and an active committee member manages the program.

In the head teachers' questionnaire, the head teacher was asked to state whether parents assisted with specific school feeding activities, if the school had a school feeding program. The responses indicated a very high degree of involvement: nearly 80 percent of head teachers said that parents helped with cooking, cleaning and serving, 30 percent said parents helped to provide foods, and nearly 60 percent that they helped to raise funds.

The surveys asked parents to assess their own level of involvement in school feeding-related activities, and head teachers to assess parents' involvement in such activities. The results are given in Table 12. While there are differences in head teachers' and parents' perceptions, in all survey rounds, more responses from treatment school parents and head teachers indicated a high level of involvement in fund raising and school feeding activities than those from control schools. It should be noted that many control schools are actively preparing for the SFP, hence their positive responses to involvement in fund-raising and school-feeding activities.

Table 12: Participation of parents in school feeding-related activities

	Percent indicating a high level of involvement					
	Round 1		Round 2		Round 3	
	C	T	C	T	C	T
Parents' perceptions						
Fund-raising activity	31.8	37.6	26.4	34.6	21.7	28.8
School feeding activity	16.4	31.8	19.3	34.1	18.7	22.0
Head teachers' perceptions						
Fund-raising activity	40.9	57.9	38.1	42.1	30.8	57.9
School feeding activity	15.9	52.6	16.7	42.1	30.7	52.6

Source: Own estimations using Guyana IE surveys, 2007-2009

4.2.2 Safety net and price shocks

4.2.2.1. Food prices shocks and SFP as a safety net

SFPs around the world have been limited in finding benefits to better understand how they can serve as a safety net mechanism for poor families, particularly when linking social protection, consumption of nutritious foods (frequency and diversity) and uninterrupted education.

SFPs can provide and/or maintain diversity/balance in food consumption and micronutrients to complement, and not compete, with other nutrition programs. Little has been explored about the interrelation between food delivery modalities and SFPs effectiveness. At the local level, SFPs may contribute to creating new markets for agricultural produce. Guyana's SFP was implemented in a period of unprecedented increases in food prices (2007 and 2008). This gives the program a unique timing to be evaluated from a safety net perspective in the face of food price shocks.

A meal for poor families can represent a safety net mechanism to counter adverse shocks in prices and production of agricultural commodities. For instance, the food crises faced around the globe produced average increases of 130 percent in commodity prices (de Hoyos and Lessen, 2008). Commodities such as corn, wheat, rice and soybeans rose by 190, 162, 318 and 246 percent respectively (Lustig, 2009). The value of transfer of in-school meals appears to fall in the range of transfers common to other safety net programs.

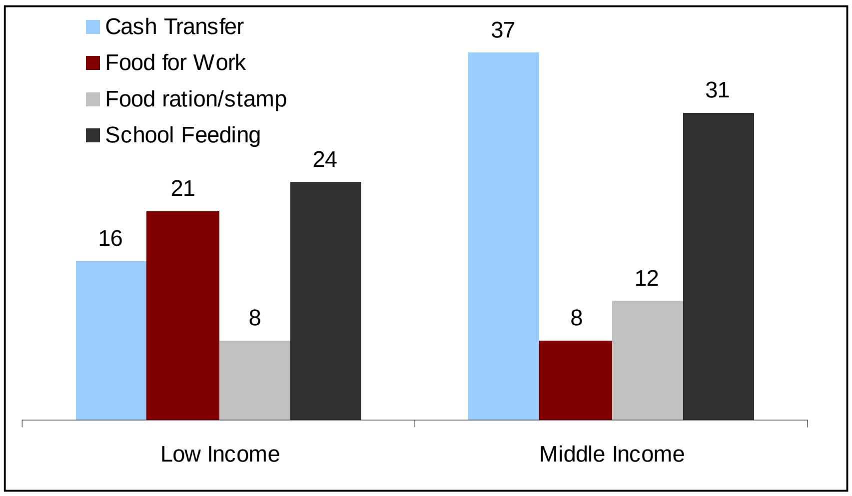
Guyana is largely independent of agricultural imports: around 32 percent of its GDP depends on agriculture and agricultural exports represent around 37 percent of export earnings (Ministry of Agriculture, 2008). Since food represents a relatively large share of developing countries' consumption baskets, inflationary pressures are common, with a negative impact on the living standards of poor net consumers. In the hinterland areas of Guyana, the SFP provides incentives to continuous local food production which can affect prices paid by poor households. In this way, governments can use SFP safety nets to protect the poor from rising food prices. Such broad school-based interventions may be even more effective in targeting the poor than food subsidies or import restrictions to stabilize food prices.

Safety net programs implemented around the world can be arranged in four categories: Cash Transfers, Food for Work, Food rations/stamps and School Feeding (see Figure 11). These programs have been shown to prevent steep and sudden declines in poor people's income in the advent of economic crises and price shocks. According to Lustig (2009), 19 (out of 49) low-income and 49 (out of 95) middle-income countries do not have safety net programs of any kind. Given the characteristic of the adverse shock—i.e., an increase in the price of a basic good takes up a substantial portion of a poor person's budget—the most adequate safety net is to compensate the affected population for their loss in purchasing power in cash or in kind.

In the absence of cash transfer programs, countries could resort to school feeding programs. While they will not compensate the poor for the loss of purchasing power associated with higher food prices, school feeding programs can insulate (at least in part) children of poor households from suffering a cut in their nutritious food intake.

Figure 11 shows how school feeding programs are widely prevalent among low and middle income countries, compared to other safety net programs. Since vulnerable populations are most affected by food price shocks, the presence of school feeding programs provide enormous non-tangible benefits by i) investing early in the health and education of children, and ii) shielding partially from economic shocks the disposable income of households, at least in the short-run.

Figure 11: Food Crises - Safety Nets in Low and Middle Income Countries (number of programs)



Source: Lustig, 2009.

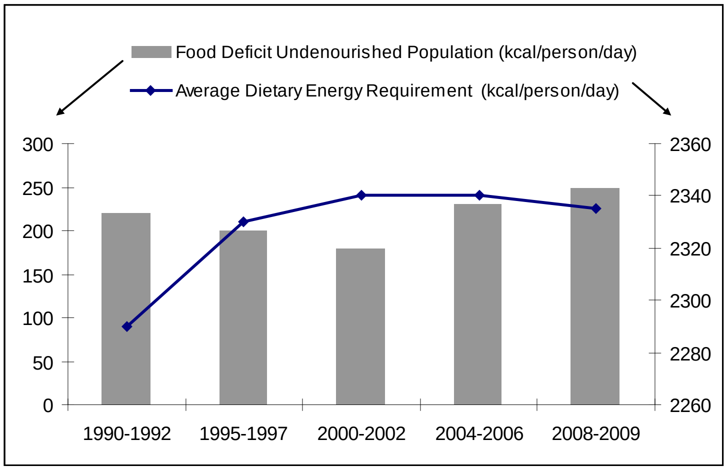
In Guyana, Regions 1 and 7 are rural areas where many families depend on local agricultural markets to preserve their purchase power on food consumption. Other adjacent regions within Guyana contribute to meeting the agricultural and food needs of regions 1 and 7, but subsistence farming is common. In Guyana, food deficit and dietary requirements rise and fall, respectively, in the period where food prices increases took place (see Figure 12)[8].

Evidently, food price increases may have reduced the consumption capacity of poor households on food products. As a consequence the food deficit among the population increased or, at least remained constant. The food deficit can also be explained by income and substitution effects (changes in relative prices and spending capacity on food products). Although Guyana has improved substantially in terms of nutritional status of its population[9] the pace nutrition improvements could have more rapid if dietary changes would have been more steady.

[8] Although production data in Guyana has several shortcomings, the FAO estimations based on Food Balance Sheets provide an approximation of the diet trends in the country given the supply and demand side levels.

[9] According to FAO (2008) Guyana is one of the five countries in LAC that have relatively high rates of income growth, and strong productivity in the agricultural sector (along with Argentina, Chile, Peru and Uruguay). In Guyana the proportion and numbers of undernourished decreased over the 1990s and 2000s. Incidentally, the numbers and proportions undernourished are derived from statistics using the DES figures, and not on any food consumption or nutrition surveys.

Figure 12: Food Deficit and Average Dietary Requirement in Guyana

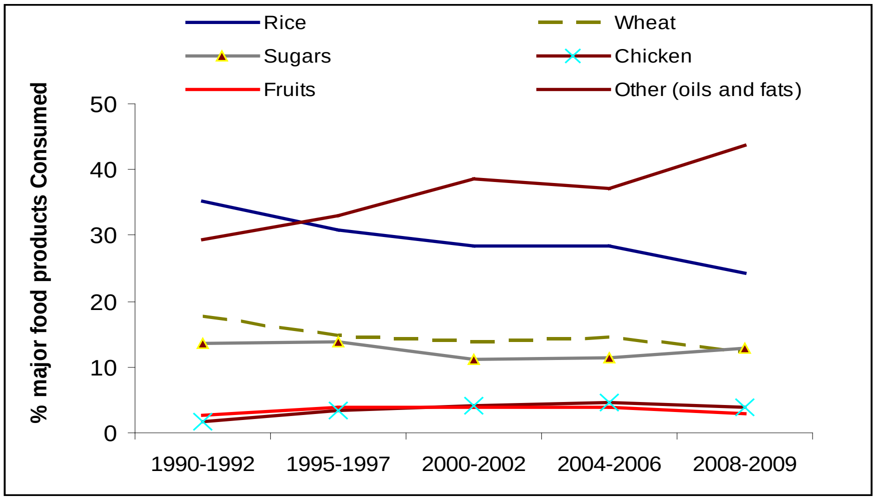


Source: FAO, 2009; Guyana Market Corporation, 2010.

Generally speaking, if the percent of calories (dietary energy supply, DES) from fat in a country rises (Figure 13), it means that people may be eating "more expensive" diets but not necessarily more nutritious ones. Going along with this, based on the FAO Guyana country profile, the percent of DES from carbohydrates decreases (from 76% to 70%). Apparently, this may improve the nutritional balance of households. However, the marked shift over the past 20 years to diets high in saturated fat, sugar and refined foods, trends in Guyana might pose a double burden on households: to health and purchasing power. Over the long run, changing dietary patterns and lifestyles - spurred by urbanization, the liberalization of markets, demographic shifts and declining levels of physical activity - may contribute to overweight and chronic diseases, along with nutrition deficits. In this way, school feeding programs have the objective of preserving healthy diets among children and prevent this double burden that is present in countries like India, Philippines, Mexico, South Africa, China and Egypt where both under- and over-nutrition have seriously posed a significant burden in their health care systems (FAO, 2008).

Given that Guyana is a net food exporter, recent increases in food prices provide an incentive to Guyana's export market to expand supply, which could possibly shrink local supply. This local scarcity can in turn increase prices. A reduction in purchasing power of the rural poor population takes place. This leads to an increase in the internal demand for substitute food groups (see Graph 13).

Figure 13: Availability of selected foods and food groups in Guyana 1990-2009



Source: FAO, 2009

An increase in food prices can not only harm the diet and nutritional intake of poor households, it can also reduce spending capacity which can bring a household to below the poverty threshold. To measure the price shock transmission to household poverty, price change simulations in treatment and control areas were estimated based on food consumption (see Annex 4). With price and consumption differences, the SFP safety net contribution to preventing households and individuals to falling below the poverty threshold can be estimated. If an SFPs is seen as a transfer program with specific safety net mechanisms towards poor households (Alderman, 2009), then not only education and health outcomes need to be assessed but also more general welfare effects should be explored. When comparing school meals to transfer programs then cost per meal compared to alternatives including take home rations and snacks are relevant. The main advantages of Guyana's SFP compared to the general experience of other SFP around the world are adequacy, equity, cost effectiveness and sustainability, which position it as a program with high potential for welfare protection program conditioned to a national expansion.

Table 13: Guyana's SFP compared to SFPs around the World

Measurement	General SFP Experience in the World	Guyana's Case
Appropriateness	Relatively easy to scale in crisis/or once piloted	Already implemented isolated rural areas
Adequacy	Good (>10% of HH income)	Good for rural areas/ Amerindian population
Equity	Moderate (lowest where ED low)	Improve some EDU and Health indicators of poor
Cost-effectiveness	Poor to Moderate (20-40% non-transfer costs)	Moderate
Avoiding dependency	Good, could be Very Good	Very Good: Community/Schools and Parents Involved
Sustainability	Questionable	Depends on medium-term funding as ECD/CCT
Dynamism	Usually not	Not

Source: Adapted from Alderman (2009)

Costs and Sustainability of the SFP Safety Net

The Guyana EFA-FTI SFP has also financial returns. Beyond the benefits of increasing school enrollment, height of children, and providing a safety net mechanism to poor rural households, the program shows financial viability. To illustrate the financial viability of the program it is important to estimate the unit average costs and ratios as benchmarks for comparison with other similar school feeding programs.

The program costs can be estimated using the costs per child, the fixed start up costs, and the variable costs (see Annex 4 for cost details by schools). The recurrent cost is G$175 per school day (approximately US$ 0.90 per child enrolled). This covers all running costs: food, cooks' salaries, cooking fuel, water etc. The academic year comprises 192 schooldays. In addition, each school receives a one-off start-up sum. This is equal to one-third the annual recurrent costs: G$175 x 64 schooldays x number of children enrolled. With these costs we can estimate the average costs per day per school. Also by using actual data on the costs absorbed by the government of Guyana and the EFA-FTI funding it is possible to compare program expenditures with other programs.

Table 14 shows the costs indicators for the Guyana SFP program and the Day Meal Program (DMP) in India, which is co-financed by the government of India and the World Food Program (WFP). Although the DMP has expanded substantially to cover 5,700 schools, it is arranged in similar fashion to Guyana's SFP operation.

Table 14: Guyana SFP Costs vs. India's Day Meal Program

Cost Categories	GUYANA SFP (EFA-FTI-GOG)	INDIA Day Meal Program (WFP-GOI)	Ratio
		USD	
Average Cost Per Day Per School	228.5	192.6	0.84
Average Number of Students per school	261.2	168.4	0.64
Number of Schools	137	5,700	41.6
Average Unit Cost (USD per student /day)	0.9	1.14	1.31
		(In USD Millions)	
EFA-FTI Expenditure *	2.33	3.8 ***	1.64
Government Expenditure SFP ***	4.05	3.20	0.79
Total Expenditure ****	6.37	7.00	1.10

Costs for Guyana program accumulated for 2007-2009 period.
Costs for India program accumulated for 2008-2009 period.
* Includes community grants and training
** Includes food expenditures
*** WFP contribution
**** In the case of Guyana all costs are incorporated by EFA-FTI and Government.
In the case of India there are also state contributions that increase the total expenditures.
For comparability issues, only the Government expenditures and EFA-FTI Expenditures included in each country. This is why, although India's SFP has higher unit costs and more schools, total expenditures are marginally above Guyana's total expenditures.

Sources: Own Estimations based on Guyana's SFP Program; National Mid-Day Meal Program; Akshaya Patra Foundation, 2008.

The average SFP cost is around US$230 per school per day[10]. The DMP has a lower average cost per day of around US$193[11]. However, the DMP expanded to 5,700 schools which allowed the program to have economies of scale based on a large numbers of schools. This reduces substantially the sunk costs to start the program, since they are averaged to the total number of schools. Conversely, the SFP has a cost of $0.90 USD compared to the $1.14 USD that cost the DMP per student per school-day. The Guyana SFP has lower costs than a large scale program in India which sets it in a good benchmark against costs increases. The unit cost ratio between the DMP and the SFP is 1.31 indicating that the SFP unit cost is 30 percent lower than the DMP.

[10] The number of schools covered by the EFA-FTI impact evaluation is 64. However, we consider all primary schools in Regions 1, 7, 8 and 9, covering a total of 137 schools.
[11] Based on all costs of the program, including state's/UT contributions.

The average cost per day per school shows a ratio of 0.84 between the DMP and the SFP, which is partially a result of the large scale presence of the DMP program[12]. Expansion not only can bring benefits to a target population with reasonable program costs, it can also serve as means to achieve a financially sustainable program that takes advantage local agricultural markets to stimulate local/communities' economies. As such, local purchase of food for school feeding is seen as a multiplier, benefiting children and the local economy at the same time.

4.2.2.2. Household diets

Household diets vary considerably by ethnic group in Guyana. The diet of Amerindian communities, especially the more remote/rural ones, often lacks diversity. A diet that is monotonous risks being nutritionally unbalanced, and it is likely to be deficient in one or more micronutrients (vitamins and minerals).

In Amerindian communities, diets are low in vegetables, fruit, legumes and dairy products. The reason is likely two-fold: on the one hand meat and/or fish and cassava are culturally the most acceptable commodities, and on the other hand, vegetables, fruit, legumes and dairy products are scarce and expensive.

A primary objective of the nutrition training provided as part of the hinterland school feeding program is the promotion of nutritionally balanced diets with the increased consumption of vegetables, fruits and legumes. This objective is linked to the promotion of community development and participation: schools are encouraged to procure all commodities needed to provide nutritious meals from local farmers, and farmers are encouraged to grow the products for this guaranteed market, thereby increasing their incomes.

The impact evaluation surveys included a limited food frequency questionnaire as a sub-component of the parents' questionnaire. Parents were asked how often certain commodities had been consumed in their households during the previous week. Table 15 shows the results of this dietary assessment.[13] We also developed two scores: a food frequency score which is based on the frequency of consumption of each item included in the food list (1 lowest, 21 highest), and a diet diversity score which simply sums consumption/non-consumption of each food as 0/1 variables (1 lowest, 8 highest consumption), and takes no account of frequency of consumption. The means of these scores by survey round and group are shown in Table 15 and are presented as graphs in Figures 14 and 15.

[12] Other local costs, procurement and program organization can play an important role in reducing costs.
[13] Foods included: meat of any kind, including poultry, seafood, legumes, milk, cheese, eggs, vegetables, fresh fruits and juices. Specifically excluded were root vegetables, called ground provisions locally, which include the staple cassava. This was not intended to be a full food frequency questionnaire which would have been too time consuming to administer and would have required substantially more training.

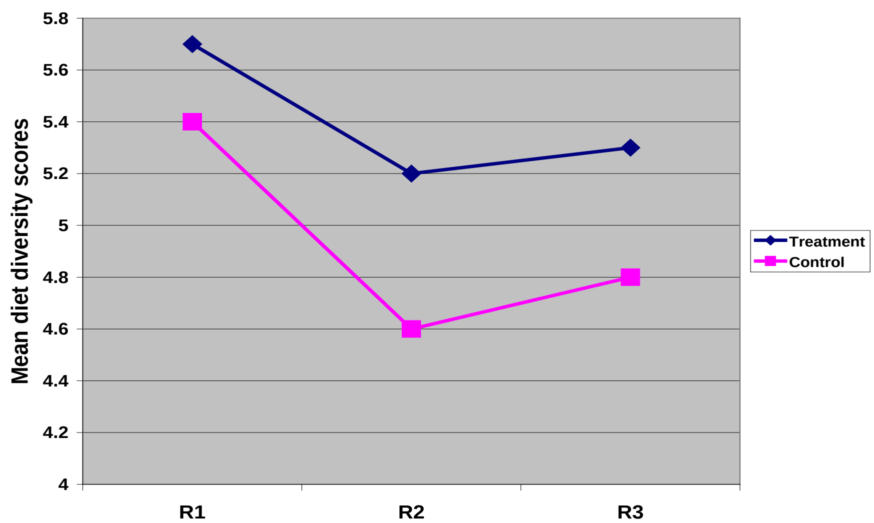
Table 15: Food groups and scores by survey round and by group

	Percent of respondents											
Frequency of consumption:	**Once only or not at all in previous week**						**Once a day or more in previous week**					
Food groups	**C**			**T**			**C**			**T**		
	R1	**R2**	**R3**	**R1**	**R2**	**R3**	**R1**	**R2**	**R3**	**R1**	**R2**	**R3**
Protein foods	4.4	5.2	1.9	5.3	1.5	3.7	67.1	53.5	61.1	67.9	65.9	65.1
Vegetables	14.1	20.8	21.1	11.1	18.0	12.7	50.6	37.5	40.2	56.0	47.3	53.5
Fruits & juices	32.8	40.4	49.3	29.1	31.4	27.5	13.8	8.1	9.6	16.9	20.1	19.0
Dairy products	18.7	47.1	28.5	10.5	26.8	19.0	37.9	19.3	30.4	46.8	41.8	47.6

	Means ± SD					
	C			**T**		
Score	**R1**	**R2**	**R3**	**R1**	**R2**	**R3**
Food frequency score	9.0 ± 4.2	6.7 ± 3.4	7.4 ± 3.6	9.8 ± 4.4	8.6 ± 3.9	9.1± 3.9
Diet diversity score	5.4 ± 1.9	4.6 ± 2.0	4.8 ± 1.9	5.7 ± 1.8	5.2 ± 1.9	5.3 ± 1.7

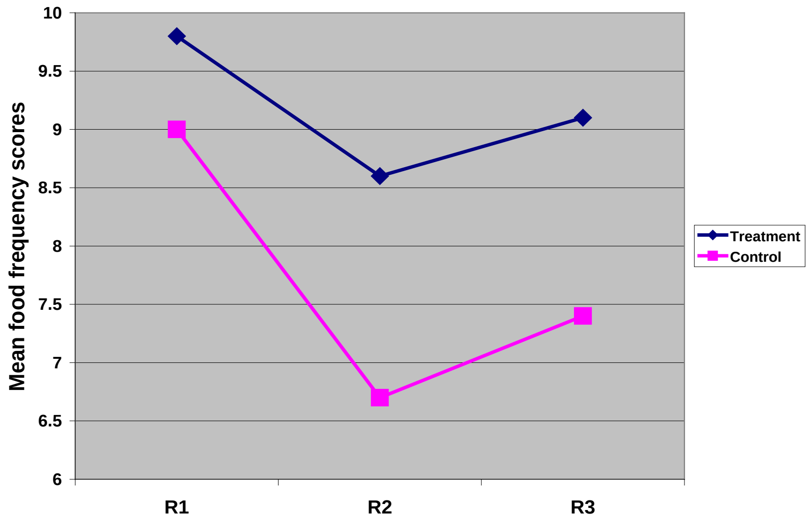
Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 14: Mean diet diversity scores by survey round and group



Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 15: Mean food frequency scores by survey round and group



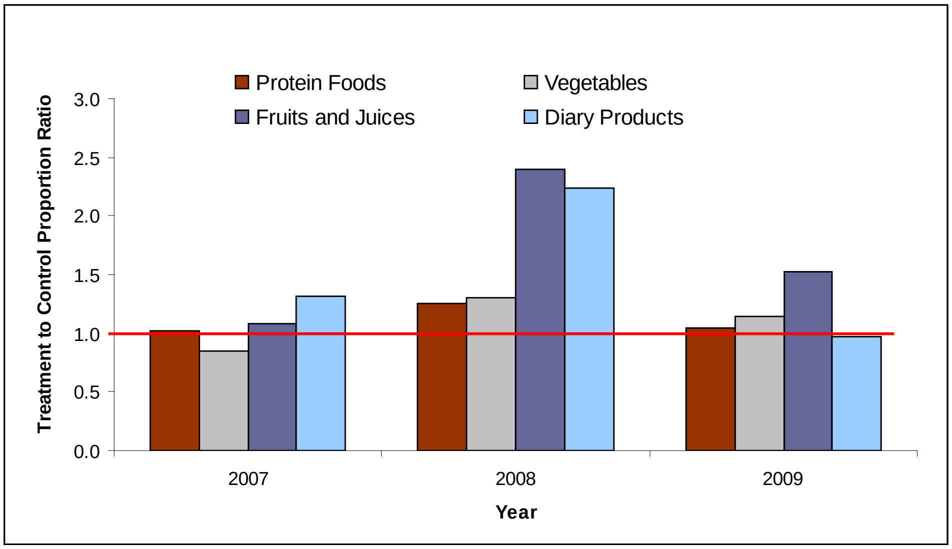
Source: Own estimations using Guyana IE surveys, 2007-2009

The treatment group began at baseline with higher food frequency and diet diversity scores, in line with the higher wealth indicators noted in Section 5.2. Food prices rose substantially in Guyana in the period between rounds 1 and 2. Both the figures and the table show that while food frequency and diet diversity fell between rounds 1 and 2, they fell more sharply in the control group. By Round 3, the gap between the groups had increased substantially. These findings suggest that the school feeding program was able to at least partially cushion the schools in the treatment group against the increase in food prices.

Another way to look at this last point is to build food frequency ratios between treatment and control areas. Figure 16 shows the ratios for 2007 through 2009 by food group categories. At baseline the gap between comparison groups was relatively small for all food groups. During 2008 the ratios of all food groups increased, particularly for fruits and dairy products. This means that the treatment areas kept the frequency of consumption relatively steady while the control group areas reduced food consumption frequency, which in turn is manifested in larger gaps between comparison groups.

Section 4.3 presents SFP impacts on diet diversity and food frequencies using regression analysis. Food frequency and diet diversity scores are defined exactly as defined in this section.

Figure 16: Treatment and Control (T/C) Ratios of Frequency of Food Consumption



Source: Own estimations using Guyana IE surveys, 2007-2009

4.2.2.3. Breakfast consumption

Consuming an adequate breakfast helps a child stay alert and to benefit more fully from the education offered during the morning hours. We asked both parents and students in Rounds 2 and 3 about the kind of breakfast consumed by the student on the survey day. Table 16 shows their responses.

In Sections 5.1.2 and 5.2.3 we note the facts that more than 30 percent of students with an arduous travel to school each morning received at most a light breakfast, and that single parents (especially fathers) were least likely to provide a full breakfast.

Table 16: Children's breakfasts on day of interview: parent and student responses

Factor	Category	Percent of respondents				
		Round 1	Round 2		Round 3	
		All	C	T	C	T
Students' responses	No	4.7	2.2	4.4	1.8	3.5
	Yes	95.3	-	-	-	-
	Drink only		1.1	1.5	0.9	1.8
	Light breakfast		28.8	46.0	25.3	48.6
	Full breakfast		67.8	48.1	72.0	46.1
			C	T	C	T
Parents' responses	None		1.0	1.5	0.3	0
	Drink only		1.0	3.1	1.6	1.1
	Light breakfast		38.0	55.7	25.8	43.2
	Full breakfast		59.9	39.7	72.3	55.8

Source: Own estimations using Guyana IE surveys, 2007-2009

Table 16 shows that in rounds 2 and 3, students attending treatment schools were significantly less likely to receive a full breakfast. This is potentially a serious concern. Are parents of treatment schools withholding a full breakfast because they know the child will receive a substantial lunch? If this is indeed the case, then the training offered by the school feeding program needs to stress the importance of an adequate breakfast, even when a full lunch is to be offered at noon.

4.3 Impact analysis: What was the impact of the school feeding program?

Regression analysis can shed light on some of the impacts of SFPs on children and schools while controlling for demographic, social and economic characteristics. In addition, the data collected in three rounds is rich enough to even allow controlling for observed factors that may have enhanced comparison group differences and sample selectivity. The regression analysis considered the following outcome variables:

1) Health Indicators: Stunting (height-for-age) and Wasting (BMI)
2) School enrollment
3) Attendance
4) Educational attainment
5) Household food consumption

The regression analysis cannot be limited to reporting on simple estimators. Because the groups were not selected randomly and because SFP implementation was delayed in some schools, there is sample selectivity in the treatment group, which may bias the estimates. To control for sample selectivity a technique was used to correct bias in the SFP estimates (see Annex 4 for a detailed description of the methodology).

4.3.1 Health Indicators

Stunting (height-for-age)

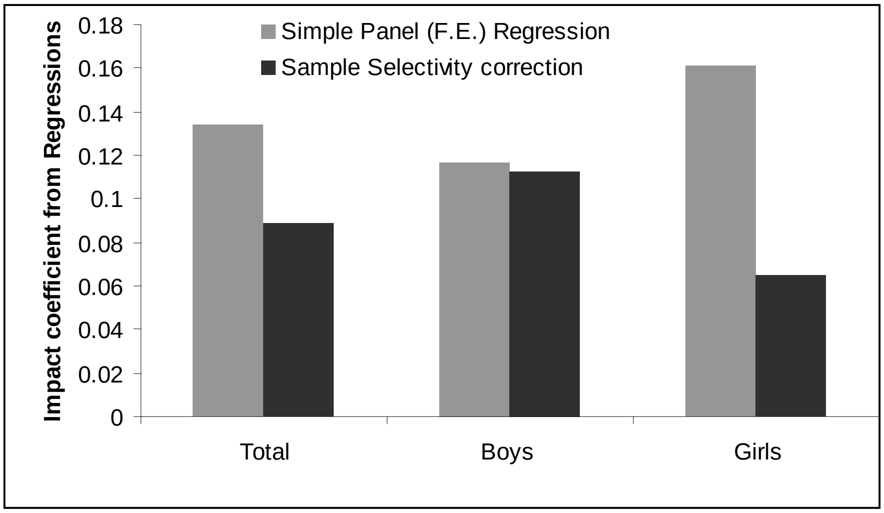
Stunting, measured by the height-for-age z-score (HAZ), is an important variable for the program. It allows us to explore whether the program is actually supporting early childhood development. The SFP will be highly effective if it can produce changes at this level, independently of which subgroups (age, gender) concentrate the larger share of impacts. The long term consequences of reducing stunting among children in Guyana's hinterland regions will produce better cognitive abilities of children and higher probabilities of completion rates of primary school (Alderman, Hoddinott and Kinsey, 2006).

As mentioned before, selectivity in unobserved variables might be present between comparison groups, given the baseline difference. In order to estimate the impacts and to highlight the sensitivity of impact estimators, fixed effects and sample selection (2-stage) models were run. Figure 17 shows the effects of SFP on height-for-age z-scores of children[14]. There are two important aspects to highlight. First, by not correcting for sample selectivity impacts are overestimated. We expect a positive coefficient, which is the case, to infer that the SFP causes an increase in z-score mean. Second, by separating the effects between girls and boys it is found that the selectivity is predominant among girls, leading to a higher overestimation of SFP impacts for girls rather than boys.

Figure 18 shows the differences in height for the children sample in 2007, 2008 and 2009. For 2008 and 2009 the mean height for children is fairly similar. However, for the baseline year (2007) the height of children is higher for the treatment group than the control group. This intuitively implies that girls selected in the treatment group at baseline were taller than control group girls. Overall, girls included in the sample were taller at baseline that boys.

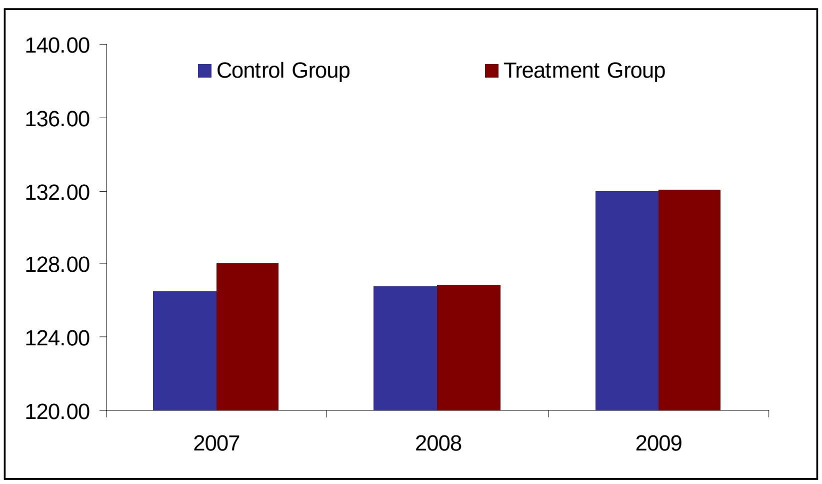
[14] For full description and results of the models see Annex 4.

Figure 17: Estimation of SFP impacts on height-for-age z-scores



Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 18: Treatment and Control Groups Students' Height Comparison (centimeters)



Source: Own estimations using Guyana IE surveys, 2007-2009

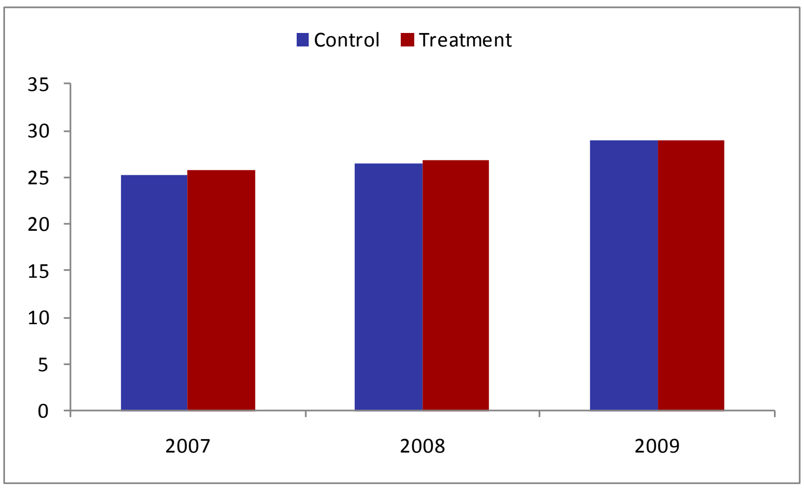
SFP impacts on the height-for-age scores are small but not negligible. The impacts are larger for boys than girls. Overall, the mean impact coefficient of the SFP on HAZ is around 0.09. Because the mean height of children is 1.26 meters in our sample, and because our HAZ score is standardized to a normal distribution, the coefficient will be translated in a proportional shift to one standard deviation. Because the standard deviation of children's height is 8.7 centimeters, the impact coefficient of 0.09 will imply on average an increase of 0.8 centimeters (8.7 cm x 0.09) of children that participate in SFP compared to children that do not participate in the program. An increase in 0.8 centimeters in children's height might be small, but the long term consequences of such a height increase will be enormous in terms of human capital gains.

Subsample of Children at-risk of Stunting and Wasting

Annex 3 shows the cutoff points to define children at-risk of stunting based on height-for-age z-scores. Based on these cut-off points, two models were run containing an interacted term between the SFP dummy and the at-risk-of-stunting dummy (see Annex 4). The results of these models with full controls show no significant impact of SFP for children at-risk of stunting, even after using the PSM matched sample. Although it was shown that the average treatment effect is small and statistically significant, the impacts for the vulnerable subgroup (at-risk children) are not significant.

Wasting, on the other hand, showed a different story. The impacts were close to zero and insignificant even after sample selection correction[15]. Baseline characteristics were fairly similar between treatment and control groups, but BMI's composition is affected by the height differences shown at baseline.

Figure 19: Treatment and Control Groups Students' Weight Comparison (kilograms)



Source: Own estimations using Guyana IE surveys, 2007-2009

Nevertheless, the estimated models for at-risk children of wasting (Annex 4) show that SFP increases the BMI from 1.07 (0.704/0.65[16]) to 1.34 (0.874/0.65) standard deviations compared to non-participants. The average treatment effect for the complete sample of children that reported BMI was insignificant, but it was significant for the subgroup of children that are at higher risk of wasting, according to the WHO cutoffs.

4.3.2 School Enrollment

Table 17 shows the number of children enrolled in schools. A typical effect of SFP program would be on enrollment because of the economic incentive it creates for parents to enroll their

[15] Results of regressions not included in the paper.

[16] 0.65 is the standard deviation of wasting (BMI) z-score for the at-risk subpopulation.

children in school in order to receive a free meal. Many evaluations target school enrollment as an important outcome of SFPs.

Table 17: School Enrollment in 2007 and 2009

Status	2007	2009	Difference
Treatment	**4,442**	**5,173**	**731**
Region 1	3,640	3,841	201
Region 7	1,302	1,521	219
Control	**5,290**	**4,897**	**-393**
Region 1	3,480	3,648	168
Region 7	923	853	-70
Total	**9,732**	**10,070**	**338**

Source: Own estimations using Guyana IE surveys, 2007-2009

Enrollment at baseline was higher for control schools. More schools were incorporated in the treatment group in 2008 and 2009 making the total number of children enrolled in treatment schools higher than in control schools. The changes in enrollment can be confounding because comparison groups were dissimilar at baseline. This is suggestive of sample selection in the outcome variable and would lead to biased program impact estimates.

Figure 20 shows the differences in school enrollment *estimated* through a simple model. We cannot infer if the program *caused* an increase in enrollment because simply the groups have different enrollment levels at baseline and randomization was not achieved. The impacts might be driven come from those intrinsic differences rather than from SFP participation. These estimations can be carried out by modeling the proportion of enrollment present in each region and the composition of girls and boys present in each school.

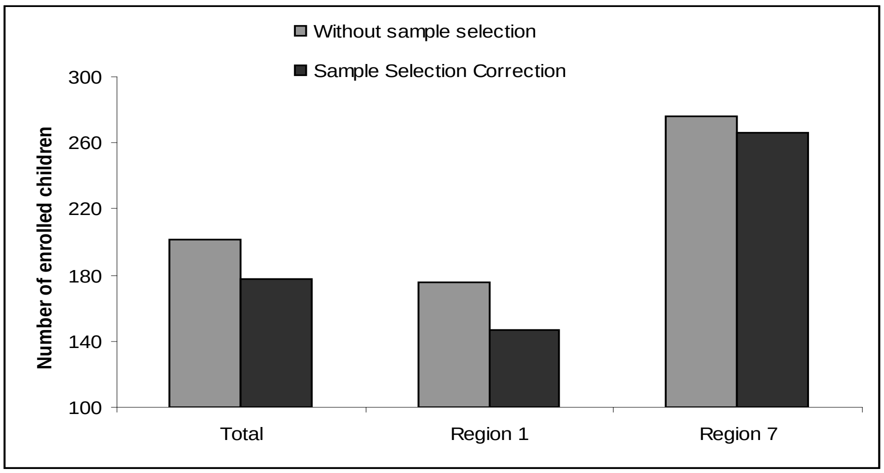
The impact estimators measure the increase in the number of enrolled children by the program[17]. With sample selection correction we can reduce the bias from the intrinsic enrollment differences shown at baseline. Simple OLS estimates show that the SFP increases enrollment by 200 children; with the sample selection correction model there are only around 178 children enrolled because of the SFP. The total increase in enrollment observed in the survey data equals 338 students. This means that around 53 percent of the observed change in enrollment between 2007 and 2009 could have been induced by the SFP[18].

[17] See Annex 4 for a detailed description of the models used.

[18] The differences in enrollment for the control group are the same between 2007 and 2009 from survey data and from official data from the Ministry of Education. It is worth to mention that Enrollment data may have measurement errors even from Administrative records from the Ministry of Education. The degree of the error is unknown but can indeed bias estimates.

The predictions in enrollment by region are shown in Figure 20. These includes the estimations of the mean enrollment after running the two models one with sample selection correction and the other with simple fixed-effects regression. Selectivity is present predominantly in Region 1 and total enrollment had higher predicted values for Region 7. Primary enrollment in Region 1 is higher than Region 7. A marginal increase in enrollment in Region 7 relative to Region 1 will be better captured in the model because of the higher enrollment gap existing in Region 7 between primary-age population and primary enrollment.

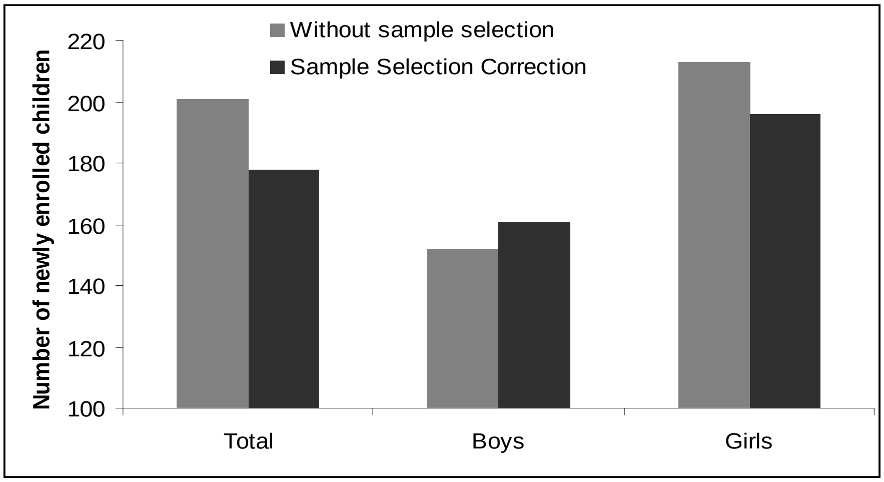
Figure 20: Estimated SFP impact on Enrollment by Region, 2007-2009



Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 20a shows the model estimations in the number of students enrolled in SFP schools compared to non-SFP schools. The overestimation of impacts, given by selectivity present in SFP participation variable that affect the enrollment outcomes, was predominantly biased towards girls in the predictions. This is because the program had a higher effect on increasing girls' enrollment. On average, the program creates 196 newly enrolled girls compared to an average of 161 newly enrolled boys.

Figure 20a: Estimated SFP impact on Enrollment by Gender, 2007-2009



Source: Own estimations using Guyana IE surveys, 2007-2009

4.3.3 Students' attendance

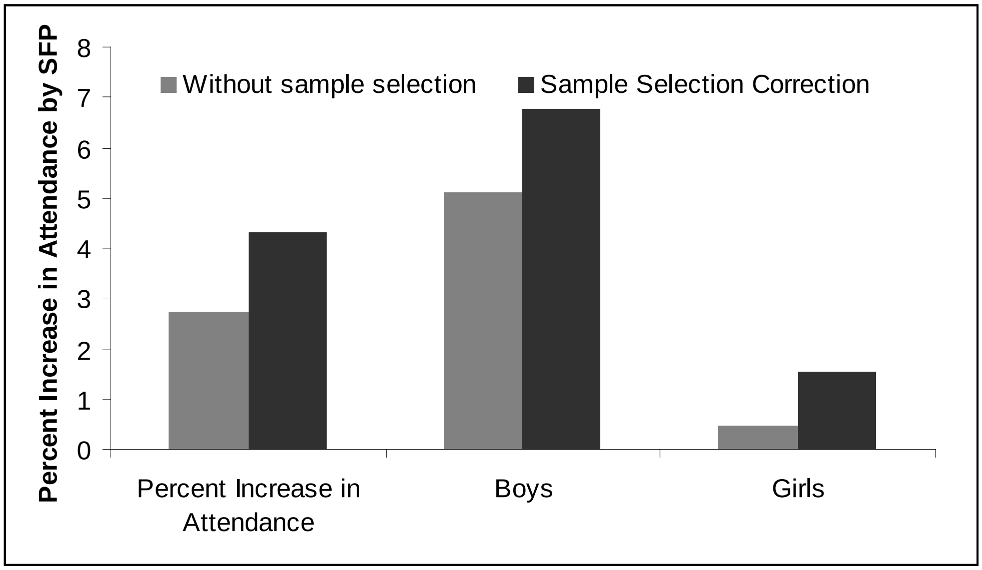
As noted in Section 4.1.1, attendance rates show differences at baseline between treatment and control groups. Again, self-selection is present and thus it is necessary to correct with an econometric technique to reduce bias on impact estimates of SFP on attendance.

The impact coefficients for the fixed-effects model and the two-stage sample selection[19] correction are shown in Figure 21 (full regressions in Annex 4). A positive coefficient indicates that children exposed to the program attend school more days on average. Treatment schools had higher attendance rates than control schools at baseline (sample selection), but control schools catch up with higher growth rates of attendance between 2007 and 2009. Both factors bias the effects of the program.

The estimated impacts of SFP in attendance rates are reported in Figure 21, showing that SFP increased average attendance by 4.3 percent between 2007 and 2009. With the selectivity correction estimates it was found that underestimation of impacts was driven by boys. Boys showed an increase in attendance of 6.7 percent compared to an increase in girls' attendance of 1.6 percent using the 2 stage sample selection correction. Girls have higher attendance rates than boys and non-reported attendance was primarily skewed towards boys. Boys often contribute with labor at early ages to enhance household incomes, so the economic incentive of the SFP within beneficiary households might be reflected in these findings.

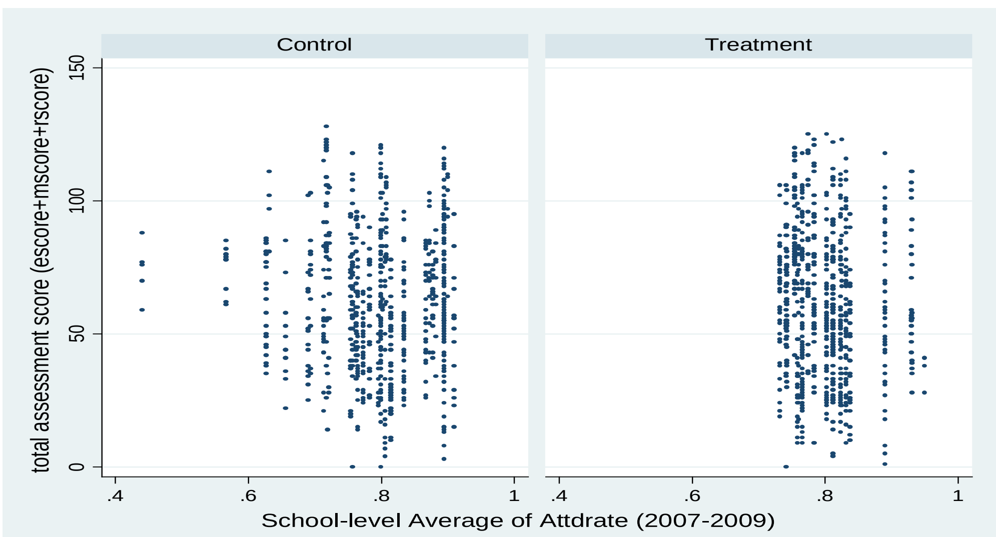
[19] The influence of self-selection effects must be assessed in order to accurately interpret outcome data. The analysis then should directly model the process of entry into a program and incorporating information on the factors affecting self-selection into estimation of program effects. The two-stage sample selection models are designed to address such situations.

Figure 21: SFP impact coefficients on Attendance Rates 2007-2009



Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 21a: Average School Attendance and Academic Performance, 2007-2009



Source: Own estimations using Guyana IE surveys, 2007-2009

4.3.4 Educational Attainment

As noted in Section 4.1.3, the surveys captured academic scores in multiple subjects. Regressions were run to explore the effects of the SFP on the scores reported from National

Assessments in grades 2, 4 and 6. In this case, the issue of non-random selection of comparison groups can be corrected using propensity score matching on students' characteristics[20].

For grade 6 there are two additional subjects tested: science and social sciences. However, the scores of 6 graders were only collected in the third round so it is not possible to draw conclusions of SFP impacts without baseline data[21]. As shown in section 4.1.3 the education performance outcomes of students show ambiguous results in terms of the simple average differences between 2007 and 2009 (Table 8). The causal impact of the program can be measured only if the comparison groups can be matched to student characteristics are similar and preserve fairly similar scores for the matched subsample of treatment and control groups. Sample selection correction is not enough since the scores of students can be modeled to gain comparability of students in terms of educational outcomes. In this case, it provides better statistical justification to perform matching methods to explain the existence of any difference in the educational outcomes induced by the SFP. The techniques available for matching will only allow the identification of Average Treatment on the Treated (ATT) effects[22].

To verify the importance of estimate educational performance impacts using Propensity Score Matching (PSM) method (see Annex 4), given that scores are observed, table 17a shows the effects estimated using standard fixed effects and sample selection correction (unobserved attributes explaining treatment and control allocation). In the case of Science and Social Studies (only for 6th graders) there is indeed an impact of the program. The main issue with these estimations, as previously noted, is that it is possible to increase the accuracy of the estimations by matching students with similar characteristics and scores into the treatment and control groups. In the cases of the English, Math and Reading PSM estimates cannot be compared to the F.E. and SSC models given that the coefficients for both methods are statistically insignificant and the source of bias unobserved.

[20] All estimates using with sample selection correction, showed no significant impacts in Reading, English and Mathematics for grades 2 and 4.
[21] However, the data will be useful to evaluate educational outcomes in future survey rounds.
[22] The explanation to estimate and interpret ATT is in the annex.

Table 17a: Effects of SFP on different Academic Subjects

Summary Tables: Educational Attainment Impacts		
Subject	**Simple Model (F.E.)**	**Model with Sample Selection Correction**
Science	0.037	1.96
Significant	Yes	Yes
Social Studies	0.221	3.79
Significant	Yes	Yes

Significant at 10 percent level or less.

Subject	**Simple Model**	**Model with Sample Selection Correction**
English	-1.13	-1.95
Significant	No	No
Math	-3.36	-4.10
Significant	No	No
Reading	0.865	1.62
Significant	No	Yes

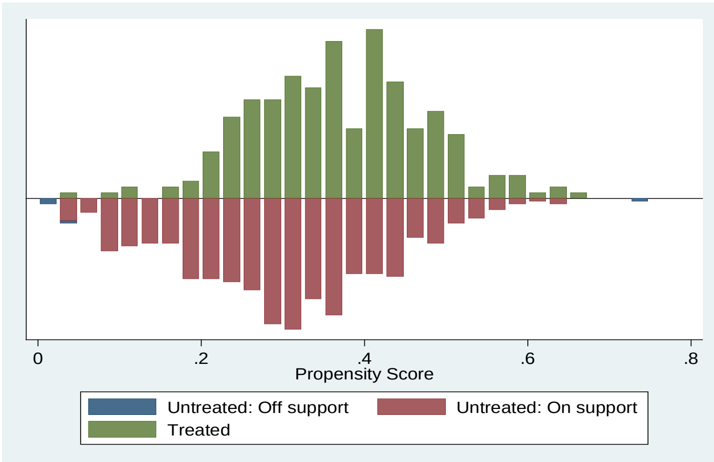
Significant at 10 percent level or less.

Source: Author's estimates GY SFP Surveys

The PSM common support distribution is shown in Figure 21a. The balancing of both groups with the characteristics and the performance scores make both distributions fairly similar. This depicts the level of comparability gained by estimating the scores for each block of characteristics. All other observations where there cannot be a match are dropped from the PSM estimation. However, the number of observations that remained after the PSM was enough to proceed to the next stage of the estimations[23]. Table 17b shows the PSM ATT results with the kernel matching. The estimators are expressed in percent increase (decrease) from the average scores. English and Math scores show statistically significant increases of scores: 28.5 and 29.8 percent, respectively. Reading and Science scores showed statistically significant increases and close to zero. The Social Studies scores increased marginally and statistically significant, with an ample confidence interval which makes the results less robust that Math and English scores. This may be due to the fact that Social Sciences is only evaluated for 6th graders, while English and Math scores are measured for a larger sample of individuals: 2nd, 4th, and 6th graders.

[23] Propensity score matching was not performed by school grade because of the small number of observations remaining in each grade subsample.

Figure 21b: Propensity Scores for Treated and Untreated (common support) for all individuals with at least one score reported



Note: Dependent Variable of the pscore model Dummy of Program Participation. Several control variables added at the individual, school and household levels. See annex for detail on propensity score (probabilistic) regression results.
Source: Author's estimates GY SFP Surveys

Table 17b: Propensity Score Matching Results

Average Treatment on the Treated (only for comparison sample)					
	Grades 2, 4 and 6			Only 6th Grade	
Indicator	**English (2007-2009)**	**Math (2007-2009)**	**Reading (2007-2009)**	**Science (2007-2009)**	**Social Studies (2007-2009)**
Observations	2193	2193	2193	1018	1020
Treatment	410	410	410	278	284
Control	1783	1783	1783	740	736
Average Treatment on the Treated \a	28.48 ***	29.77 ***	-0.03	0.54	3.15 *
Standard Error \b	6.078	4.19	0.757	1.33	1.65
Confidence Interval	[16.26 -- 40.70]	[21.34 -- 38.20]	[-1.55 -- 1.49]	[-2.12 -- 3.21]	[-0.16 -- 6.47]
Bias	0.40	0.847	-0.158	0.32	-0.018
Average Score					
Treatment	40.9	50.82	18.20	60.1	64.2
Control	36.7	42.74	13.43	57.9	60.9

\a ATT (Average Treatment on the Treated). Propensity score applied to match students with similar individual and household characteristics; kernel matching was used to estimate the ATT. Impact Estimators in %.
\b Estimated with bootstrapping method
Source: Author's estimations

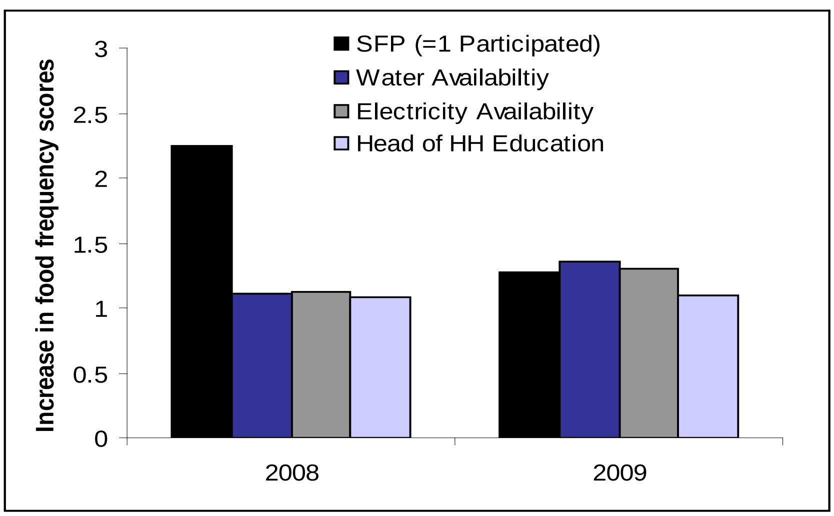
Performing simple propensity score matching estimators to assess impacts at the educational attainment level increased the accuracy of the estimates. The small coefficients shown with the conventional econometric estimations could be explained by confounding factors that played a role in determining SFP impacts. The incentive to keep children in school by providing a daily meal represents important gains in some educational attainment outcomes. Other outcomes are still showing very small impacts.

4.3.5 Households' food consumption and Food Price Volatility Impacts

The parent's survey has important information regarding the diet diversity and food frequency of households. With this information regressions were estimated to explore if SFP participation enhances the diet diversity and food frequency scores[24]. In principle, because the parent surveys were drawn randomly from the sample of eligible schools (treatment and control) we would not expect to find significant bias from sample selectivity. However, both simple regression and sample selection correction regressions are reported (see Annex 4).

The food frequency score has a mean in 2008 of 7.3 and rose to 7.9 in 2009. A higher food frequency score implies that the household consumed more food products rich in nutrients at a higher frequency on average per week. Figure 22 shows the impact coefficients from sample selection correction regressions[25]. The food frequency score is the outcome variable[26]. The coefficients show that compared to 2007 SFP increased the food frequency score on average 2.2 points in 2008 and 1.3 in 2009. The standard deviations from the food frequency scores for 2008 and 2009 are fairly similar, 3.7 and 3.8 respectively.

Figure 22: Impact of SFP on Food Frequency Scores (from Baseline)



Source: Own estimations using Guyana IE surveys, 2007-2009

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[24] Food frequency is recoded as 0 or 1, where 1= consumption frequency in last week of at least 2-3 times. The frequency is summed by food group to build the diversity score. The food frequency ranges from 0 to 25 (being 25 the highest frequency) and the diversity score ranges from 1 to 8, being 8 the highest diversity in consumption of different food groups (protein, vegetables, etc.).

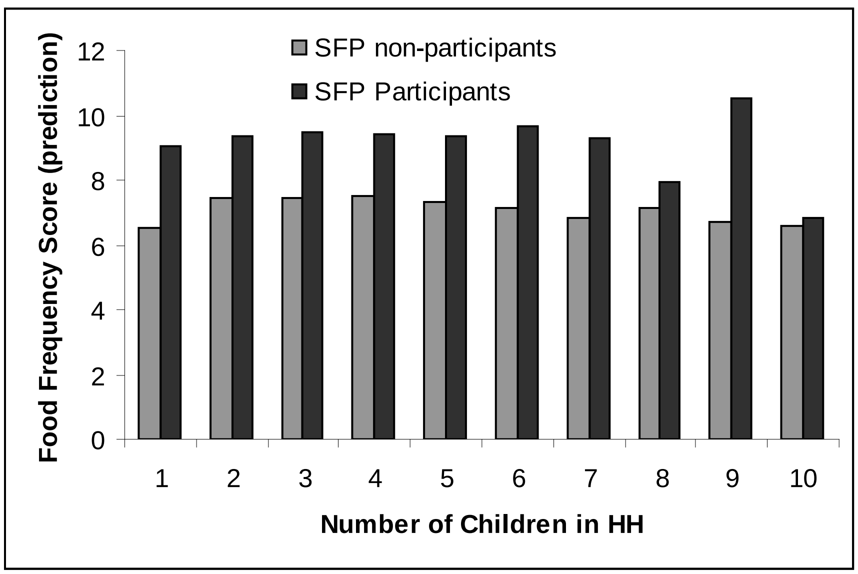
[25] All coefficients significant at least at 10 percent level, see Annex 4 for regression results.

[26] The results were very similar to the linear regression, which implies that random selection of interviewed parents was relatively successful. See annex 4 for a detailed description of the models.

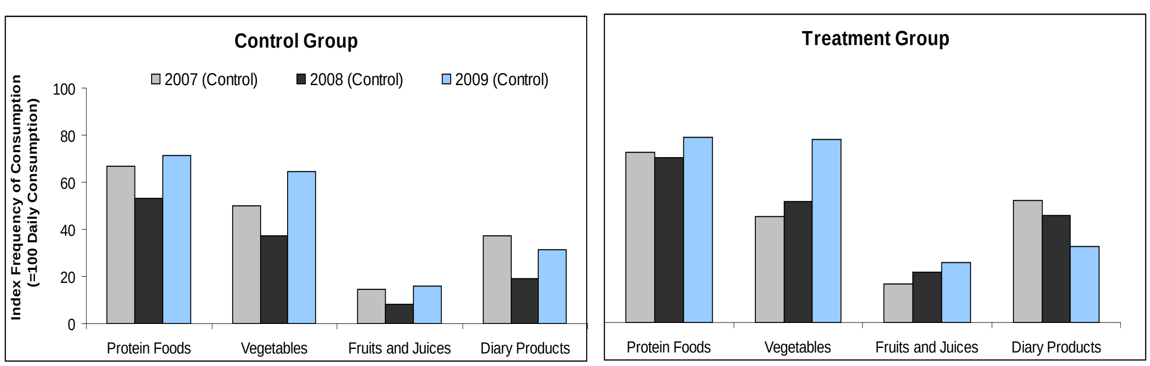
Other factors that contribute to an increase in the food frequency scores over baseline are proxies of household access to services and human capital. Having a household with electricity or water access increases the food frequency index by an average of 1.1. Similarly, the education level of the head of household also increases the food frequency scores. High frequency of consumption of nutritious food products enables a nutritionally balanced dietary intake which produces long term health and education benefits, particularly to children at early ages.

Figure 23 shows the predictions of the food frequency scores from the regressions and food frequencies by food group. Overall, after controlling for socio-demographics and other characteristics, the predicted scores are higher for the SFP group compared to non-SFP. Regardless of the number of children in each household, SFP is an important contributor in keeping higher food consumption frequencies, thus preserving adequate child nutrition.

Figure 23: Food Frequency Scores Prediction by SFP status



Source: Own estimations using Guyana IE surveys, 2007-2009



Source: Own estimations using Guyana IE surveys, 2007-2009

Another important outcome is diet diversity. Using the diet diversity score (defined in section 4.2.2.2.) it is possible to qualitatively assess how the diversity score changes based on household characteristics. This is important because school feeding programs are considered important safety nets whereby households alleviate food consumption pressure that rises from adverse economic and social conditions. We computed box plots of the diversity scores with three variables (Figure 24).

The first variable is SFP participation which shows higher average diversity scores than non-SFP participants. The second variable is employment status of the head of household.[27] This is relevant because when the head of household is not fully employed there are consumption restraints, particularly on food. The third variable included is "family type": whether the household is composed of a single parent, both parents, or is an extended family. More strain in consumption would be present in single parent households (which generally have a single source of income at best). Extended family households can present a mixed picture, depending on how many adults are employed and how many family members are supported by the household's income.

First it is important to note in Figure 24 that households without the SFP have the lowest mean diversity scores and higher variability in these scores, regardless of the employment status of the head of the household (Figures 24a and 24c). Households with SFP show higher diversity scores, again regardless of the employment status of the head of the household (Figures 24b and 24d). In this way, the SFP acts as a mechanism to keep diet diversity high and relatively equal among families that have higher propensity of consumption restraints. The lowest food diversity scores with relatively large variability are seen when children in the household do not have SFP, and when the household is an extended family. This combination represents the worst case for children because they do not have access to a safety net and the household structure increases the likelihood of restraining food consumption diversity. On the other hand, families where the head of household works and children have access to SFP have higher levels of the food diversity scores in all types of family structure (single parent, both parents, extended family[28]), but are especially high among extended families.

But these types of households show higher variability in the scores compared to those households where head does not work and children have access to SFP. If the head of household is partially or totally unemployed, household income is very low. Moreover, unless the employed household head is a single parent, the care of the kids is generally the responsibility of the mother, who is very often a housewife or only partially employed (Table 17c). Both frequency of food consumption and diet diversity are important indicators to evaluate SFPs from a social safety net standpoint. School feeding programs are often used for social protection purposes as much as or more than for education goals.

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[27] The questionnaire asked simply if the household head was fully employed. If the answer was no, the s/he could be either partially employed or unemployed. The former is the more likely scenario.

[28] Extended families can mean more incomes – it all depends on the child to adult ratios, but most of the time more adult members in the households tend to disproportionally consume more, leaving lower levels of disposable income.

Table 17c: Diet Diversity Scores and Households' Characteristics

Household type	Unemployed No SFP Figure 25A	Employed No SFP Figure 25C	Unemployed Have SFP Figure 25B	Employed Have SFP Figure 25D
One parent	4.67 ± 2.27	5.53 ± 1.68	5.86 ± 1.35	5.35 ± 1.69
2-parent	4.82 ± 1.83	4.82 ± 1.89	5.26 ± 1.65	5.21 ± 1.69
Extended	4.1 ± 1.97	4.11 ± 2.03	5.0 ± 1.41	6.2 ± 2.39
All types	4.71 ± 1.9	4.8 ± 1.9	5.36 ± 1.58	5.32 ± 1.77

Note: Extended family types have small sample size. Means and Standard Deviations Reported
Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 24: Diet Diversity scores, SFP participation and Household Variables

Figure 24a: Partially employed, no SFP

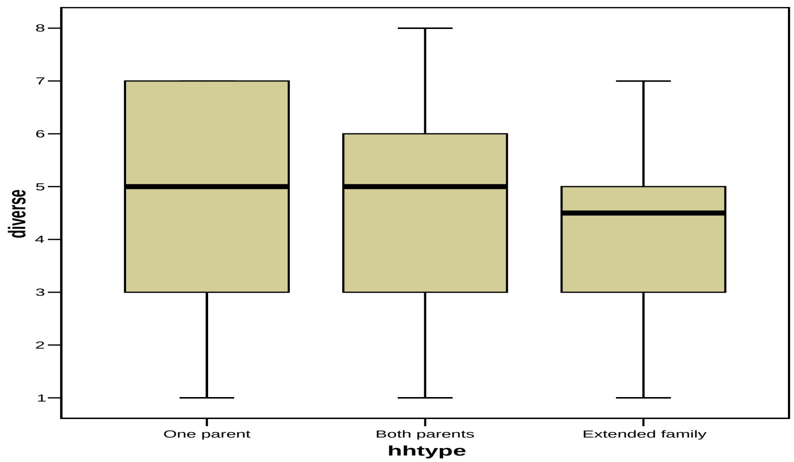


Figure 24b: Partially employed, with SFP

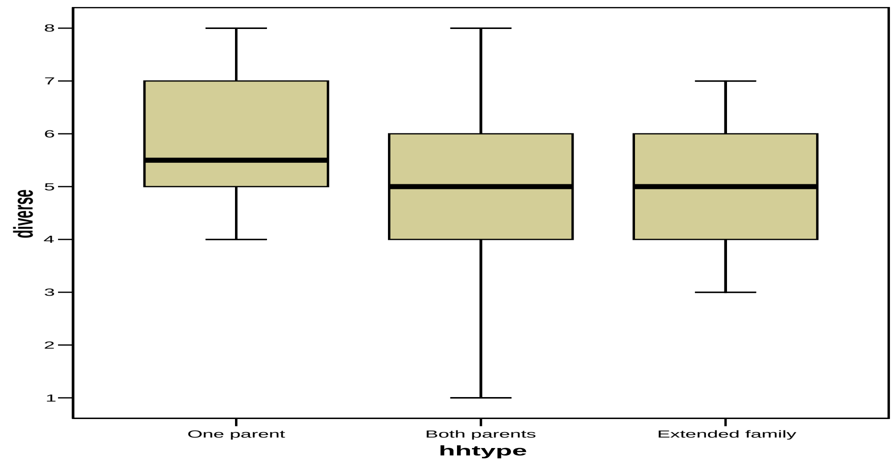


Figure 24c: Fully employed, no SFP

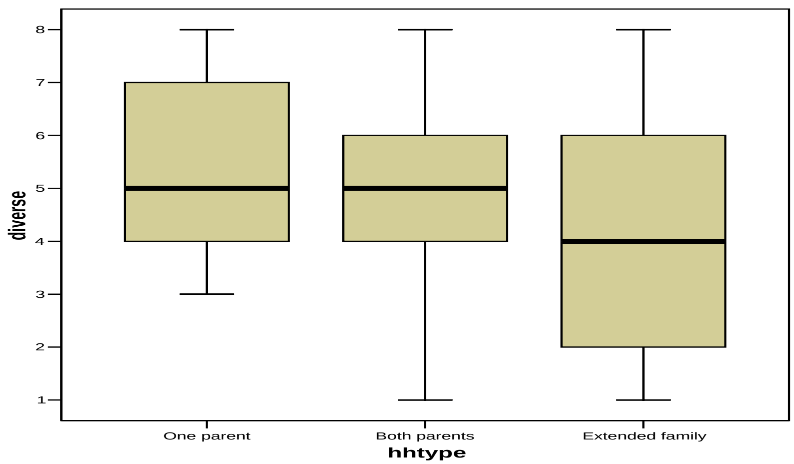
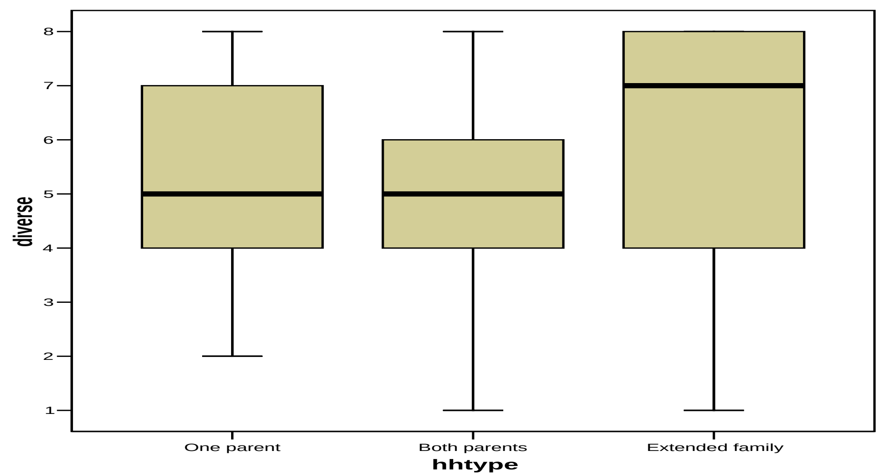


Figure 24d: Fully employed with SFP

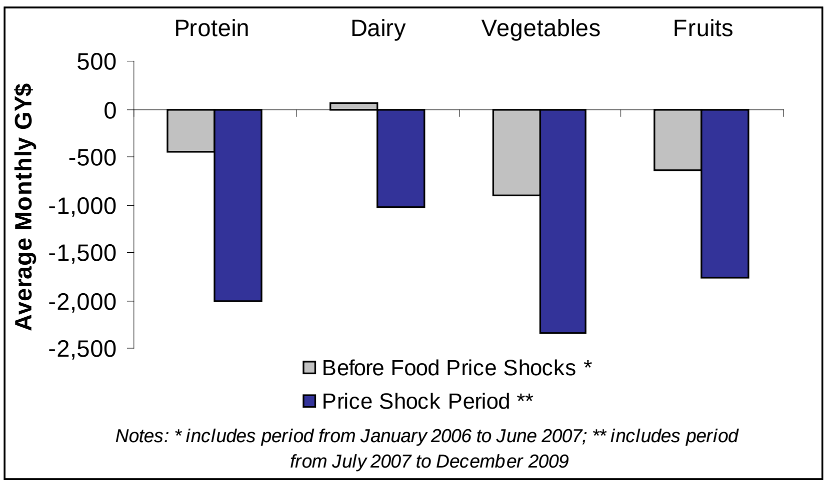


Source: Own estimations using Guyana IE surveys, 2007-2009

Figure 25 shows the results of the simulations of price shocks on the consumption of four food categories between treatment and control groups. On average, in control group areas there was a reduction of food consumption worth GY$2,000 per household per month in protein food groups, compared to treatment areas. Fruits and vegetables food groups averaged shocks in consumption are worth GY$1,700 and GY$2,300 respectively.

On average, before the food prices shocks a household in control areas consumed US$2.4 less per month (all food categories) compared to treatment areas. With the food price increase from mid-2007 to the beginning of 2009, control areas consumed US$9 less per month worth of food compared to treatment areas. The SFP shielding mechanism in preserving the diet balance and the purchasing power of nutritious food can become even more pronounced in those households that have more than two children as program beneficiaries.

Figure 25: Food Prices Shocks in Areas Without a Safety Net (SFP)



Source: Own estimations using Poverty Figures (BOS); Guyana Central Bank data and GMC Prices.

Table 13 shows the estimation of poverty rate and population at risk of falling into poverty before and after the food prices crisis between treatment and control areas. Using the national poverty rates in rural areas and assuming that the program would operate in all regions, rural areas without the program would have 6 percent more poverty prior to the food price crisis.

Because the SFP contributes to developing local agricultural production, prices will be less volatile than in those areas without the SFP which are more likely to import agricultural products from other regions. In consequence, the period of food price increases (between the second half of 2007 and the beginning of 2009) increases by 21.5 percent the population at risk of falling into poverty in control areas.

Although it is hard to conclude whether these poverty risk changes are dominated by price differentials prior to the food crisis, the food crisis itself, or other local contextual factors, it is illustrative of the risk gaps present in areas with a safety net mechanism compared to areas that lack these types of programs. These relationships can be estimated for the child population at risk, based on the proportion of child population. Around 2,500 more children in all regions in rural areas without a safety net fall in the poverty risk category before the food prices crisis.

After the food prices crisis, the number of children at risk of falling into poverty will rise to 9,000. Based on the proportion of children that live in regions 1 and 7, control areas would have had 150 more children at risk of falling into poverty compared to treatment areas, before the food price crisis. After the food price crisis more than 510 children in control areas would be at risk of falling into poverty. This illustrates under modest and conservative assumptions (see Annex 4) that safety nets can provide solid mechanisms against adverse shocks that limit poor households spending power, particularly those households with young children.

Table 17d: Poverty Impact of the Food Price Crisis and the SFP Safety Net

Poverty Change from Price Difference	Before Food Price Shocks *	Price Shock Period **
Rural Poverty Change (%) all regions	6.0	21.5
Population at risk rural areas (#) all regions	12,595	44,124
Rural Children at risk of poverty	2,572	9,011
Regions 1 and 7: Children at Risk of Poverty	148	517

* Includes from January 2006 to June 2007

** From July 2007 to December 2009

Source: Own estimations using Poverty Figures (BOS); Guyana Central Bank data and GMC Prices.

5 The schools and their communities

5.1 The learning environment

5.1.1 The schools and their staff

Table 18 shows the distribution, ranges and medians of school enrolment in each survey round using the school-level and teaching staff survey. Median school enrollment rose steadily with survey round. Enrollment was substantially larger in the treatment schools. For control schools, the median rose from 70 to 80, and for treatment schools it rose from 132 to 152.

Table 18: Schools – enrollment

	Categories	Percent of schools		
		Round 1	Round 2	Round 3
3. Enrollment	≤ 50 students	24.1	23.0	27.8
	51 – 100	41.4	32.8	29.6
	101 – 200	15.5	23.0	22.2
	201 – 500	12.1	13.1	14.8
	> 500	6.9	8.2	5.6
	Range	13 - 841	15 - 976	15 - 943
	Median	76	79	84

Source: Own estimations using Guyana IE surveys, 2007-2009

Table 19: Classes

Factor	Categories	Percent of teachers responding					
		Round 1		Round 2		Round 3	
1. Class type	Multigrade	51.8		52.9		49.4	
	Single grade	48.2		47.1		50.6	
2. Repeaters	None	66.4		72.9		65.1	
	1 – 5	20.5		15.0		21.4	
	≥ 6	13.1		12.1		13.5	
		Round 1		**Round 2**		**Round 3**	
	Categories	**Median**	**Range**	**Median**	**Range**	**Median**	**Range**
2. Enrollment: multigrade classes	Boys	6.0	1 – 25	11.5	2 – 39	11	1 – 41
	Girls	7.2	1 – 21	10.5	2 – 38	9.5	1 - 49
	Total enrollment	12.0	3 – 41	21.5	7 - 73	21	4 - 90
3. Enrollment: single grade classes	Boys	17.0	4 – 52	16	3 – 41	15	3 – 52
	Girls	14.0	3 – 62	16	0 – 51	14	2 – 54
	Total enrollment	33.0	10 - 114	31.5	3 - 92	30	5 - 106

Source: Own estimations using Guyana IE surveys, 2007-2009

Schools had single grade classes, multigrade classes or a mix of the two. Of the 64 schools surveyed, twelve had single grade classes only, 31 had multigrade classes only and 21 had both types of classes. Table 19 provides data on the classes covered by the survey, using the class teacher questionnaire. Median enrolment was higher in single grade classes.

Profiles of head teachers and class teachers are provided in Annex 5 (Tables A5-1, A5-2)

5.1.2 The students

Table 20 provides some basic information on the students included in the sample. As grade coverage increased with survey round, so too mean age and mean number of siblings rose with survey round.

Table 20: Student profiles

Factors	Categories	Percent of students		
		Round 1	Round 2	Round 3
1. Sex	Male	50.8	49.4	50.2
	Female	49.2	50.6	49.8
2. Age (years)	≤ 7	7.8	6.8	17.0
	8	25.3	24.2	17.4
	9	29.8	21.3	19.8
	10	24.9	23.9	17.7
	≥ 11	12.3	23.8	28.2
3. Grades	2	32.5	30.4	24.1
	3	35.2	22.6	20.9
	4	32.3	26.5	20.0
	5		20.5	15.9
	6			19.1
4. Number of siblings	≤ 2	17.8	16.7	14.2
	3 – 4	30.2	30.7	30.5
	5 – 6	28.5	28.4	29.2
	≥ 7	23.6	24.1	26.1
5. Living arrangements	With both parents	76.1	73.4	74.7
	With mother only	10.5	13.1	12.6
	With father only	6.8	3.8	3.5
	Other	6.2	9.8	9.3
		Means ± SD		
		Round 1	**Round 2**	**Round 3**
	Age (years)	9.1 ± 1.2	9.4 ± 1.4	9.9 ± 1.7
	Number of siblings	4.8 ± 2.5	4.9 ± 2.5	5.1 ± 2.5

Source: Own estimations using Guyana IE surveys, 2007-2009

A significantly larger proportion of students in the treatment group lived in single parent homes: 20.6 percent in the treatment group as compared to 12.6 percent in the control group. We examined whether single parent children differed significantly from those living with both parents with regard to key outcome indicators, in both treatment and control groups. There was no significant difference in school attendance, but children living with their mothers only were less likely to be stunted than all other children, and children living with their father alone were more likely to obtain higher mathematics scores in the National Assessments.

Students were asked also if they had consumed a breakfast on the day of the survey, and if so whether it had been a beverage only, a light or a full breakfast (see also Sections 4.2.2.3 and 5.2.3). Single parent families were least likely to provide a full breakfast when compared to families with both parents present, in both the treatment and the control groups. Of the single parent families, students with only the father present fared worst in relation to breakfast.

5.2 The parents, their households and communities

One important aspect of the hinterland school feeding program is the promotion of the communities' participation in all the program's activities. Equally important, especially for the impact analysis of the survey data, is the extent to which treatment schools and their communities differ from control schools and their communities, in terms of the households' wealth, the amenities they enjoy and their access to services. The surveys therefore gathered information on the schools' communities and their households. This section presents information on the parents and their households, the parents' participation in school activities, and their children's ease of access to their schools. More detailed information is provided in Annex 5, Tables A5-5 and A5-6.

5.2.1 Socio-demographic profiles of parents and their households

Table 21 presents a profile of the parents interviewed and their households. Details of the occupations of the mothers and fathers are given in Table A5-5 (Annex 5). Focusing on Round 3 data, we see significant differences between communities served by treatment schools and those served by control schools. In treatment communities there are:

- More single parent families;
- More female household heads;[29]
- Fewer household heads in full employment;
- Fewer children;
- Mothers and fathers with higher education levels.

In Round 3 only, students were asked if they were able to read a full page from a storybook, if there were any books or newspapers in their homes, and if they had ever heard their mother and father read a book or newspaper. Responses are given in Table 22. A significantly higher proportion of students in the treatment group stated that they had heard their mother read a book or newspaper.

[29] In some cases, the household head may have been a male absent due to employment in mining or logging.

Table 21: Profile of parents and their households, by survey round

Factor	Category	Percent of respondents			
		Round 1	Round 2	Round 3	
				C	T
1. Type of household	One-parent	13.2	13.2	7.9	19.0
	Two-parent	71.2	75.4	81.9	72.5
	Extended	15.6	11.4	10.2	8.5
2. Sex of household head	Female	17.7	31.5	20.2	32.1
	Male	82.3	68.5	79.8	67.9
3. Relationship of respondent to child	Parent	93.4	93.2	92.5	91.7
	Guardian / other	6.6	6.8	7.5	8.3
4. Sex of respondent	Female	66.3	70.3	59.6	79.3
	Male	33.7	29.7	40.4	20.7
5. Respondent's age	≤ 29 years	24.9	18.8	18.0	18.8
	30 – 39	36.0	38.1	35.5	38.7
	40 – 49	28.7	31.9	31.2	27.2
	≥ 50	10.3	11.2	15.3	15.2
6. The household head employed full-time?	Yes	63.0	65.5	25.3	40.3
	No	37.0	34.5	74.7	59.7
7. Number of children in household	1 – 3	32.2	29.1	25.1	43.5
	4 – 5	31.7	30.8	29.7	28.0
	6 – 16	36.1	40.1	45.2	28.5
8. Mother's education	None	6.5	17.5	17.4	9.0
	Primary	73.5	67.9	72.9	65.6
	Secondary	15.0	12.6	7.8	23.3
	Tertiary / other	5.0	1.9	1.9	2.1
9. Father's education	None	2.3	14.8	17.3	9.9
	Primary	68.8	66.2	66.6	59.3
	Secondary	22.7	15.8	13.7	24.7
	Tertiary / other	6.1	3.2	2.5	6.0

Source: Own estimations using Guyana IE surveys, 2007-2009

Table 22: Literacy (Round 3 only, students' responses)

	Control (SF 0)	Treatment (SF 1)
Child can read a page	63.3	63.9
Has books or newspapers in home	73.5	68.7
Has heard mother read book or newspaper	75.4	80.9
Has heard father read book or newspaper	71.7	70.7

Source: Own estimations using Guyana IE surveys, 2007-2009

5.2.2 Household possessions and access to services and amenities

Table 23 gives information on households' access to services. Although the responses for all services differ substantially between survey rounds, in each round respondents from communities with the treatment schools have better access to piped water, electricity and roads.

Table 23: Access to services

	Percent of respondents					
	Round 1		Round 2		Round 3	
	C	T	C	T	C	T
Piped water	34.9	47.6	15.5	21.5	10.6	24.0
Electricity	20.5	40.1	23.5	37.9	38.3	51.6
Roads	5.1	17.1	2.6	9.7	3.2	9.9

Source: Own estimations using Guyana IE surveys, 2007-2009

Table 24 summarizes information for households' amenities and possessions in Round 3 only. While information on household possessions was obtained at each survey round, the rest of the information given in Table 24 was obtained only in Round 3. Full details of household possessions for each survey round are given in Table A5-6 (Annex 5).

Table 24: Amenities and possessions: parents' and students' responses (Round 3 only)

	Categories	Control	Treatment
A. Parents' responses			
Bathroom	Yes	37.3	59.9
Toilet	None	15.8	0.7
	Pit latrine	81.2	89.3
	Flush toilet	3.0	10.1
Possession score	0 – 3 items	37.9	18.8
	4 – 6 items	41.1	46.9
	7 – 10 items	21.1	34.4
B. Students' responses			
Toilet	None	9.6	0.3
	Pit latrine	82.3	87.3
	Flush toilet	8.1	12.3
Home's walls	None / thatch	10.2	1.9
	Wood, concrete or both	89.8	98.1
Livestock	Yes	8.0	9.2
	No	92.0	90.8

Source: Own estimations using Guyana IE surveys, 2007-2009

As with access to services, both parents and students from communities with treatment schools indicate significantly better amenities and a greater number of possessions than those from control schools. In short, the information shown in Tables 23 and 24 indicates strongly that communities served by treatment schools are wealthier and have better access to services than those served by the control schools.

5.2.3 How children get to school

In Rounds 2 and 3 only, we asked both parents and students how the child goes to school and to estimate the time taken to travel to school. Their responses are given in Table 25. A large proportion of children walk to school, or travel by paddle boat. Of those who travel by paddle boat, more than 25 percent take an hour or more to reach school. Of those who walk, more than 15 percent take thirty minutes or more to reach school. Of these children with long and arduous travel to school, more than 30 percent leave homes with at most a light breakfast to sustain them. These data are based both on parents' and students' responses.

Table 25: Students' access to schools

		Percent of respondents	
Parents' responses	**Categories**	**Round 2**	**Round 3**
1. Time taken for child to travel to school	< 15 mins	41.2	47.0
	15 – 30 mins	29.8	26.1
	30 – 60 mins	16.2	18.1
	> 1 hour	12.8	8.9
2. How child gets to School	Walks	63.8	69.0
	Bicycle	0.7	3.5
	Paddle boat	30.2	24.0
	Speed boat + other	5.4	3.5
Students' responses			
3. Time taken for child to travel to school	< 15 mins	38.1	34.1
	15 – 30 mins	27.2	30.8
	30 – 60 mins	22.9	22.7
	> 1 hour	11.8	12.4
4. How child gets to School	Walks	65.6	70.1
	Bicycle	2.6	5.2
	Paddle boat	23.5	21.4
	Speed boat + other	5.2	3.3

Source: Own estimations using Guyana IE surveys, 2007-2009

6 Conclusions

The impact evaluation of Guyana's hinterland school feeding program was successfully conducted in sixty-four schools in Regions 1 and 7. Survey data were collected from schools, students, teachers and parents in three rounds in 2007, 2008 and 2009. Out of the 64 schools included in the surveys, twenty one had started school feeding before Round 3 and constituted the treatment group. The rest formed the control group. Because of the procedures followed to assign communities and schools into treatment and control groups, self-selection in the sample produced uneven treatment and control group characteristics, in some cases differing significantly at baseline. In addition, sample selectivity was manifested in student samples because of absence in the day when the survey and the tests were applied. Parametric and non-parametric corrections in both cases were carried to reduce, not eliminate, these sources of bias in the estimates.

Primary level education poses challenges to the Ministry of Education in its efforts to improve academic achievement in the hinterland regions, mainly due to:

- Poor school attendance;
- High levels of stunting, associated with a poor diet and with important consequences to cognitive development;
- Poverty and limited access to essential resources and services impose constraints to increase nutritionally-balanced diets.

The conceptual framework to evaluate the SFP addresses the following questions:

- Has the program had a positive impact on students' attendance, nutritional status and school performance?
- Has the program led to improvements in students' classroom behavior and parental participation in school activities?
- Has the program provided a safety net against food price increases?
- Has the program improved diets of households?

The evaluation's most robust findings are listed as follows:

- The SFP increased average attendance by 4.3 percent between 2007 and 2009.
- Control schools showed consistently higher levels of stunted and severely stunted children in all survey rounds, because of their poorer economic status (selectivity) and perhaps also because they had more children of Amerindian ethnicity than treatment schools. Children in treatment schools grew 0.8cm more than children attending control schools, a small but significant difference.
- Children's classroom behavior improved with the introduction of a school meal. By Round 3, students in treatment schools had higher levels of class participation than those in control schools. Conversely, students' disconnect and distraction from classroom activities showed a lower incidence in treatment schools.

- SFP had impacts on academic performance for Math and English scores. However, further academic performance will take time to achieve, especially for Reading and Science subjects. Better attendance, improved student participation in classroom activities, and better nutritional status, when combined with the EFA-FTI's efforts to improve schools' human and physical resources, must ultimately promote the Ministry's aim of improving academic achievement in the hinterland regions.
- Community participation in school feeding-related activities has been achieved: parents actively participate in cooking and serving meals, and in growing and providing food commodities.
- SFP implementation coincided with a period of uncertainty and high volatility in food and agricultural commodities' prices. A daily meal to children in poor household represents a safety net mechanism from adverse price shocks. An increase in food prices harms the spending capacity of households which in turn affects food consumption, nutritional intake and poverty levels.
- The diet of rural and Amerindian communities often lacks diversity. In poor and Amerindian communities, diets are low in vegetables, fruits, dairy products and legumes. The SFP improved diet diversity and frequency of food consumption in treatment communities as compared to control communities, despite higher food prices. During the food price shocks the gap in food consumption frequency and diet diversity between control and treatment groups increased substantially. The SFP has thus successfully provided a safety net against food price increases.
- The financial returns of the SFP can be substantial if it expands considerably. Expansion can also bring a safety net mechanism to regions and communities facing economic hardship. Compared to other large-scale programs SFP has a relatively low cost per child enrolled. Expansion to all rural schools could drop the unit cost by half.

The evaluation findings and the experiences of the SFP raise a number of important issues that need the attention of the Ministry of Education:

- Although attendance was indeed better in treatment schools, absenteeism remains a serious concern. More than 59 percent of all children included in the evaluation were absent for at least one day in the two weeks preceding the survey day. And of these children, more than 22 percent gave labor of some kind as a reason for their absence. Labor included care of younger siblings, work on the farm or in the home.
- A further 6.6 percent of children with absences in the two weeks preceding the survey were absent because of the household's economic condition: no food, no uniform, no cash or no stationery. Interestingly, of those who gave lack of food as the reason for absence, all children except one attended control schools where no lunch was offered.
- The short-term hunger which occurs if a child receives an inadequate breakfast and/or has a long and arduous journey to school, is a major contributor to poor classroom behavior and academic achievement (see Annex 3). Single parents were least likely to offer a full breakfast to their children. An important finding of the evaluation was that students attending treatment schools were significantly less likely to receive a full breakfast. Are parents of treatment school children withholding a full breakfast because they know the child will receive a substantial lunch? If this is indeed the

case, then the training offered by the school feeding program needs to stress the importance of an adequate breakfast, even when a full lunch is to be offered at noon.

- Sustainability of the hinterland school feeding program when external funding ends is clearly a serious issue and one that needs urgent attention. When considering the obvious educational and nutritional benefits of the Program, the Ministry needs also to take into account the important role of the Program in providing a safety net, as well as aspects that address poverty in hinterland communities. Thus, for example, the Program offers guaranteed markets to farmers for their produce and employment for women as cooks.
- While the SFP is a cost-effective program, the Ministry may wish to consider ways by which the Program's costs may be reduced so as to increase the likelihood of sustainability. These include modest parental cash contributions, a reduction in the number of days when a meal is provided, establishing school gardens to provide produce for the meals, encouraging home gardens, seeking partnerships with the private sector, and finding ways in which the school kitchens could be used on weekends and during school holidays to raise funds through small business enterprises. These are possibilities that should be discussed with community members.

Finally, the SFP's achievements with regard to improving community participation in school activities can make a key contribution to finding solutions to many of the challenges facing the Ministry of Education.

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ANNEX 1

LIST OF SCHOOLS SURVEYED
(Schools in bold are treatment schools)

School ID	School name
REGION 7	
Cluster 1: Lower Mazaruni	
1	**Agatash**
2	Batavia
3	Butukari
4	Karrau Creek
5	St. John the Bap.
6	Wineperu
8	**Itaballi**
9	**72 Miles**
10	**Two Miles**
11	**St. Anthony's**
12	**Kartabo**
13	**Holy Name**
14	**St. Mary's**
Cluster 2: Middle Mazaruni	
15	St. Martin
16	**St. Martin's Annex**
17	**Kurupung**
18	**Isseneru**
REGION 1	
Cluster 4: Matarkai	
21	**Port Kaituma**
22	**Arakaka**
23	Baramita
24	Matthews Ridge
25	Sebai
26	Falls Top
Cluster 5: Mabaruma	
27	Almond Beach
28	Aruka Mouth
29	Barabina
30	Black Water

School ID	School name
31	Hobedia
32	Hosororo
33	Hotoquai
34	Kamwatta (Mabaruma)
35	Lower Kaituma
36	Lower Waini
37	**Mabaruma**
38	Peter & Paul
39	Sacred Heart
40	St. Anselm's
41	St. Anthony's
42	St. Cyprian's
43	St. Dominic's
44	St. John's
45	St. Margaret's
46	St. Mary's
47	St. Ninian's
48	Unity Square
49	**Wauna**
50	Yarakita
67	White Water
Cluster 6: Moruca	
51	**Assakata**
52	**Kamwatta (Moruca)**
53	**Karaburi**
54	Kokerite
55	Kwebana
56	Santa Cruz
57	**Santa Rosa**
58	St. Bede's
59	St. Nicholas
60	Wallaba
61	**Waramuri**
62	Warapoka
63	Kokerite Annexe
64	Father's Beach
65	Chinese Landing
66	Waramuri Annex

Note: Kokerite annex is now considered part of Kokerite school. The total number of schools adds up to 64. No schools were surveyed in Cluster 3. Schools that began school feeding after Round 3 were kept in the control group. Source: SFP

ANNEX 2

IMPACT EVALUATION TEAM

Project organizers[30]

Edward Jarvis, EFA/FTI Program Manager, Ministry of Education
Angela Demas, Sr. Education Specialist, The World Bank

Trainers

Norma Howard, Director, Food Policy Division, Ministry of Health
Suraiya Ismail, Public Health Nutritionist, Director, Social Development Inc.
Anthony Hunte & Edward Jarvis, Ministry of Education

Enumerators

Region 1

Ellis Alphonso	Francine Bennet James	Carlos Rodrigues
Seeta Antonio	Oliver John	Jacqueline Rodrigues
Sharon Atkinson	Isabella Moonsammy	Genevieve Rufino
Pablino Cupido	Cecily Phillips	Magdalyn Simon
Lawrence David	Kelly Pierre	Rosana Smith
Stanley Fredericks	Alex Ragwen	Helen Thomas
Ignatius Gomes	Karon Roberts	Enan Williams
Natalie Henry	Melissa Robinson	

Region 7

Thea Chase	Diannah Fredericks	Deanne Jones
Felicity Da Silva	Onica James	Keisha King
Winston Ferreira	Youlanda James	Beverly Shewram

Data management

Patricia Roopnaraine & Lalita Murphy – data entry (Ministry of Education)
Sharon James & Nini Osaze – data entry (SDI)
Suraiya Ismail – coding, file management, data analysis (SDI)
Christian Borja – data analysis (World Bank)

Report preparation

Suraiya Ismail
Christian Borja
Edward Jarvis
Angela Demas

[30] Advisory inputs were also provided by Mrs. Evelyn Hamilton, Chief Planning Officer, MOE and by staff of the World Bank. Dr. Nandram Persaud, Procurement Officer, MOE, and his staff organized the speedy delivery of the anthropometric equipment.

NUTRITION NOTES

Nutritional status indicators

Nutritional status is assessed by measuring the weight and height of the individual, and then comparing these quantities to international reference standards obtained from healthy well-nourished populations. For this study, the latest WHO reference standards were used, published in 2007. Using weight and height, two indicators are calculated for this sample of primary school children:

- Height for age – a measure of stunting or chronic malnutrition. This is calculated by comparing the height of the individual to the reference height of an individual of the same age and sex.

- Body Mass Index (BMI) for age – a measure of wasting (acute malnutrition) or obesity. BMI is calculated first[31], then the BMI is compared to the reference BMI of an individual of the same age and sex.

Nutritional status of the individual is then defined by means of cut-off points below the individual's reference median:

Table A3-1 Cutoff Points World Health Organization

Cut-offs below the reference median	Nutritional status Stunting (height for age) and wasting (BMI for age)
< -3 standard deviations (SD)	Severely Stunted or wasted
< -2 standard deviations (SD)	Stunted or wasted
≥ -2 SD and < -1 SD	At-risk of stunting or wasting
≥ median	Not stunted or not wasted

Note: WHO classification and cutoffs for defining the severity of stunting and wasting changed recently. For an update and description of cutoffs see: http://www.who.int/nutgrowthdb/about/introduction/en/index5.html

a) Stunting

Stunting or chronic malnutrition is generally considered to be the consequence of a diet lacking diversity and / or a high level of disease. A monotonous diet is likely to be deficient in a number of nutrients. A stunted child may be receiving adequate quantities of energy (calories), protein and fat, but yet be lacking in vitamins and minerals. Consequences of stunting include poor

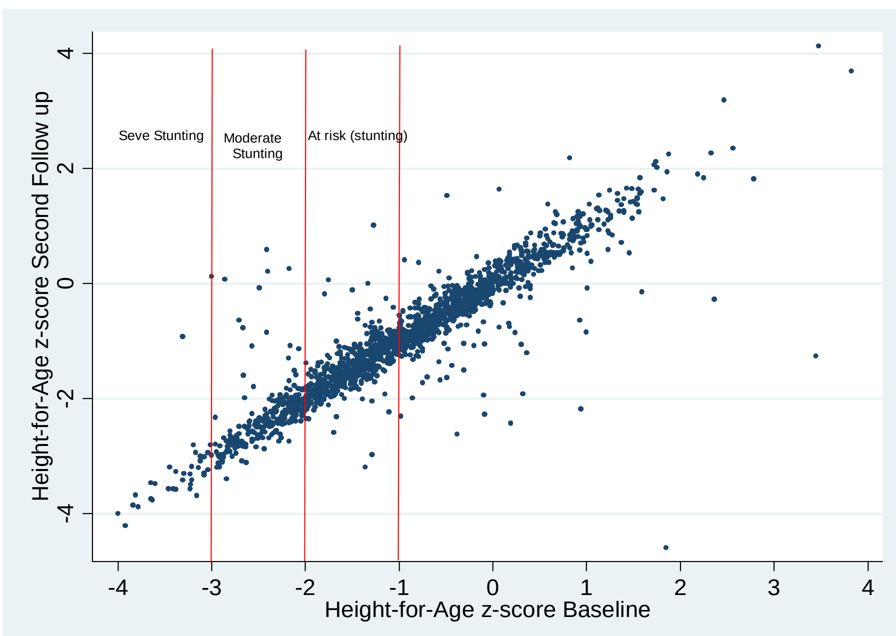
[31] $\text{BMI} = \frac{\text{weight}}{\text{height}^2}$

mental development and poor school achievement. Other consequences may be linked to deficiencies of specific vitamins and minerals.

Stunting has been the subject of the classic "nature vs nurture" debate i.e. whether it is the result of a person's genetic make-up or because of environmental insults suffered during a child's growth periods, insults such as high morbidity or poor nutrition. In favor of the nurture position is the fact that ethnic groups, such Indian, Chinese and Japanese, traditionally considered to be of short stature, are now achieving heights comparable to those found in European and North American populations. This is especially so when economic status improves or when these groups migrate to the States or Europe. A PhD study conducted in Guyana[32] compared the heights of two groups of Amerindians: the group with the better economic status and a more diverse diet was taller than the other. The diet of Amerindian communities, especially the more remote ones often lacks diversity. Specifically, as found in this baseline survey, consumption of vegetables is low. Consumption of dairy products and legumes may also be low.

It is important to appreciate that what matters with stunting is not the fact of being short, but rather the failure to achieve one's full growth potential, and why this failure has occurred.

Graph A3-1 Stunting Distribution SFP Students 2007-2009 (Height-for-Age)



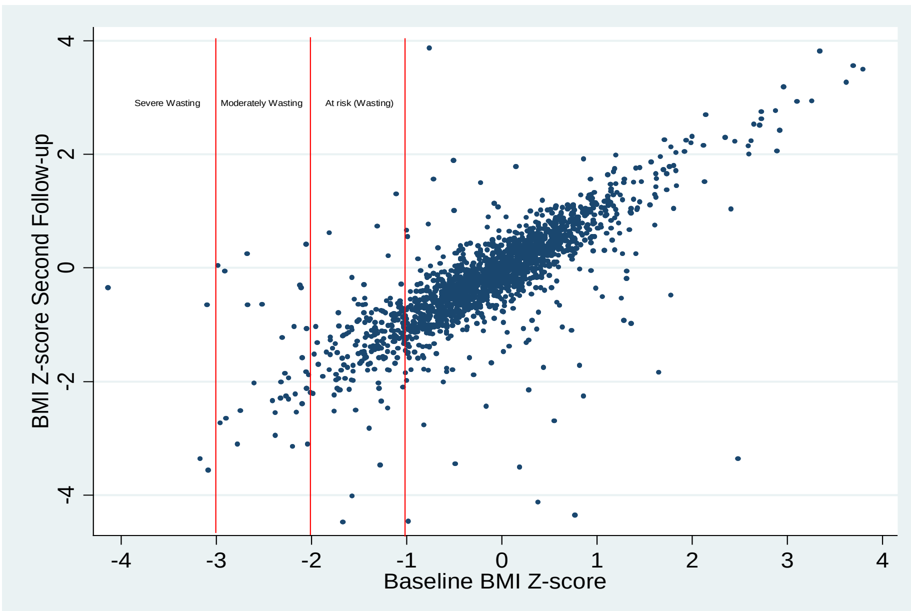
Source: Own estimations using Guyana IE surveys, 2007-2009

b) Wasting

[32] Alan Dangour (1998) *Growth of body proportions in two Amerindian tribes in Guyana.* PhD thesis, University College, London.

Wasting, or acute malnutrition is the result of an inadequate intake of energy (calories) and / or a recent illness. The diet is primarily deficient in energy, but going along with what is essentially an insufficient food intake are deficiencies in many other nutrients. Extreme thinness, or severe wasting, of the form seen in famine conditions, is associated with a high risk of disease and, ultimately, death.

Graph A3-2 Wasting Distribution SFP Students 2007-2009 (Body Mass Index)



Source: Own estimations using Guyana IE surveys, 2007-2009

c) Short-term hunger

During the course of the day, a child may receive an adequate quantity of nutrients, and thus his/her nutritional status may be satisfactory. If, however, a child arrives at school with no breakfast or an inadequate breakfast, the child will experience short-term hunger until it is offered a snack or a meal. Studies have shown that short-term hunger is associated with a short attention span and with poor school achievement, even if the child's nutritional status is good.

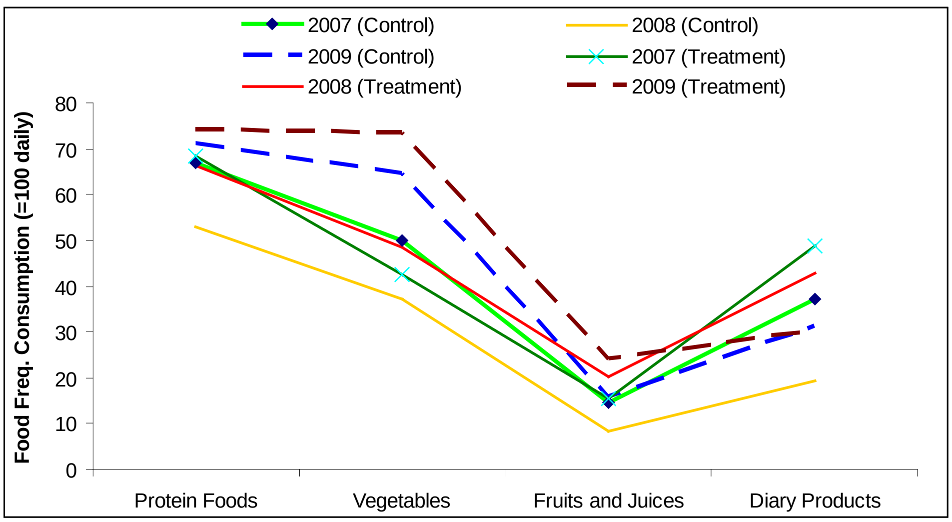
d) Diet diversity

Diet diversity is linked to the diet's nutritional adequacy. Simply put, a diet that is monotonous and deficient in one or more food groups is likely to be deficient in specific vitamins and minerals, and result in sub-optimal linear growth (height). This manifests itself in children as stunting or short stature.

Guyanese Amerindian diets are reportedly monotonous, and the prevalence of stunting in Amerindian children is significantly higher than that found in children of other ethnicities. A major thrust of the EFA-FTI hinterland school feeding program is to promote the production and consumption of a wider range of foods than is traditionally the case. Thus the program has stressed in the course of community training exercises the importance of including a range of fruits, vegetables and legumes, and of encouraging the production of these items on local farms.

The food frequency questionnaire for the impact evaluation was restricted to a selected number of foods. The choice of foods was based on deficiencies identified anecdotally and from earlier studies.[33] The questionnaire did not ask about the frequency of consumption of staples, mainly cassava in these communities. Studies on Amerindian diets are limited, and it is important to recall that food consumption patterns differ from tribe to tribe and according to the ecology of the area.

Graph A3-3 Food Frequency by Comparison Groups and Food Groups



Source: Own estimations using Guyana IE surveys, 2007-2009

[33] Vegetables were subdivided into three categories (green leafy, yellow/orange, and other) because different vitamins and minerals are supplied by these categories. For example, orange and yellow vegetables are rich sources of β-carotene, a precursor of Vitamin A, while green leafy vegetables are important sources of iron.

ANNEX 4

ESTIMATION PROCEDURES AND METHODS

Program Evaluation Framework

Program monitoring provides ongoing information on the direction and the magnitude of change in outputs or outcomes of the project. Monitoring is then critical to know whether the project is moving in the right direction. Program monitoring, however, is not a tool that provides information to determine if the observed changes in specific outcome indicators are the direct consequence of the intervention. The main purpose of an impact evaluation study is to provide convincing and reliable evidence that the changes in the outcome indicators are *attributed* exclusively to intervention and not to other factors.

In order to be able to establish *causality*, the impact evaluation designs a credible "counterfactual" that describes what would have happened had the project never taken place. For example, in the case of the impact evaluation of the school feeding program the counterfactual consists of what participants would have experienced had their communities not participated in the SFP.

The central problem in the evaluation of any program is the fact that communities participating in the program cannot be simultaneously observed in the alternative state of no treatment. At a first glance, one has to resort to statistical methods to address this problem (e.g., see Heckman, LaLonde and Smith, 1999). But when the impact evaluation is planned prospectively, the process of selecting the unit of analysis fitted into the design can be understood and randomized methods to select counterfactuals may provide enormous advantages to infer causal linkages.

The idea to evaluate a program lies on constructing a suitable counterfactual outcome in the untreated state conditional on receiving treatment. If T=1, the state that denotes participation, then the treatment parameter can be express as:

$$TT = E[Y_1 - Y_{0,}|T = 1] = E[Y_1|T = 1] - E[Y_0|T = 1]$$

The equation above shows the counterfactual that is impossible to estimate. We can observe, however, the average outcome in the untreated states conditional on similar characteristics:

$$TT = E[Y_1 - Y_{0,}|X, T = 1] = E[Y_1|X, T = 1] - E[Y_0|X, T = 0]$$

Since in the equation above,

$$E[Y_0|X, T = 0] \neq E[Y_0|T = 1]$$

The evaluation problem arises when finding an accurate estimate that makes both elements of the equation above to be closer. Formally, "randomization provides a mechanism to derive probabilistic properties of estimates without making further assumptions."(Rubin, p 693) Randomized trials of participants in the intervention may also be useful for incorporating causal effects. Holland (1985) reminds to us that randomized trials for participation can be a powerful aid in investigating causal relations. Randomly assigning individuals or communities into treatment and control groups, solves the evaluation problem by using information from communities or households in the control group to construct an estimate of what participants would have experienced had they not participated in the program. Therefore, impact evaluation with randomized participation criteria focus attention on impacts across persons with certain similar features.

Fixed-Effects Regression

Non-experimental data can get much closer to the virtues of a randomized experiment. Specifically, by using the fixed effects methods it is possible to control for all possible characteristics of the individuals in the study—even without measuring them—so long as those characteristics do not change over time. There are two key data requirements for the application of a fixed effects method. First, each individual in the sample must have two or more measurements on the same dependent variable. Second, for at least some of the individuals in the sample, the values of the independent variable(s) of interest must be different on at least two of the measurement occasions.

In panel data analysis, the term fixed effects estimator (also known as the within estimator) is used to refer to an estimator for the coefficients in the regression model. If we assume fixed effects, we impose time independent effects for each entity that are possibly correlated with the regressors.

Formally, the model is specified as:

$$y_{it} = \beta_0 + X_{it}\beta + Z_i\gamma + \alpha_i + u_{it},$$

where y_{it} is the dependent variable observed for individual i at time t, X_{it} is the time-variant regressor, Z_i is the time-invariant regressor, α_i is the unobserved individual effect, and u_{it} is the error term. α_i could represent motivation, ability, genetics (micro data) or historical factors and institutional factors (country-level data).

The two main methods of dealing with α_i are to make the random effects or fixed effects assumption:

1. Random effects (RE): Assume α_i is independent of X_{it}, Z_i or $E(\alpha_i \mid X_{it}, Z_i) = 0$

2. Fixed effects (FE): Assume α_i is not independent of X_{it}, Z_i.

To get rid of individual effect α_i, a differencing or within transformation (time arranging) is applied to the data and then β is estimated via Ordinary Least Squares (OLS). The most common differencing methods are:

$$y_{it} - \overline{y_i} = \left(X_{it} - \overline{X_i}\right)\beta + (u_{it} - \overline{u_i})$$

$$\overline{X_i} = \frac{1}{T}\sum_{t=1}^{T} X_{it}$$

$$\overline{u_i} = \frac{1}{T}\sum_{t=1}^{T} u_{it}$$

Sample Selection Correction

The Heckman correction (the two-stage method) is any of a number of related statistical methods developed by James Heckman in 1976 through 1979 which allow the researcher to correct for selection bias. The Heckman correction, a two-step statistical approach, offers a means of correcting for non-randomly selected samples.

Heckman discussed bias from using nonrandom selected samples to estimate behavioral relationships as a specification error. He suggests a two-stage estimation method to correct the bias. The correction is easy to implement and has a firm basis in statistical theory. Heckman's correction involves a normality assumption, provides a test for sample selection bias and formula for bias corrected model.

The Heckman correction takes place in two stages. First, the researcher formulates a model, based on economic theory, for the probability of participating in a program. The canonical specification for this relationship is a probit regression of the form:

$$\mathrm{Prob}(D = 1|Z) = \Phi(Z\gamma),$$

where D is an indicator variable (D = 1 if the respondent is employed and D = 0 otherwise). Z is a vector of explanatory variables, γ is a vector of unknown parameters, and Φ is the cumulative distribution function of the standard normal distribution. Estimation of the model yields results that can be used to predict this probability for each individual. In the second stage, the researcher corrects for self-selection by incorporating a transformation of these predicted individual probabilities as an additional explanatory variable.

$$w^* = X\beta + u$$

which leads to,

$$E[w|X, D = 1] = X\beta + E[u|X, D = 1].$$

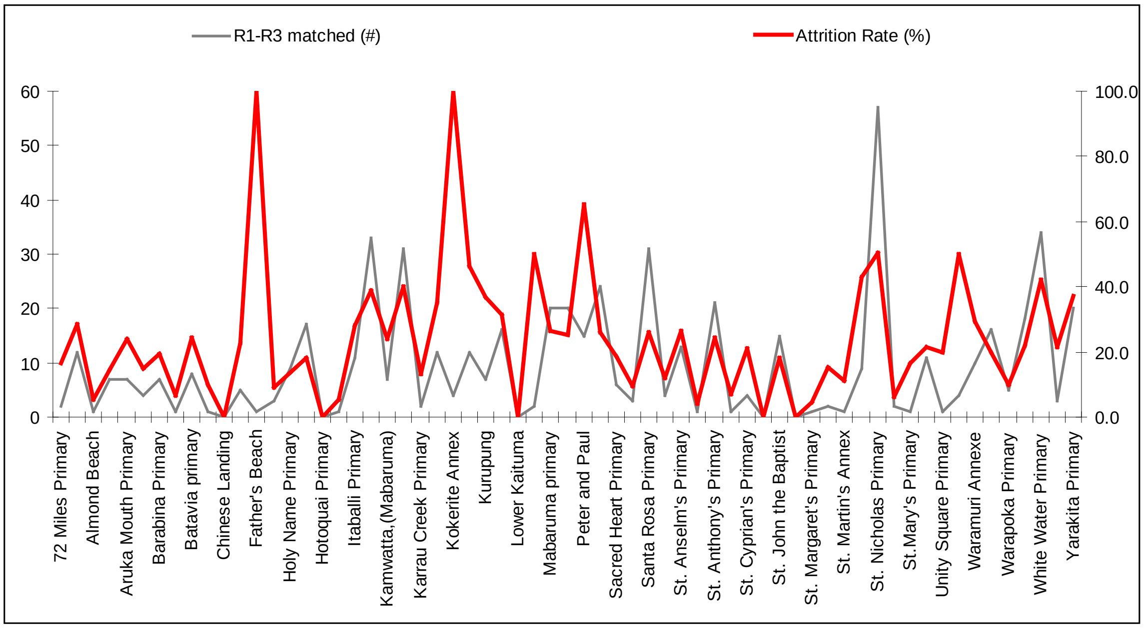
The model for sample selection that allows treatment and control comparability needs further specifications. The model obtains formal identification from the normality assumption when the same covariates appear in the selection equation and the equation of interest, but identification will be tenuous unless there are many observations in the tails where there is substantial nonlinearity in the Inverse Mills Ratio. Generally, an exclusion restriction is required to generate credible estimates: there must be at least one variable which appears with a non-zero coefficient in the selection equation but does not appear in the equation of interest, essentially an instrument. If no such variable is available, it may be difficult to correct for sampling selectivity.

In our models we included many selection variables which are uncorrelated with the error but that explain the selectivity of the sample and the comparison groups. First by including the days taken to implement SFPs in schools we have a variable that controls exogenous conditions that modified entrance into the treatment group. Because many factors such as school organization/performance dealt with the delays in SFP implementation, the variable captures both the organizational skills of schools to submit SFP applications, and other institutional aspects that played a role in postponing the planned date of entrance of schools to the SFP. Another important variable included in the selection equation are the clusters, regions and schools. This can be thought of as fixed effects that play a role in determining the selection of schools into the treatment and control groups. In addition it corrects for all sample limitations derived from attrition rates from the longitudinal sample.

When data are collected over two or more points in time, it is common for some participants to drop out of the study prematurely. The attrition of the original sample can occur in longitudinal research as well as in experimental designs that include pretest, posttest, and follow-up data collection. In longitudinal research, which often lasts many years, some participants move between data points and cannot be located. Others, especially older persons, may die or become too incapacitated to continue participation
in the study. In clinical treatment studies, there may be barriers to continued participation in the treatment program, such as drug relapse or lack of transportation. Attrition of the original sample represents a potential threat of bias if those who drop out of the study are systematically different from those who remain in the study. The result is that the remaining sample becomes different from the original sample, resulting in what is known as attrition. In our sample the mean attrition rate is of 25 percent for all schools in treatment and control groups.

Still attrition rates where very variable by school. Graph A4-1 shows the attrition rates and the number of matched students in survey rounds by each school included in the sample. Although the variability shown in the attrition, only in few cases attrition was high enough to drop the majority of children followed in the longitudinal sample.

Graph A4-1 Attrition Rates and Matched Students in Longitudinal Sample by School



Source: Own estimations using Guyana IE surveys, 2007-2009

Counterfactual analysis enables evaluators to attribute cause and effect between interventions and outcomes. The 'counterfactual' measures would have happened to beneficiaries in the absence of the intervention, and impact is estimated by comparing counterfactual outcomes to those observed under the intervention. The key challenge in Impact Evaluation is that the counterfactual cannot be directly observed, but must be approximated with reference to a comparison group. There are a range of accepted approaches to determining an appropriate comparison group for counterfactual analysis, using either prospective (ex ante) or retrospective (ex post) evaluation design. Prospective evaluations begin during the design phase of the intervention, involving collection of baseline and end-line data from intervention beneficiaries (the 'treatment group') and non-beneficiaries (the 'comparison group'), and may also involve selection of individuals or communities into treatment and comparison groups. Retrospective evaluations are usually conducted after the implementation phase, and may exploit existing survey data, although the best evaluations will collect data as close to baseline as possible, to ensure comparability of intervention and comparison groups.

There are five key principles relating to internal validity (study design) and external validity which rigorous Impact Evaluations should address: confounding factors, selection bias, spillover effects, contamination, and impact heterogeneity.

Confounding occurs where certain factors, typically relating to socio-economic status, are correlated with both exposure to the intervention and, independent of exposure, are causally related to the outcome of interest. Confounding factors are therefore alternate explanations for an observed (possibly spurious) relationship between intervention and outcome. Because nutrition status and educational outcomes might be influenced by many factors, the SFP may capture confounding factors. This is why the regressions include fixed-effects and the sample selection correction.

Selection bias occurs where intervention participants are non-randomly drawn from the beneficiary population, and the criteria determining selection are correlated with outcomes. Unobserved factors, which are associated with access to or participation in the intervention, and are causally related to the outcome of interest, may lead to a spurious relationship between intervention and outcome if unaccounted for. In the case of the SFP, Self-selection occur where, for example, more able or organized individuals or communities, who are more likely to have better outcomes of interest, are also more likely to participate in the intervention. Endogenous program selection occurs where individuals or communities are chosen to participate because they are seen to be more likely to benefit from the intervention. Ignoring confounding factors can lead to a problem of omitted variable bias. In the special case of selection bias, the endogeneity of the selection variables can cause simultaneity bias. All these types of bias can be addressed substantially with sample selection correction models.

Impact evaluation designs are identified by the type of methods used to generate the counterfactual and can be broadly classified into three categories – experimental, quasi-experimental and non-experimental designs – that vary in feasibility, cost, involvement during design or after implementation phase of the intervention, and degree of selection bias. White (2006) and Ravallion (2008) discuss alternate Impact Evaluation approaches.

Under experimental evaluations the treatment and comparison groups are selected randomly and isolated both from the intervention, as well as any interventions which may affect the outcome of interest. These evaluation designs are referred to as randomized control trials (RCTs). In experimental evaluations the comparison group is called a control group. When randomization is implemented over a sufficiently large sample with no contagion by the intervention, the only difference between treatment and control groups on average is that the latter does not receive the intervention. Random sample surveys, in which the sample for the evaluation is chosen on a random basis, should not be confused with experimental evaluation designs, which require the random assignment of the treatment.

The experimental approach is often held up as the 'gold standard' of evaluation, and it is the only evaluation design which can conclusively account for selection bias in demonstrating a causal relationship between intervention and outcomes. Randomization and isolation from interventions are seldom practicable in the realm of social policy, and may also be ethically difficult to defend, although there may be opportunities to utilize natural experiments. Bamberger and White (2007) highlight some of the limitations to applying RCTs to development interventions. Methodological critiques have been made by Scriven (2008) on account of the biases introduced since social interventions cannot be triple blinded, and Deaton (2009) has pointed out that in practice analysis RCTs falls back on the regression-based approaches they seek to avoid, and so are subject to the same potential biases. Other problems include the often heterogeneous and changing contexts of interventions, logistical and practical challenges, difficulties with monitoring service delivery, access to the intervention by the comparison group and changes in selection criteria and/or intervention over time. Thus, it is estimated that RCTs are only applicable to 5 per cent of development finance.

Quasi-experimental approaches can remove bias arising from selection on observables and, where panel data are available, time invariant unobservables. Quasi-experimental methods include matching, differencing, instrumental variables and the pipeline approach, and are usually carried out by multivariate regression analysis.

If selection characteristics are known and observed then they can be controlled for to remove the bias. Matching involves comparing program participants with non-participants based on observed selection characteristics. Propensity score matching (PSM) uses a statistical model to calculate the probability of participating on the basis of a set of observable characteristics, and matches participants and non-participants with similar probability scores. Regression discontinuity design exploits a decision rule as to who does and does not get the intervention to compare outcomes for those just either side of this cut-off.

Difference-in-differences or double differences, which use data collected at baseline and end-line for intervention and comparison groups, can be used to account for selection bias with under the assumption that unobservable factors determining selection are fixed over time (time invariant). Instrumental variables estimation accounts for selection bias by modelling participation using factors ('instruments') that are correlated with selection but not the outcome, thus isolating the aspects of program participation which can be treated as exogenous.

The pipeline approach (stepped-wedge design) uses beneficiaries already chosen to participate in a project at a later stage as the comparison group. The assumption is that as they have been selected to receive the intervention in the future they are similar to the treatment group, and therefore comparable in terms of outcome variables of interest. However, in practice, it cannot be guaranteed that treatment and comparison groups are comparable and some method of matching will need to be applied to verify comparability.

Propensity Score Matching

In the evaluation literature, data often do not come from randomized trials but from (non-randomized) observational studies. In seminal work, Rosenbaum and Rubin (1983) proposed propensity score matching as a method to reduce the bias in the estimation of treatment effects with observational data sets. These methods have become increasingly popular in medical trials and in the evaluation of economic policy interventions.
Since in observational studies assignment of subjects to the treatment and control groups is not random, the estimation of the effect of treatment may be biased by the existence of confounding factors. Propensity score matching is a way to partially "correct" the estimation of treatment effects controlling for the existence of these confounding factors based on the idea that the bias is reduced when the comparison of outcomes is performed using treated and control subjects who are as similar as possible. Since matching subjects on an *n*-dimensional vector of characteristics is typically unfeasible for large *n*, there are new methods that propose to summarize pre-treatment characteristics of each subject into a single-index variable (the propensity score) which makes the matching feasible.

The propensity score is defined by Rosenbaum and Rubin (1983) as the conditional

Probability of receiving a treatment given pre-treatment characteristics:

$$p(X) \equiv Pr\{D = 1|X\} = E\{D|X\}.$$

where D = {0, 1} is the indicator of exposure to treatment and X is the multi dimensional vector of pre-treatment characteristics. Rosenbaum and Rubin (1983) show that if the exposure to treatment is random within cells defined by X, it is also random within cells defined by the values of the mono-dimensional variable p(X). As a result, given a population of units denoted by i, if the propensity score p(Xi) is known the Average effect of Treatment on the Treated(ATT)can be estimated as follows:

$$\begin{aligned} \tau &\equiv E\{Y_{1i} - Y_{0i}|D_i = 1\} \\ &= E\{E\{Y_{1i} - Y_{0i}|D_i = 1, p(X_i)\}\} \\ &= E\{E\{Y_{1i}|D_i = 1, p(X_i)\} - E\{Y_{0i}|D_i = 0, p(X_i)\}|D_i = 1\} \end{aligned}$$

For practical ends, the methodology for propensity score matching used first an equation that included individual and household characteristics and student test scores (grades) to explain participation in the treatment dichotomous variable. Given the relatively small number of observations included in the individual-level sample the command *pscore* in Stata v 10 was used to include common support blocks to minimize the dropout of observations. After the propensity scores are estimated, they are used to balance the sample and estimate the Average Treatment on the Treated effects (ATT) for each type of test (Reading, English, Math, etc.). The method to match the scores is based on the kernel distribution. This facilitates a robust distributional configuration of the scores along the subsample derived from the propensity scores. The method estimates the standard errors via bootstrapping so that estimators are efficient as well. The ATT effects should be interpreted carefully. They do not represent results beyond the sample in question, given the non-random assignment. But they do represent impacts at the survey sample level, which is relevant at least from the program perspective.

The procedure to match treatment and control subsamples encompasses 3 steps. First, a simple *probit* model is estimated with a set of observable characteristics, where the outcome variable is the dummy of program participation. The most relevant variables for the *probit* model step are shown in the following table:

Table A4-1 Propensity Score Matching:
Selection into Treatment (observables)

Dependent Variable (=1 SFP)		
	Coefficient	**S.E.**
Gender (=1 male)	0.037	0.069
Age	-0.382	0.065
Grade (Primary)	0.514	0.098
Both parents in HH	-0.067	0.042
Child's Score (NAS)	-0.228	0.087
Attendance Rate (School)	0.007	0.002
Z-score Body Mass Index	-0.266	0.053
Constant	2.145	0.554
Observations	1516	
LR Chi2(8)	111.6	
Log of Likelihood	-898.177	

Source: Author's estimation using pscore command Stata v.10. with SFP Survey data

The second step is to estimate the propensity score distribution with the blocks that identify "common support" characteristics between the groups:

Table A4-2 Estimated propensity score in region of common support

	Percentiles	Smallest		
1%	0.045	0.0291		
5%	0.105	0.0291		
10%	0.158	0.0291	Obs	1508
25%	0.246	0.0291	Sum of Wgt.	1508
50%	0.4237		Mean	0.423406
		Largest	Std. Dev.	0.120458
75%	0.5070	0.7747		
90%	0.5777	0.7747	Variance	0.01451
95%	0.6157	0.7747	Skewness	-0.05825
99%	0.7583	0.7747	Kurtosis	2.763906

Source: Author's estimation using pscore command Stata v.10. with SFP Survey data

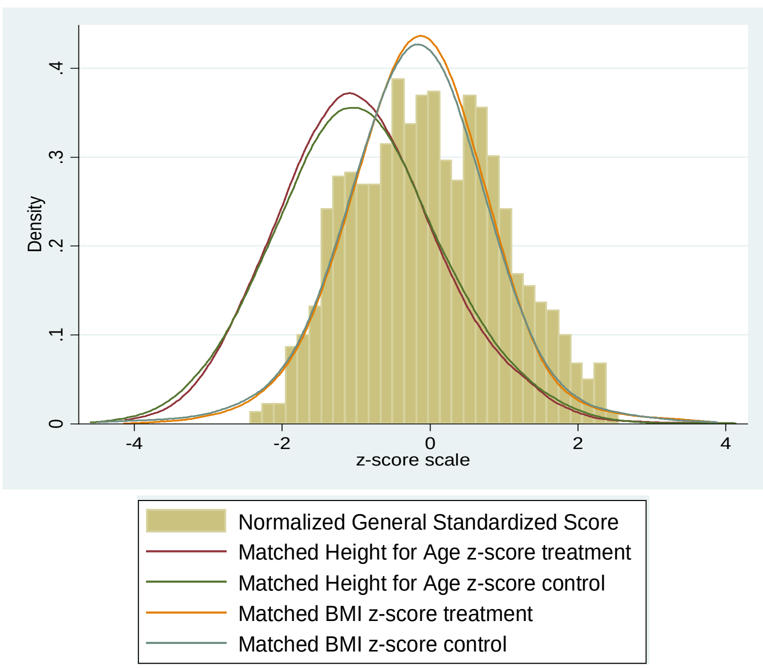
The final step is to estimate the inferior block that needs to be rebalanced. The results shown in the following table contains the inferior blocks with relatively low observations compared to the total PSM estimates. This is why the pscore graphs have satisfied balancing properties[34].

Table A4-3 Inferior Block of Pscore

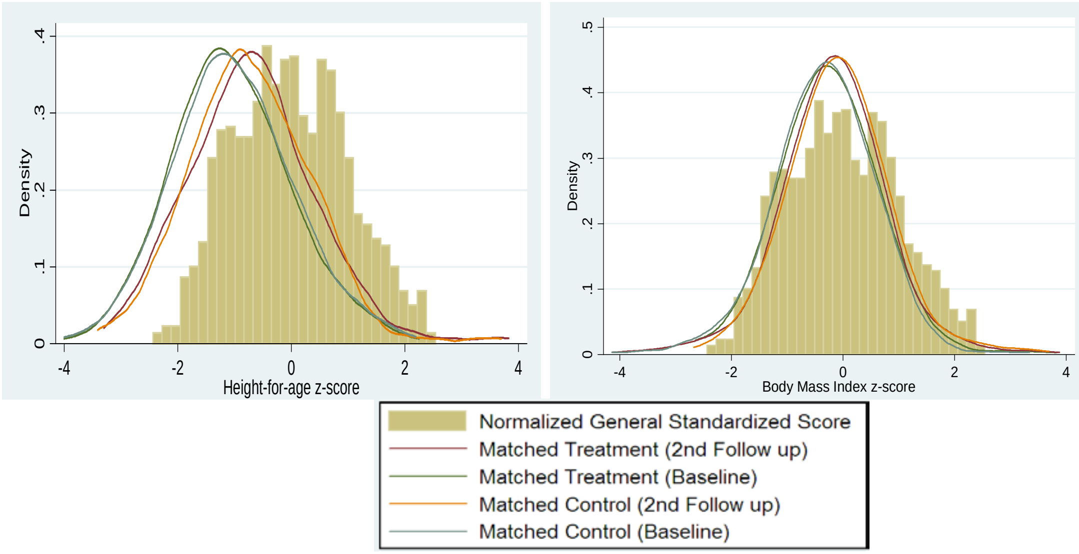
Score	Control	Treatment	Total
0.029	98	8	106
0.125	78	6	84
0.188	162	48	210
0.450	630	378	1,008
0.600	50	50	100
Total	**1,018**	**490**	**1,508**

Source: Author's estimation using pscore command Stata v.10. with SFP Survey data

Graph A4-2 Distributions of Normalized Scores vs. Health Indicators



[34] Although the scores could match at higher propensities, the results are enough to correct for observed biases in SFP participation, particularly those resulting from the student education and health outcomes.



Source: Author's estimation using pscore command Stata v.10. with SFP Survey data

Why SFP participation has Selectivity Issues?

In non-experimental studies like this one, researchers often try to approximate a randomized experiment by statistically controlling for other variables using methods such as linear regression, logistic regression, or propensity scores. While statistical control can certainly be a useful tactic, it has two major limitations. First, no matter how many variables are controlled for, there is always room for arguing that selectivity still remains.

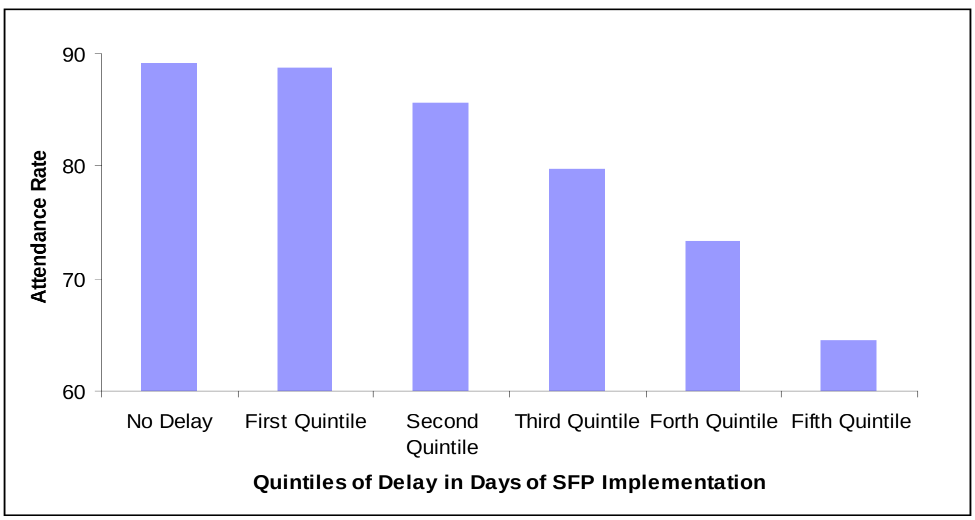
Given this evaluation design and they way in which the SFP participation was structured, fully randomization for the allocation of the program to participant schools was not achieved. The program comprised 3 phases of training prior to the provision of grants to establish community-run kitchens in schools. The first phase included a promotion campaign and awareness sessions with parents, teachers, village councils, and members of communities. Overall this phase have high levels of participation from schools and dwellers. During phase 2, training was provided to elaborate a proposal to request financing grants in order to create conditions to food preparation, agricultural production, financial management and administration of the school feeding program. The sessions were carried with school representatives and community members interested in implementing the SFP in their communities. This phase was very important because it involved producing a quality proposal to receive the award. In parallel, phase 3 included a certification of cooks, and readiness of facilities to launch the program. Without certification SFP could not start.

Based on this design and steps to select schools, there are sample selection issues that may bias the impact estimators of the SFP participation to the above mentioned outcomes. In particular, phase 2 contributes to enhance self selectivity. Schools and communities that are better organized and show higher commitment to implement an SFP will tend to have higher probabilities of success in elaborating high quality proposals and, as a consequence, receive the grant to launch the SFP. Intuitively, the characteristics that may affect this sample selection have to do with attributes at the school, region and sub-region levels. In addition, community organization will be fundamental to submit on time the proposal and to timely implement the SFP.

Fortunately the richness of the information contained in the surveys provides important observable characteristics to reduce the bias generated by the aforementioned selection process reflected in the outcome variables. Other unobservable characteristics may be corrected through statistical techniques. Correcting for both observable and unobservable characteristics of sample selection between comparison groups will minimize the bias, therefore improving statistical inference of SFP's impacts.

Non randomness in the assignment of treatment and control groups can be partially corrected if we have observed factors that could determine the selection bias that is manifested in the outcome variables. Graph A4-2 shows the relationship between the delay in days of SFP implementation and attendance rates. It is worth noticing that there is a clear relationship between the outcome variable (attendance) and the delay in days. The delays in SFP implementation was caused by multiple factors that range from school organizational level to budgetary and grant allocation delays. However, this variable captures intrinsic characteristics of schools and other contextual characteristics that produced higher quality schools to enter in the treatment group in the initial phase of the SFP. Because of this reason, the delay in days to implement SFP was used as a control within the selectivity equation of Heckman's two stage procedure.

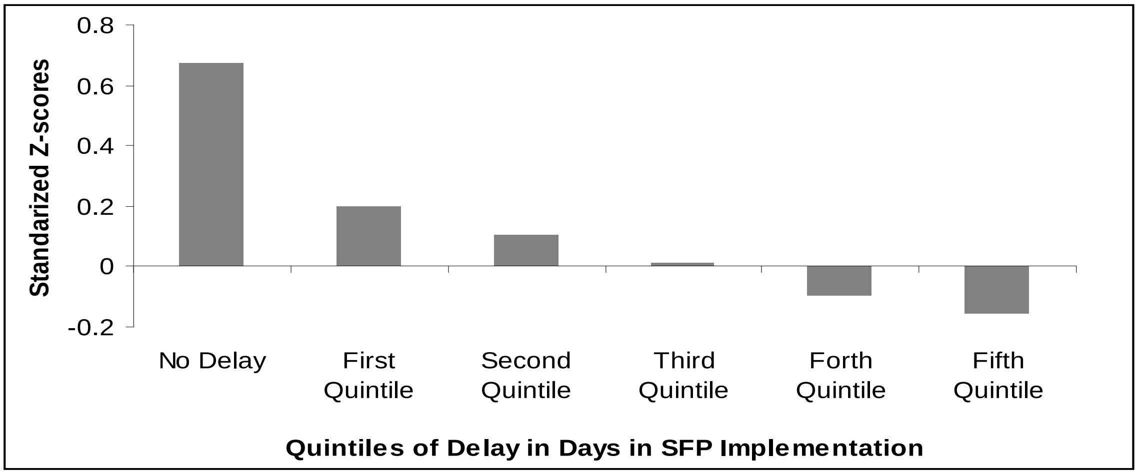
Graph A4-3 Relationship between Delay in SFP Implementation and Attendance Rates



Source: Own estimations based on Guyana's SFP IE Surveys

In order to verify how strong is the variable "days of delay in SFP implementation" in terms of capturing school quality attributes, graph A4-3 shows the relationship between the days of delay in SFP implementation and the standardized z-scores. Schools with no delays in implementation show higher average z-scores than those schools that presented at least one day of delay in SFP implementation. More days of delay in SFP implementation is associated with consistently lower total standardized z-scores.

Graph A4-4 Relationship between Delay in SFP Implementation and Total Standard Z-scores (Academic)



Source: Own estimations based on Guyana's SFP IE Surveys

Sample selection correction included this variable to increase accuracy in the observable attributes that may contribute to increase sample selection bias. In addition, other regional, school and cluster unobserved attributes were included in the selection equation to improve the accuracy in the estimations. Although the results reported are consistent, they should be interpreted with caution because sample selectivity will always be present in non-random assignments. However, the models allow approximate a fairly accurate estimate of SFP's impacts.

Overall Sample Changes and Children At-risk (stunting and wasting) subsample results

The school datasets (Round 1, 2 and 3) contain rich information of programs and activities undertaken in each school. The longitudinal database was constructed based upon face-to-face interviews to head teachers. Baseline and the first follow up surveys show a perfect matching of 64 schools. However, when the third round is merged, 6 schools do not match with baseline and round 2 data. This represent 90 percent of information kept at the school level for all three rounds (58 schools).

Student level data was also merged for baseline, round 2 and round 3. The merge of baseline and round 2 showed 3,590 students[35] that were perfectly matched. In other words, the sample of children that was followed in baseline and the subsequent round was of 3,590 students. Out of these children, 616 belong to the treatment group (considering the dates of entrance to the program) and 2,974 were in control areas. Using the third round data, the sample increased to 6,581 students, but 3,590 were perfectly matched. This means that at the student level, there was not a single child that did not matched between the baseline-round2 merged data and the round 3

[35] The total sample of children is 5,405 students but the sample was reduced due to missing data on children and unsuccessful follow up of children.

data. Out of the 3,590 children with data for the three rounds[36], 1,982 belong to the control group and 1,608 to the treatment group. This means that from the baseline-round2 merged data there was an increase of 992 children (which compensated the decrease from 2,974 to 1,982 children in the control group).

The treatment and control groups show the following distribution of children by region:

Table A4-4 Number of Children
Total Sample with Data*
(Rounds 1, 2 and 3)

Region	Treatment	Control	Total Sample
1	1,006	1,728	**2,734**
7	602	254	**856**
Total	**1,608**	**1,982**	**3,590**

*With observed data on NAS and Health Indicators

Longitudinal Sample of Children
(Baseline and First Follow up)

Region	Baseline and First Round	Treatment	Control
1	**1,367**	323	1,044
7	**428**	293	135
Total	**1,795**	**616**	**1,179**

Longitudinal Sample of Children
(Baseline and Two-Follow ups)

Region	Panel 3 Periods	Treatment	Control
1	**1,494**	503	991
7	**428**	301	127
Total	**1,922**	**804**	**1,118**

With the longitudinal sample the analysis can be done at the student level controlling for student, school and region characteristics. Additional controls for school/community quality proxies (absenteeism, days taken to implement SFP and test scores). Long-term health outcomes cannot be assessed at this point, although marginal effects can be computed for changes in BMI and HAZ. Two additional models that included dummies to identify the children at-risk of stunting and wasting were run to verify if the program had any these impacts across these vulnerable subgroups (see Table below). The first model included a simple regression (OLS) with matched

[36] Absenteeism data was also merged from a separate database and all 3,590 students merged successfully.

sample using PSM and the second an Instrumental Variable model where the instrument used was the delay in days in implementing the program (see Graphs A4-2 and A4-3), as it is exogenous from participation but it can change the stunting and wasting distribution by adding most disadvantaged children at later points in time.

Table A4-5 AT-RISK CHILDREN: STUNTING (HAZ)

	(1)	(2)	(3)	(4)
Height-for-age z-score (% Change)				
SFP (=1 Treatment)	**0.003**	**0.010**	**0.128**	**0.031**
s.e.	0.016		0.088	0.029
Dummy At-Risk (=1 WHO Cutoff)		**0.006**	**0.031**	**0.038**
s.e.		0.018	0.058	0.033
Interaction term=Atrisk*SFP		**-0.017**	**-0.036**	**-0.031**
s.e.		0.030	0.058	0.038
Constant	**-0.004**	**-0.007**	**-0.284**	**0.043**
s.e.	0.009	0.014	0.429	0.157
Observations	*2642*	*2642*	*1134*	*1432*
R-squared	*0.01*	*0.01*	*0.03*	*0.03*

CHILDREN AT-RISK: WASTING (BMI)

	(1)	(2)	(3)	(4)
BMI z-score (% Change)				
SFP (=1 Treatment)	**0.094**	**0.051**	**0.060**	**0.208**
s.e.	0.020	0.018	0.115	0.029
Dummy At-Risk (=1 WHO Cutoff)		**-0.574**	**-0.708**	**-0.596**
s.e.		0.050	0.236	0.078
Interaction term=Atrisk*SFP		**0.314**	**0.411**	**0.290**
s.e.		0.066	0.246	**0.102**
Constant	**-0.077**	**0.017**	**0.523**	**0.206**
s.e.	0.012	0.010	0.373	0.157
Observations	*3518*	*2642*	*1132*	*1436*
R-squared	*0.01*	*0.01*	*0.19*	*0.15*
Note: Controls for student, school, community characteristics were included				
in models (3) and (4)				

(1) OLS, robust standard errors				
(2) OLS, robust standard errors				
(3) OLS, clustered errors school level. Matched sample PSM.				
(4) IV regression using delay in days in implementing the program as instrument				

On merging the "parents" data there are several points worth mentioning. For the baseline survey, parents and food frequency data were collected separately. Merging both datasets caused a reduction in 27 observations. This represents around 95 percent (567 observations) of data kept in the baseline where food frequency and parent data is available. For the second round data (first follow-up) the parent and food frequency data was built in the same dataset. By merging both, the baseline parents-food frequency and the second round parents-food frequency data there were left 546 observations (58 observations were lost). After merging the final Round (3) to the merged panel of parents for baseline (R1) and follow-up (R2), the number of observations preserved were 506. In the R1 and R2 data there were 376 parents interviewed in control and 130 in treatment areas. Subsequently, R3 added 47 new parents from the control to the treatment group ending up with 329 and 177, respectively for control and treatment groups.

The regional distribution of parents in treatment and control areas for the longitudinal sample is as follows:

Table A4-6 Number of Parents in Complete Panel Sample (Rounds 1, 2 and 3)

Region	Treatment	Control	Total Sample
1	77	292	**369**
7	100	37	**137**
Total	**177**	**329**	**506**

School Enrollment (2007 and 2009)

Region	2007	2009	Difference
Region 7	**2,409**	**2,374**	**-35**
Cluster 1	2,149	2,101	-49
Cluster 2	260	273	13
Region 1	**7,323**	**7,696**	**373**
Cluster 4	1,439	1,571	132
Cluster 5	3,099	3,171	72
Cluster 6	2,785	2,954	169
Total	**9,732**	**10,070**	**338**
Status	**2007**	**2009**	**Difference**
Treatment	**4,442**	**5,173**	**731**
Region 1	3,640	3,841	201

Region 7	1,302	1,521	219
Control	**5,290**	**4,897**	**-393**
Region 1	3,480	3,648	168
Region 7	923	853	-70
Total	**9,732**	**10,070**	**338**

Table A4-7 SFP impacts on enrollment 2007-2009

Dependent: School Enrollment	**Fixed Effects Model \1**	**Sample Selection Model**
School Feeding Program*2nd Follow Up	**201.4 *** **	**178.3 *** **
Standard Error	*10.9*	*13.0*
Controls		
GRADE \2	-31.7 ***	-31.7
Standard Error	*6.64*	*27.17*
Age	1.03***	1.46 ***
Standard Error	*0.39*	*0.42*
Proportion Communities with Electricity	60.5 ***	57.4 ***
Standard Error	*8.0*	*8.4*
Proportion Households with Radio	-1.7	12.11 *
Standard Error	*8.29*	*6.23*
Dummy Households without Both parents	-5.8	-2.68
Standard Error	*5.5*	*5.2*
Average Numbers of Siblings	-14.9 ***	-12.9***
Standard Error	*2.4*	*2.5*
Time kid takes to go to School (minutes)	1.67	9.7 **
Standard Error	*4.0*	*3.9*
Time Controls	Yes	Yes
Selection Variables on SFP:		
Reported Absenteeism (Baseline)		-0.03
Standard Error		*0.020*
Days to implement SFP		0.002***
Standard Error		*0.000*
Cluster (6)		-.0.144
Standard Error		*0.11*
Region		-0.218***
Standard Error		*0.065*
School		-0.028 ***
Standard Error		*0.005*
Rho		0.04
Lambda (Mills)		8.10**

R2/Wald Chi	0.228	780.6
Number of Observations	1,534	1,534

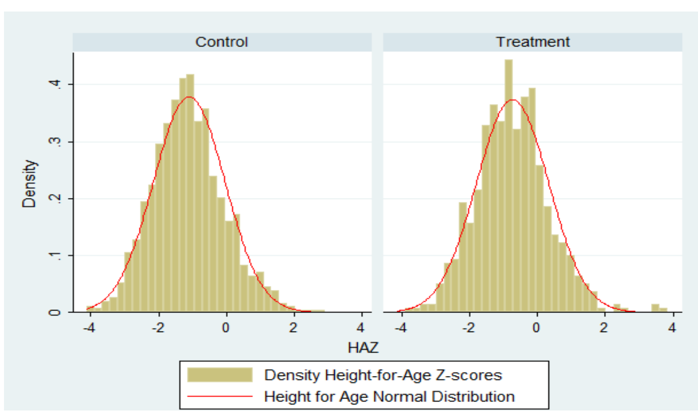
\1 Robust corrected standard errors reported
\2 Grades 2, 3, 4 included
* Significance at 10 percent level. ** Significance at 5 percent level. *** Significance at 1 percent level.
Source: Own estimations based on Guyana's SFP IE Surveys

Table A4-8 Height for Age Z-scores
2007 and 2009

Category	**2007**	**2009**	**Difference**
Total	-1.075	-0.972	0.103 ***
s.e	(1.086)	(1.141)	
Girls	-0.983	-0.890	0.092 ***
s.e.	(1.091)	(1.201)	
Region 1	-1.193	-1.113	0.080 **
s.e	(0.019)	(0.024)	
Region 7	-0.557	-0.531	0.026 *
s.e.	(0.038)	(0.047)	
Treatment	-0.851	-0.721	0.126 ***
s.e.	(0.035)	(0.037)	
Control	-1.236	-1.097	0.138 ***
s.e.	(0.031)	(0.027)	

* Significance at 10 percent level. ** Significance at 5 percent level. *** Significance at 1 percent level.
ttest mean differences
Source: Own estimations based on Guyana's SFP IE Surveys

Graph A4-5 Distribution of HAZ Scores by Region



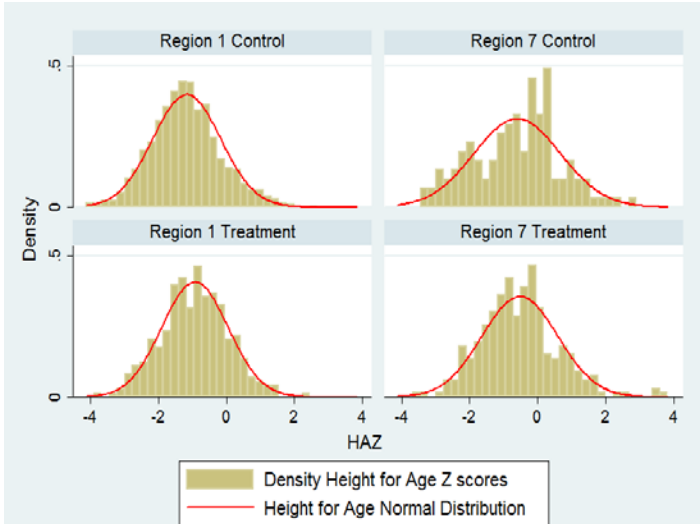


Table A4-9 SFP Impacts on Stunting 2007-2009

Dependent: Height-for-Age (Stunting) Variable Normalized in Z-Score	Fixed Effects Model \1	Sample Selection Model
School Feeding Program*2nd Follow Up	**0.135 ****	**0.089 ***
Standard Error	*0.067*	*0.05*
Controls		
GRADE \2	0.271 ***	0.324 ***
Standard Error	*0.076*	*0.037*
Age	-0.026***	-0.026 ***
Standard Error	*0.003*	*0.002*
Proportion Communities with Electricity	0.334 ***	0.315 ***
Standard Error	*0.059*	*0.044*
Proportion Households with Radio	0.061	0.097 **
Standard Error	*0.067*	*0.041*
Dummy Households without Both parents	-0.037	-0.011
Standard Error	*0.040*	*0.025*
Average Numbers of Siblings	-0.079 ***	-0.064 ***
Standard Error	*0.014*	*0.012*
Time kid takes to go to school (minutes)	-0.109 ***	-0.091 ***
Standard Error	*0.030*	*0.020*
Time Controls	Yes	Yes
Selection Variables on SFP:		
Reported Absenteeism (Baseline)		-0.0813 ***
Standard Error		*0.011*
Days to implement SFP		0.001 **
Standard Error		*0.000*

Cluster		-0.184 **
Standard Error		*0.072*
Region		-0.072 **
Standard Error		*0.034*
School		0.007 **
Standard Error		*0.003*
Rho		-0.71
Lambda (Mills)		-0.857 ***
R2/Wald Chi	0.15	481.2
Number of Observations	1,498	1,513

\1 Robust corrected standard errors reported
\2 Grades 2, 3, 4 included
* Significance at 10 percent level. ** Significance at 5 percent level. *** Significance at 1 percent level.
Source: Own estimations based on Guyana's SFP IE Surveys

Table A4-10 SFP Impacts on School Attendance 2007-2009

Dependent: School Attendance	**Fixed Effects Model \1**	**Sample Selection Model**
School Feeding Program*2nd Follow Up	**2.75****	**4.33 ****
Standard Error	*1.13*	*1.38*
Controls		
GRADE \2	2.38	2.38 ***
Standard Error	*1.47*	*0.95*
Age	-0.411***	-0.404 ***
Standard Error	*0.068*	*0.056*
Proportion Communities with Electricity	2.19 *	2.66 ***
Standard Error	*1.18*	*1.12*
Proportion Households with Radio	0.89	1.06
Standard Error	*0.97*	*1.07*
Dummy Households without Both parents	-0.85	-0.77
Standard Error	*0.66*	*0.64*
Average Numbers of Siblings	-0.21	-0.32
Standard Error	*0.322*	*0.312*
Time kid takes to go to school (minutes)	-1.18 ***	-1.62 ***
Standard Error	*0.494*	*0.050*
Time Controls	Yes	Yes
Selection Variables on SFP:		
Reported Attendance (Baseline)		-0.714 ***
Standard Error		*0.117*
Days to implement SFP		0.000
Standard Error		*0.000*

Cluster		-0.049
Standard Error		*0.074*
Region		-0.039
Standard Error		*0.036*
School		0.001
Standard Error		*0.003*
Rho		1.00
Lambda (Mills)		-35.48 ***
R2/Wald Chi	0.167	112.5
Number of Observations	1,358	1,527

\1 Robust corrected standard errors reported
\2 Grades 2, 3, 4 included
* Significance at 10 percent level. ** Significance at 5 percent level. *** Significance at 1 percent level.
Source: Own estimations based on Guyana's SFP IE Surveys

Table A4-11 SFP Impacts Using Parents Data 2008: Food Frequency

Dependent: Food Frequency	**FE Model Model \1**	**Sample Selection Model**
School Feeding Program (Baseline/2008)	**2.35*** **	**2.25 *** **
Standard Error	*0.44*	*1.38*
Controls		
Head sex (1=male)	-0.47	-0.43
Standard Error	*0.45*	*1.20*
Employment (1=employed)	-0.22	-0.24
Standard Error	*0.32*	*0.92*
Number of Children in HH	0.009	2.66 ***
Standard Error	*0.069*	*1.12*
Education of Head	0.278 *	0.272 **
Standard Error	*0.22*	*0.14*
Water access	1.12 ***	1.11 **
Standard Error	*0.35*	*0.64*
Electricity	1.15 ***	1.12
Standard Error	*0.43*	*0.312*
Roads	0.45	0.409
Standard Error	*0.69*	*1.80*
Selection Variables on SFP:		
Cluster (6)		-0.032
Standard Error		*0.117*
School effects		-16.62 *
Standard Error		*10.13*

Rho		1.00
Lambda (Mills)		9.53 *
R2/Wald Chi	0.168	81.28
Number of Observations	462	461

\1 Robust corrected standard errors reported
\2 Grades 2, 3, 4 included
* Significance at 10 percent level. ** Significance at 5 percent level. *** Significance at 1 percent level.
Source: Own estimations based on Guyana's SFP IE Surveys

Table A4-12 SFP Impacts Using Parents Data 2009: Food Frequency

Dependent: Food Frequency	**FE Model Model \1**	**Sample Selection Model**
School Feeding Program (2008/2009)	**1.359 ****	**1.275 ****
Standard Error	*0.597*	*0.641*
Controls		
Head sex (1=male)	0.257	0.424
Standard Error	*1.018*	*3.06*
Employment (1=employed)	-0.186	-0.266
Standard Error	*0.512*	*1.92*
Number of Children in HH	0.005	-0.029
Standard Error	*0.101*	*0.341*
Education of Head	1.05 *	1.08 **
Standard Error	*0.317*	*0.541*
Water access	1.31**	1.35 ***
Standard Error	*0.65*	*0.64*
Electricity	1.24 ***	1.30 ***
Standard Error	*0.54*	*0.64*
Roads	0.73	0.32
Standard Error	*1.36*	*4.24*
Selection Variables on SFP:		
Cluster (6)		-0.31 *
Standard Error		*0.189*
School effects		-5.02 *
Standard Error		*2.52*
Rho		1.00
Lambda (Mills)		-13.80 *
R2/Wald Chi	0.24	25.36

Number of Observations	240	238

\1 Robust corrected standard errors reported
\2 Grades 2, 3, 4 included
* Significance at 10 percent level. ** Significance at 5 percent level. *** Significance at 1 percent level.
Source: Own estimations based on Guyana's SFP IE Surveys

Table A4-13 Math Scores
Regressions with Fixed Effects and Sample Selection

	Fixed Effects Model	Sample Selection Model
SFP	3.36 *	4.10 *
	(1.27)	(1.33)
Grade	34.04 ***	33.26 ***
	(1.20)	(0.84)
Age	0.282 ***	0.278 ***
	(0.10)	(0.06)
Electricity	0.855	0.843
	(1.34)	(1.04)
Radio in HH	-2.96 **	-2.09 *
	(1.23)	(0.97)
Living without 2 parents	0.16	0.025
	(0.86)	(0.59)
Number of Siblings	-0.735	-0.454
	(0.52)	(0.30)
Fixed Effects		
Time	Yes	
Region	Yes	
Selection Variables		
Time to assign program		0.003
Cluster		0.134
Region		0.075
School		-0.007
Constant	-63.45	
	(9.06)	
R-squared	0.748	
Lambda Mills		0.993
F(g, k-1)	361.5	
Number of Observations	1532	3254

Standard errors in Parenthesis
* Significance at 10 percent. ** Significance at 5 percent. *** Significance at 1 percent.
Source: Own estimations based on Guyana's SFP IE Surveys

Table A4-14 Reading Scores
Regressions with Fixed Effects and Sample Selection

	Fixed Effects Model	Sample Selection Model
SFP	0.865	1.62
	(1.18)	(1.65)
Grade	-4.31*	-3.04
	(1.81)	(1.87)
Age	-0.138**	-0.136**
	(0.056)	(0.058)
Electricity	0.157	0.807
	(1.09)	(1.17)
Radio in HH	-0.772	-0.162
	(0.85)	(1.04)
Living without 2 parents	0.823	0.205
	(0.862)	(0.675)
Number of Siblings	-0.173	-0.185
	(0.335)	(.335)
Fixed Effects		
Time	Yes	
Region	Yes	
Selection Variables		
Time to assign program		-0.01
Cluster		0.059
Region		0.029
School		-0.004
Constant	41.18	-206.43
	(6.71)	(608.33)
R-squared	0.625	
Lambda Mills		30.26
F(g, k-1)	127.17	
Number of Observations	854	3424

Standard errors in Parenthesis
* Significance at 10 percent. ** Significance at 5 percent. *** Significance at 1 percent.
Source: Own estimations based on Guyana's SFP IE Surveys

Table A4-15 English Scores
Regressions with Fixed Effects and Sample Selection

	Fixed Effects Model	Sample Selection Model
SFP	1.13	1.95
	(1.285)	(1.17)
Grade	34.86 ***	34.45 ***
	(1.40)	(0.91)
Age	0.172*	0.149**
	(0 .107)	(0.06)
Electricity	-0.873	-0.716
	(1.62)	(1.12)
Radio in HH	-0.815	0.334
	(1.479)	(1.06)
Living without 2 parents	-0.053	-0.238
	(0.969)	(0.639)
Number of Siblings	-1.05	-0.801
	(0.549)	(0.324)
Fixed Effects		
Time	Yes	
Region	Yes	
Selection Variables		
Time to assign program		0.003
Cluster		0.134
Region		0.075
School		-0.007
Constant	-53.82	
	(10.00)	
R-squared	0.7191	
Lambda Mills		0.253
F(g, k-1)	232.11	
Number of Observations	1532	3254

Standard errors in Parenthesis
* Significance at 10 percent. ** Significance at 5 percent.
***Significance at 1 percent.
Source: Own estimations based on Guyana's SFP IE Surveys

Table A4-16 Science Scores
Regressions with Fixed Effects and Sample Selection

	Fixed Effects Model	Sample Selection Model
SFP	0.037	1.96
	(1.81)	(1.95)
Grade	6.62 ***	6.64 ***
	(2.47)	(1.39)
Age	-0.535	-0.623
	(0.244)	(0.109)
Electricity	-1.69	-0.429
	(2.33)	(1.33)
Radio in HH	2.33	2.78
	(2.33)	(1.34)
Living without 2 parents	-1.48	-1.08
	(1.11)	(0.73)
Number of Siblings	-2.14***	-1.35 ***
	(0.887)	(0.39)
Fixed Effects		
Time	Yes	
Region	Yes	
Selection Variables		
Time to assign program		0.03
Cluster		0.087
Region		0.04
School		-0.004
Constant	141.06	1185.45
	(26.13)	(919.23)
R-squared	0.1037	
Lambda Mills		-8.89
F(g, k-1)	2.52	
Number of Observations	678	3422

Standard errors in Parenthesis
* Significance at 10 percent. ** Significance at 5 percent. *** Significance at 1 percent.
Source: Own estimations based on Guyana's SFP IE Surveys

Table A4-17 Social Studies Scores
Regressions with Fixed Effects and Sample Selection

	Fixed Effects Model	Sample Selection Model
SFP	0.221	3.79 *
	(1.96)	(2.05)
Grade	2.56	4.64 **
	(2.28)	(1.37)
Age	-0.412*	-0.459*
	(0.223)	(0.108)
Electricity	1.34	1.28
	(1.80)	(1.32)
Radio in HH	1.74	1.68
	(2.24)	(1.32)
Living without 2 parents	-1.36	-1.06
	(1.28)	(0.73)
Number of Siblings	-1.36	-1.89
	(0.85)	(0.385)
Fixed Effects		
Time	Yes	
Region	Yes	
Selection Variables		
Time to assign program		0.003
Cluster		0.087
Region		0.044
School		-0.004
Constant	140.9	3387.9
	(26.18)	(1907.34)
R-squared	0.103	
Lambda Mills		
F(g, k-1)	2.75	-21.47
Number of Observations	678	3422

Standard errors in Parenthesis
* Significance at 10 percent. ** Significance at 5 percent. *** Significance at 1 percent.
Source: Own estimations based on Guyana's SFP IE Surveys

Table A4-18 Food Frequency Regressions from Graph 22 Diff 2007-2008/2007-2009

```
1 . reg ffscore hhsex hhfull  totchild feduc ptago psfp water elect roads sfstatu
> s, robust
```

Linear regression

Number of obs = 462
F(10, 451) = 9.44
Prob > F = 0.0000
R-squared = 0.1679
Root MSE = 3.468

ffscore	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
hhsex	-.4766817	.4589627	-1.04	0.300	-1.378653	.4252892
hhfull	-.2234529	.3282633	-0.68	0.496	-.8685683	.4216626
totchild	.0090285	.0699034	0.13	0.897	-.1283483	.1464053
feduc	.2780987	.1204082	2.26	0.061	.1050559	.7112533
ptago	-.1639517	.2486319	-0.66	0.510	-.6525727	.3246692
psfp	-.1862929	.1522427	-1.22	0.222	-.485486	.1129001
water	1.12524	.3599786	3.13	0.002	.4177966	1.832684
elect	1.155454	.4341976	2.66	0.008	.3021527	2.008756
roads	.4524749	.6993178	0.65	0.518	.226801	.9218509
sfstatus	2.354172	.4442597	5.30	0.000	1.481096	3.227248
_cons	6.487103	.7160526	9.06	0.000	5.079889	7.894317

```
2 . heckman ffscore hhsex hhfull  totchild feduc ptago psfp water elect roads sfs
> tatus, select ( cluster school  ffid rate ) twostep
note: two-step estimate of rho = 2.3900085 is being truncated to 1
```

Heckman selection model -- two-step estimates
(regression model with sample selection)

Number of obs = 465
Censored obs = 4
Uncensored obs = 461

Wald chi2(10) = 81.28
Prob > chi2 = 0.0358

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ffscore						
hhsex	-.4356191	1.202974	-0.36	0.717	-2.793405	1.922167
hhfull	-.2443802	.9209989	-0.27	0.791	-2.049505	1.560744
totchild	.0252492	.1863883	0.14	0.892	-.3400651	.3905635
feduc	.2718788	.1372539	2.51	0.003	.1811195	.524877
ptago	-.1551288	.6296296	-0.25	0.805	-1.38918	1.078923
psfp	-.1815426	.3966566	-0.46	0.647	-.9589752	.59589
water	1.116399	.5501911	2.17	0.040	.7459416	1.978739
elect	1.124961	.5183953	2.94	0.031	.405544	1.435467
roads	.4096008	1.800239	0.23	0.820	.193805	2.118803
sfstatus	2.259479	1.141523	1.98	0.048	.0221348	4.496823
_cons	6.216124	1.948752	3.19	0.001	2.396639	10.03561
select						
cluster	-.0326092	.2660886	-0.12	0.902	-.5541332	.4889148
school	-16.62705	10.13995	-1.65	0.100	-36.501	3.246893
ffid	.1664623	.1014254	1.65	0.100	-.0323278	.3652524
rate	-.082021	.2505781	-0.33	0.743	-.5731451	.4091031
_cons	1.551542	.9428191	1.65	0.100	-.29635	3.399433
mills						
lambda	9.533139	5.75793	1.67	0.098	3.231179	42.37807
rho	1.00000					
sigma	9.5331386					
lambda	9.5331386	16.75793				

```
1 . reg FFSCORE HHSEX  HHFULL  TOTCHILD FEDUC PTAGO PSFP WATER ELEC ROADS sfstatu
> s,robust
```

Linear regression

Number of obs = 240
F(10, 229) = 8.75
Prob > F = 0.0000
R-squared = 0.2367
Root MSE = 3.4754

FFSCORE	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
HHSEX	.2572583	1.01834	0.25	0.801	-1.749255	2.263772
HHFULL	-.1858755	.5127571	-0.36	0.717	-1.1962	.8244495
TOTCHILD	.0051147	.1010994	0.05	0.960	-.1940893	.2043188
FEDUC	1.058596	.3170098	3.34	0.001	.4339676	1.683225
PTAGO	1.015214	.3776005	2.69	0.008	.2711983	1.759229
PSFP	.0924023	.2873253	0.32	0.748	-.4737369	.6585415
WATER	1.316686	.6501369	2.05	0.021	.021346	1.540684
ELECT	1.241999	.5406947	2.84	0.003	.5766267	2.707372
ROADS	.7342618	1.36743	0.54	0.592	.428614	1.960091
sfstatus	1.359417	.5972874	2.28	0.024	.1825358	2.536299
_cons	3.899014	1.419179	2.75	0.006	1.102695	6.695333

```
2 . heckman FFSCORE HHSEX  HHFULL  TOTCHILD FEDUC PTAGO PSFP WATER ELEC ROADS sfs
> tatus, select ( cluster school  ffid rate ) twostep
note: two-step estimate of rho = -2.1192385 is being truncated to -1
```

Heckman selection model -- two-step estimates
(regression model with sample selection)

Number of obs = 250
Censored obs = 12
Uncensored obs = 238

Wald chi2(10) = 25.36
Prob > chi2 = 0.0658

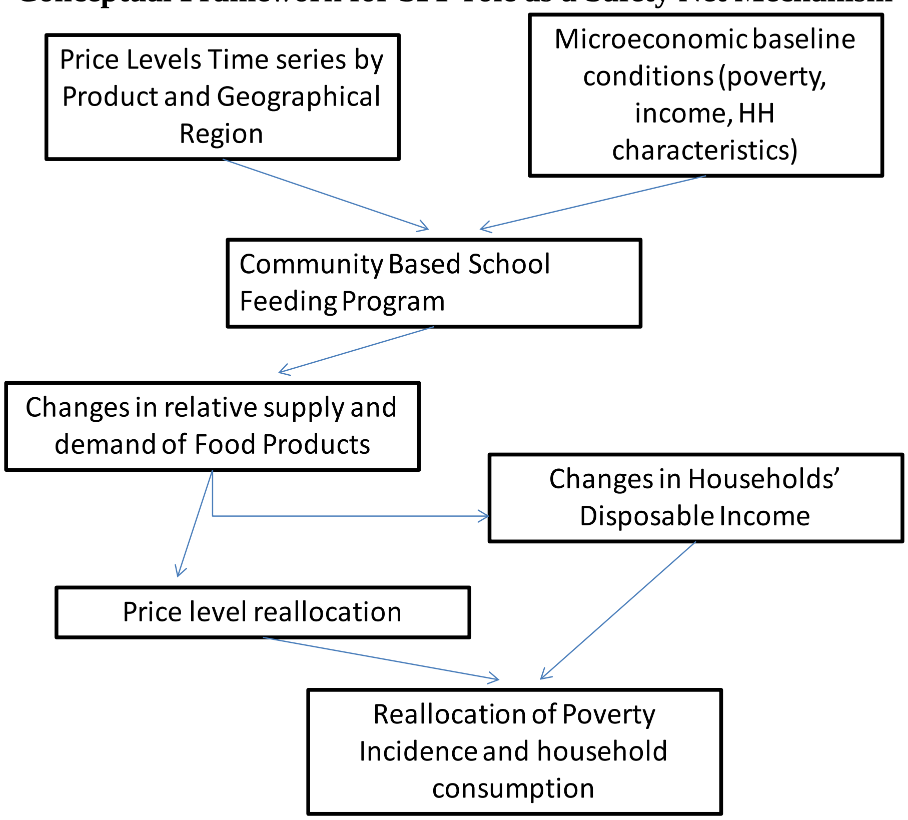
	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
FFSCORE						
HHSEX	.4242332	3.064462	0.14	0.890	-5.582001	6.430468
HHFULL	-.2660091	1.922455	-0.14	0.890	-4.033951	3.501933
TOTCHILD	-.0291999	.3405494	-0.09	0.932	-.6966646	.6382647
FEDUC	1.087286	.5416666	2.00	0.068	.8367448	2.011317
PTAGO	1.239837	1.282206	0.97	0.334	-1.27324	3.752913
PSFP	.1774931	.9359109	0.19	0.850	-1.656859	2.011845
WATER	1.358996	.743936	2.45	0.007	.783915	2.972116
ELECT	1.308603	.641757	2.60	0.009	-1.961175	5.25838
ROADS	.325435	4.244023	0.08	0.939	.643567	6.992697
sfstatus	1.274978	.641391	2.12	0.032	.726075	5.276031
_cons	5.05451	4.877787	1.04	0.300	-4.505777	14.6148
select						
cluster	-.3129476	.1894941	-1.63	0.092	-.643339	-.690229
school	-5.027924	2.523232	-1.91	0.063	-5.85326	1.797411
ffid	.0498968	.0552272	0.90	0.366	-.0583464	.1581401
rate	-.2262597	.1880822	-1.20	0.229	-.594894	.1423746
_cons	2.176442	.6850523	3.18	0.001	.8337641	3.51912
mills						
lambda	-13.80227	7.07655	-1.93	0.076	-38.64785	11.0433
rho	-1.00000					
sigma	13.802274					
lambda	-13.802274	12.67655				

Simulation: Price Shocks and SFP's Role as Safety Net

Given a change in producer and consumer staple prices, the net effect on household welfare depends on the household's condition as net seller or net buyer. If staple prices increase, the household will experience a welfare gain in the short run if it is a net seller or a welfare loss if it is a net buyer. To quantify this change in welfare in an intuitive manner a useful notion is that of compensating variation, which equals the gain/loss to the income/monetary transfer needed to restore the household to the position it was before the (price) shock occurred. In this paper the compensating variation is expressed as a percentage of the initial welfare level.

The methodology used in this paper has several antecedents, starting with Deaton (1989), and many other empirical applications thereafter, including Budd (1993), Barrett and Dorosh (1996), Minot and Goletti (2000) and, recently, Ivanic and Martin (2008). A change in the staple food price is the original income (here proxied by total consumption expenditure) of each household with the original price of the staple.

Conceptual Framework for SFP role as a Safety Net Mechanism



Source: Adapted from Colombo (2010). Linking CGE and Microsimulation Models: A Comparison of Different Approaches. International Journal of Microsimulation (2010) 3(1) 72-91

The three rounds of SFP's impact evaluation surveys are based mostly on the same sample of households, and can be combined with the household budget and expenditures survey (HBE), with additional socioeconomic characteristics of individuals and households. Additionally, the prices are calibrated with GMC data[37]. When the two data sets are combined and observations with missing sampling weights are dropped. Weights from national HBE survey are used for the merged dataset with slight calibration based on the sample in each cluster of the evaluation surveys.

One must ensure that outcomes from the micro-simulation model are consistent with the aggregate results from the poverty estimates both before and after the price shock for each comparison area. This includes aggregating the simulation results at the community level using average socioeconomic characteristics, prices, purchases and food groups by SFP participant and non-participant communities.

The model requires information on household consumption expenditure (C), the agricultural intensity of communities and a dummy variable that indicates whether the household receives SFP (Ict), and time-series price levels by food groups. The household survey provides information on the poverty line. The model simulates the impact of higher commodity prices on households by simulating attendant changes in consumption and the poverty line. We assume that simulated and baseline consumption by individual j in food group i has the following formula:

$$C_{ij}^{o}(t+1) = C_{ij}(t)[1 + \Delta GDPpc_{i}^{o}] + \Delta ct * I_{ct}, \qquad o \in \{b, s\}$$

This implies that the simulated percentage change in consumption (abstracting from changes in SFP status) is identical for every household in a community. Further, the change in SFP status over time is assumed to be unconditional. An increase in commodity prices will increase the cost of the poverty basket. Baseline and simulated increases in the real poverty line (PL) are calculated as follows:

$$PL^{o}(t+1) = PL(t)[1 + Inf_{pov}^{o}], \qquad o \in \{b, s\}$$

The simplicity of this equation leads to extensive use in the analysis of the poverty impact of increases in food prices. However, it is worth reminding that bias exists from its use. Individual food prices rarely increase by the same percentage or proportion. An individual would typically substitute away from a good whose relative price has increased. Thus this assumption results in a substitution bias that over-estimates the poverty impact of the increase in food prices. Because GMC prices measurement error tends to under-estimate prices, there could be an under-estimation of impact, which in combination with the substitution bias, both biases may cancel-out (based on their magnitudes). Given the short-run orientation of this simulation model, it is possible that this bias may not be substantial.
Let Ipj be a dummy variable indicating whether household j is poor:

[37] Prices from the Guyana Market Corporation may have substantial measurement error as communities become more isolated and rural.

$$C_{ij}^{o}(t+1) < PL^{o}(t+1) \Rightarrow I_{pj}^{o} = 1, \qquad C_{ij}^{o}(t+1) \geq PL^{o}(t+1) \Rightarrow I_{pj}^{o} = 0, \qquad o \in \{b, s\}$$

The national poverty incidence for the baseline and simulation outcomes (Hb and Hs respectively) are given by:

$$H_o = [\sum_j [I_{pj}^{o} * PW_{ij}(t+1)] / [\sum_j PW_{ij}(t+1)], \qquad o \in \{b, s\}$$

To build the model and estimate how many children in SFP areas did not fall below the poverty threshold with an increase in food prices, different data was used and several assumptions were made. First, monthly prices of food and food groups from 1990 to 2010 were used to explore the price index changes and trends. Based on frequencies of food group consumption and local food prices in sub-regions[38] the estimated price changes for the main food staples/groups were listed in frequencies. The estimations were then separated according to the price indices reported in markets adjacent or close to treatment and control areas[39].

With food prices changes estimated for treatment and control areas it is possible to calculate the differences shown in the period before and after the food price shocks by each food group. The price shocks reduce spending power and increases the likelihood of a household to fall into the poverty line. Guyana´s extreme and moderate poverty lines were estimated through a household consumption and expenditure survey collected nationally, reported in the Guyana Poverty Assessment. The thresholds are reported in Table A4-19.

Table A4-19 Poverty Line Thresholds in Guyana

Figures in Guyanese Dollars (2005)

	Year			
Poverty Line	1992	1999	2006	2009*
Extreme poverty	2,929	5,463	7,959	8,312
Moderate poverty	3,960	7,639	11,143	13,274

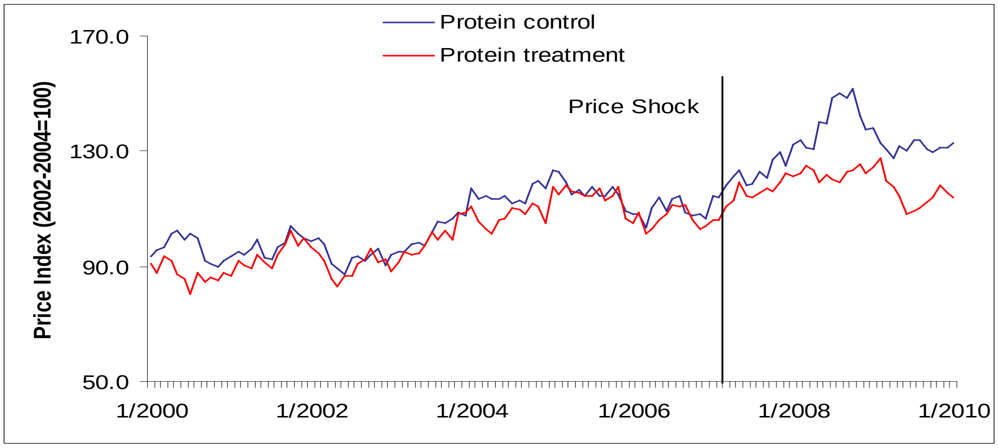
Source: Guyana Poverty Assessment (1994), and BOS 2009.
*Estimated

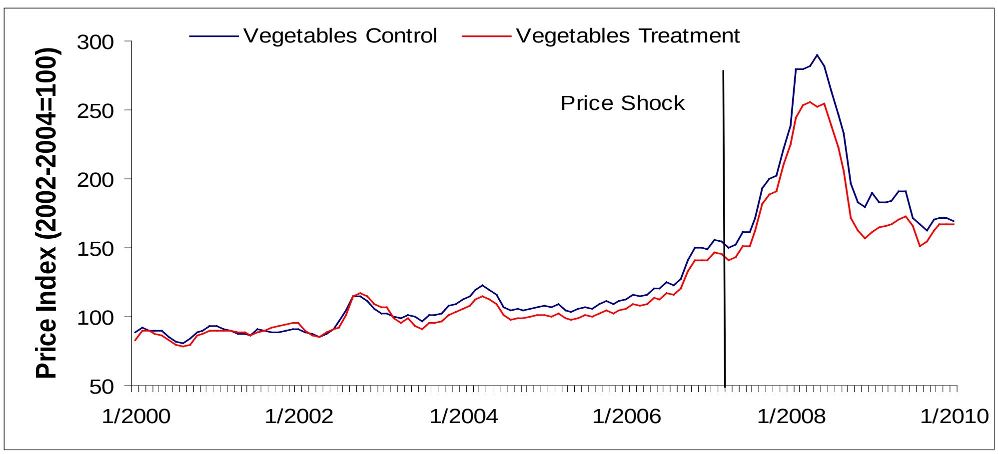
Price differences between treatment and control areas changes relative households' food expenditures and income levels, so it is possible to estimate changes in poverty levels as well. Since the differences in prices are expressed in percentage between the price levels paid in

[38] The Guyana Market Corporation (GMC) provided useful quarterly data from 2007 to 2009 on all prices paid in local markets for 50 products that included fruits, meats and proteins, legumes, ground and roots, vegetables, seasonings, starch and nuts.
[39] Local markets can provide food products to both treatment and control areas particularly when they are close enough. Prices were imputed to the comparison group that had schools close to the local market.

treatment and control areas, it is feasible that, with the incentive to provide additional meals with the SFP, local market production and food frequency-intake stability could lead to lower price levels in treatment areas. Graph A4-4 shows that the simulations produced an increase in the gap of comparison group food prices due to the assumptions made and the presence of the SFP.

Graph A4-20 Price Levels in Treatment and Control areas

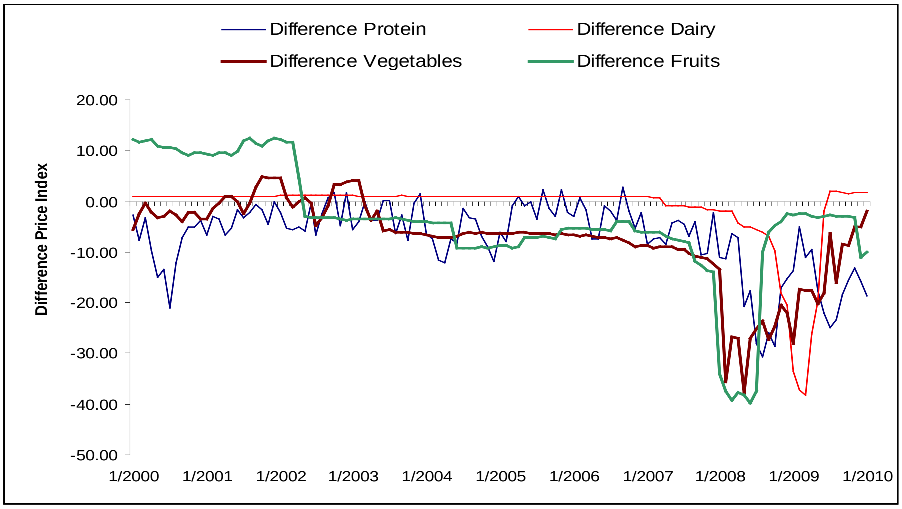




Source: Own estimations using Guyana Central Bank data and Guyana Market Corporation Prices.

The estimations of price differences between treatment and control areas for the period 2000 to 2010 is shown in graph A4-20 (for proteins and vegetables). All food groups showed price stability and small differences in the period previous to the food price crisis in both treatment and control areas. During and after the period of food price increases (mid-2007) the price differences for all food groups become higher. When the price difference is negative it indicates lower price levels for treatment areas.

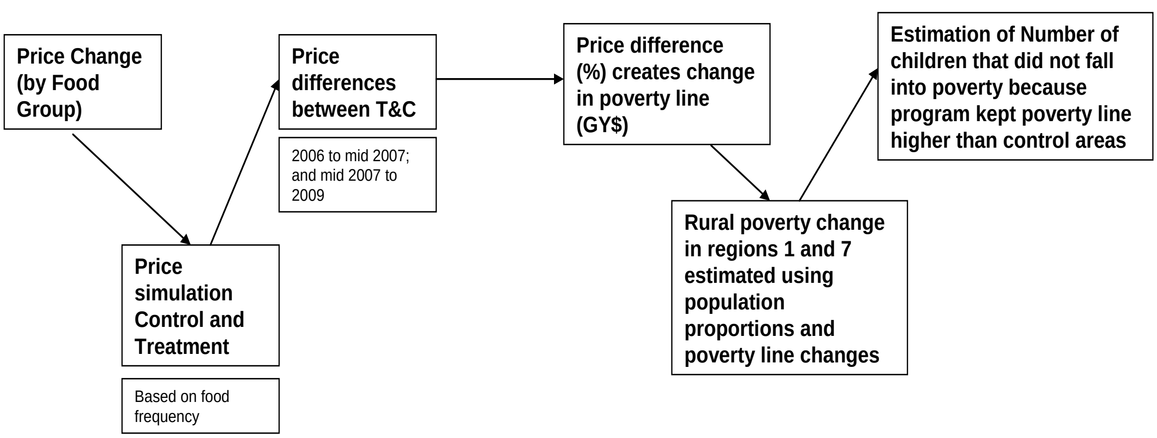
Graph A4-21 Price Differences (Treatment-Control) by Food Groups (2000-2010)



Source: Own estimations using Guyana Central Bank data and Guyana Market Corporation Prices.

Average yearly price differences, expressed in percentages, are imputed into the poverty line thresholds, assuming that any percent change in food prices will proportionally affect household expenditure. Because the poverty thresholds were built from expenditure data based on price and quantities of good consumed in the household, this is not an unreasonable assumption. Once price shocks are translated into poverty line changes it is possible to estimate the changes in the total number of poor people and estimate the number of people that did not fall into poverty because of the presence of the program. To do so, we need to further assume that the distribution of the children and region's population remains constant from 2006-2009 (see Figure A4-1).

Figure A4-1 Steps for Estimation of Price Shocks and Poverty Changes



The final step is to estimate actual poverty changes. To do so, we need the total poor population distributed by area (urban, rural) and the proportion of population distributed by region. In addition, poverty rates for 2009 were estimated using a conservative rate of population increase and poverty changes. Table A4-2 shows the total number of poor people and poverty rates in

2006 and 2009. For 2009, the difference in prices was used to change the poverty rate threshold[40]. In consequence it could be estimated the difference in the number of people that fall below the poverty threshold according to the price shock differential in treatment and control areas. In other words, without the program food prices increases would have caused an upward shift in the poverty threshold and consequently in the number of poor people.

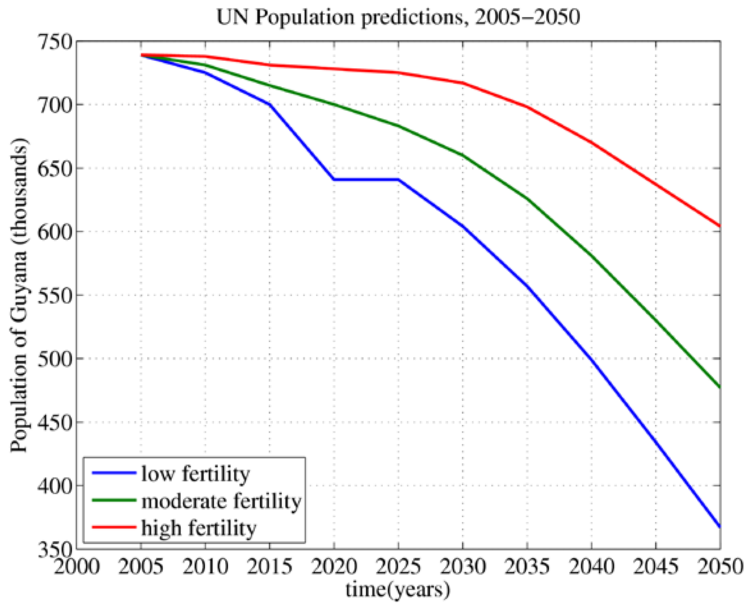
Table A4-22 Total poor population by area and Poverty Rates 2006 and 2009

	2006				2009		
					Estimates		
	Number of poor	Population	Rate		Number of poor	Population	Rate
Extreme Poverty				*Extreme Poverty*			
National	124,637	681,977	18.3	National	121,160	665,234	18.2
Urban	13,684	193,509	7.1	Urban	13,089	198,020	6.6
Rural	110,953	488,468	22.7	Rural	109,455	467,215	23.4
Moderate Poverty				*Moderate Poverty*			
National	244,088	681,977	35.8	National	237,278	665,234	35.7
Urban	35,784	193,509	18.5	Urban	34,227	198,020	17.3
Rural	208,304	488,468	42.6	Rural	205,492	467,215	44.0

Source: Own estimates using Household Budget Survey data 2006
Estimates based on annual population growth average and poverty rate change (2000-2006)

The predictions based on the conservative scenarios using the baseline population of the Census 2002. The population growth is declining in Guyana in recent years therefore the 2009 estimates in Table A4-22 show an actual decrease in rural population and nationally. But overall there is an increase in both extreme and moderate poverty in rural areas, whereas urban areas experience a decline over the baseline and simulated year.
Graph A4-23 shows the UN Population predictions for Guyana from 2005 to 2050 under three fertility scenarios. This shows the tendency of population reduction in this country.

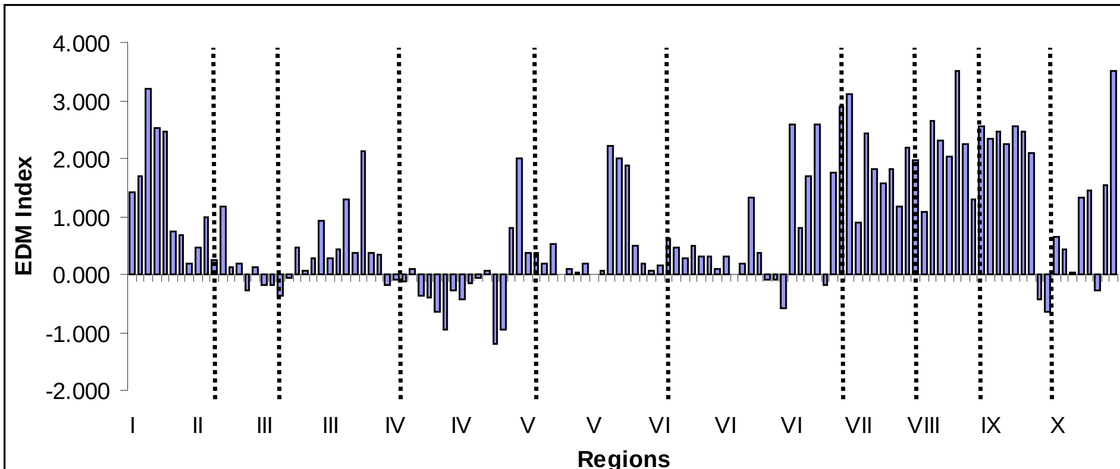
[40] Because the difference is expressed between price levels in treatment areas minus the price levels of control areas, the changes in poverty will be a result of an increase in the poverty threshold when prices in the control group are higher.



Source: UN http://ic.ltrr.arizona.edu/ic/nats101c/quiz/guyana05_50.png

Regions 1, 7, 8 and 9 rank highest among the regions with access to public services and facilities such as schools, hospitals, electricity, water and roads. The EDMI is a marginality index built at the NDC level. The higher the score the least access to services and facilities by the community.

Graph A4-24 EDMI by NDC and Region in Guyana



Enumerator District Marginality Index (Based on Skoufias, 2006)

The simple estimations of the changes in poverty due to food price changes relied on several assumptions, which are enlisted below:

Assumptions

1. Price changes entirely affect consumption (all income effect); no confounding factors of consumption and poverty change considered. This assumption does not consider changes and shift in patterns and preference of consumption. Although it does consider the frequency of food groups to approximate changes in consumption, a better model will incorporate percent changes in consumption or price elasticities of the various products included in the consumption basket to estimate poverty lines.

2. Poverty and Population Growth in the 2006 to 2009 period is constant. Population growth in Guyana's hinterland rural areas is decreasing, according to Guyana's Bureau of Statistics. Poverty has experience modest decreases in early 2000s. From 2006 and 2009 modest and conservative changes in population and poverty changes were considered.

3. Poverty rates change proportionally to the poverty line threshold. This is a strong assumption. However, in Guyana's context, relatively steady and low levels of inflation makes this assumption reasonable. This assumption will be unreasonable in countries that experience sharp changes in inflation rates.

4. Regional distribution of children population is proportional to the regional distribution of poor children. This is an assumption that prevents overestimating the poverty effects of the children that are at risk of falling into poverty in the presence of food price shocks. In other words, this represents a lower bound estimate since the number of children that may become poor is estimated by multiplying the total change in poor people in rural areas and the proportion of children dwelling in regions 1 and 7. In reality, in hinterland areas the proportion of poor children is higher than the proportion of children population.

5. Food groups and categories used determine the consumption basket. The consumption basket used to estimate the poverty thresholds comprises the same food groups but more products.

Based on the methodology and assumptions described above, Table A4-3 shows the results in poverty changes and the potential children that could fall below the poverty line in the absence of a safety net program. We use four main food group categories and estimate the treatment and control price differences before and during the food prices shock. Since food prices are reported in indices (constant terms) the changes are expressed in percentages.

For instance, the protein food group showed a marginal 4 percent difference between treatment and control areas during 2006 and mid-2007. The difference for the same food group in the food price shock period escalated to 15.1 percent. The price shocks or percentage differences are then expressed in terms of changes in the poverty line threshold. The moderate poverty line of GY$11,143 per month (USD 1.85 daily) would have increased on average G$445.4 per month (USD 0.07 daily) more in control areas for protein products in the period before the food price crises. In the food price crisis period there was around GY$2,000 per month (USD 0.33 daily) shock for control areas.

These estimates can then be used to estimate the average change in poverty using the poverty line and the population under the poverty threshold.

Table A4-23 Change in poverty in the absence of a safety net

	Before Food Price Shocks *	Price Shock Period **
Mean Price Shock (treatment minus control) (%)		
Protein	-4.00	-15.08
Dairy	0.59	-7.72
Vegetables	-8.10	-17.66
Fruits	-5.77	-13.32
Price shock change in Poverty Line (GY$, T-C)		
Protein	-445.4	-2,002.0
Dairy	65.6	-1,024.9
Vegetables	-902.4	-2,344.2
Fruits	-642.8	-1,768.5
Poverty Change from Price Difference (population)		
Rural Poverty Change (%)	6.0	21.5
Rural Poverty Change (#)	12,595	44,124
Total Children at risk of poverty	2,572	9,011
Regions 1 and 7 Children	148	517

* Includes from January 2006 to June 2007
** From July 2007 to December 2009

SFP Costs

Table A4-24 SFP Costs

School name	No. of teaching staff	No. of cooks	Start-up costs (Fixed Cost) USD	Total Variable Cost 2007-2009 USD	Total Cost 2007-2009	Average Cost per Day
Agatash	2	4	5,628	50,652	56,280	87.9
Itaballi	7	5	8,372	75,348	83,720	130.8
72 Miles	3	3	3,892	35,028	38,920	60.8
Two Miles	6	7	9,968	89,712	99,680	155.8
St. Anthony's	17	13	30,156	271,404	301,560	471.2
Kartabo	2	2	3,584	32,256	35,840	56.0
Holy Name	6	5	9,296	83,664	92,960	145.3
St. Mary's	2	2	2,828	25,452	28,280	44.2
St. Martin's Annex	1	3	3,836	34,524	38,360	59.9
Kurupung	2	3	3,416	30,744	34,160	53.4
Isseneru	1	2	3,220	28,980	32,200	50.3
Port Kaituma	24	19	50,176	451,584	501,760	784.0
Arakaka	4	5	6,860	61,740	68,600	107.2
Mabaruma	20	14	32,564	293,076	325,640	508.8
Wauna	8	12	30,688	276,192	306,880	479.5
Assakata	3	4	4,200	37,800	42,000	65.6
Kamwatta (Moruca)	6	7	13,188	118,692	131,880	206.1
Karaburi	5	7	14,168	127,512	141,680	221.4
Santa Rosa	23	14	37,324	335,916	373,240	583.2
Waramuri	9	9	19,152	172,368	191,520	299.3
TOTAL	151	140	292,516	2,632,644	2,925,160	228.5

Note: Only treatment schools with data and grant awards included
Source: SFP Data

Food Basket	Unit	Daily Amount (Oz)	2005 Sept. $ per Oz.	2005 Cost (G$) Daily	2006 Sept. $ per Oz.	2006 Cost (G$) Daily	2007 Sept. $ per Oz.	2007 Cost (G$) Daily	2008 Sept. $ per Oz.	2008 Cost (G$) Daily	2009 Sept. $ per Oz.	2009 Cost (G$) Daily
Cereals & cereals Products												
Rice (white)	$ per Oz.	2.32	2.65	6.14	2.89	6.70	3.23	7.56	3.89	8.42	4.21	9.12
Flour	$ per Oz.	2.32	3.83	8.89	3.90	9.06	4.07	9.54	4.67	10.61	5.06	11.49
Macaroni	$ per Oz.	2.32	8.16	18.93	8.24	19.12	8.50	19.93	9.85	22.19	10.67	24.03
Pulses & Pulse products												
Split peas	$ per Oz.	1.48	4.04	5.98	4.29	6.34	4.65	6.95	5.66	7.73	6.13	8.37
Blackeye peas	$ per Oz.	1.48	8.96	13.26	10.96	16.23	13.71	20.51	15.58	22.82	16.87	24.71
Meat, Fish & eggs												
Stew Beef	$ per Oz.	0.83	12.26	10.18	13.57	11.26	15.34	12.87	18.84	14.32	20.40	15.51
Chicken (frozen)	$ per Oz.	0.83	12.93	10.73	15.00	12.45	17.80	14.93	22.06	16.61	23.89	17.99
Banga mary (fish)	$ per Oz.	0.83	8.31	6.90	6.55	5.44	5.28	4.42	6.33	4.92	6.85	5.33
Shrimp,fresh	$ per Oz.	0.83	7.27	6.03	6.25	5.19	5.49	4.61	6.25	5.13	6.77	5.55
Shoulder pork	$ per Oz.	0.83	14.25	11.83	18.52	15.37	24.60	20.64	31.31	22.97	33.91	24.87
Milk & Milk products												
Fresh milk	$ per Oz.	0.83	2.38	1.98	3.97	3.30	6.77	5.68	7.86	6.32	8.51	6.84
Oil & Fats (exc. Butter)												

Fry oil	$ per Oz.	0.74	6.99	5.18	9.77	7.23	13.95	10.43	16.19	11.61	17.53	12.57
Margarine	$ per Oz.	0.74	13.31	9.85	12.96	9.59	12.90	9.65	14.97	10.74	16.21	11.63
Vegetables & vegetables Products												
Cassava	$ per Oz.	3.99	3.18	12.67	3.28	13.07	3.45	13.92	4.01	15.49	4.34	16.78
Eddoes	$ per Oz.	3.99	2.78	11.08	3.23	12.87	3.83	15.43	4.44	17.17	4.81	18.60
Pumpkin	$ per Oz.	1.98	3.39	6.72	2.23	4.41	1.49	2.98	1.73	3.32	1.87	3.60
Plantains	$ per Oz.	3.99	2.94	11.72	3.41	13.62	4.05	16.34	4.70	18.18	5.09	19.69
Callable	$ per Oz.	1.98	1.16	2.30	1.76	3.47	2.71	5.43	3.15	6.04	3.41	6.54
Ochra	$ per Oz.	1.98	3.89	7.70	4.25	8.42	4.75	9.50	5.51	10.57	5.97	11.45
Tomatoes	$ per Oz.	1.98	9.23	18.27	12.15	24.06	16.35	32.72	18.98	36.42	20.55	39.43
Fruits & fruit Products												
Oranges	$ per Oz.	1.71	5.50	9.41	4.25	7.27	3.36	5.80	4.15	6.46	4.50	6.99
Bananas	$ per Oz.	1.71	3.03	5.18	3.95	6.75	5.26	9.09	6.51	10.12	7.05	10.96
Papaw	$ per Oz.	1.71	3.80	6.50	5.40	9.24	7.85	13.56	9.71	15.09	10.52	16.34
Watermelon	$ per Oz.	1.71	5.86	10.03	3.86	6.60	2.60	4.49	3.22	5.00	3.49	5.42
Sugar (dark)	$ per Oz.	2.27	2.46	5.58	2.84	6.45	3.36	7.70	4.15	8.57	4.50	9.28
Total (Daily)		45.38		223.01		243.49		284.68		316.83		343.10
Total (Monthly)				6913.40		7548.31		8824.97		9821.58		10635.9

Source: Caribbean Food and Nutrition Institute, GMC and Guyana Bureau of Statistics

ANNEX 5

SUPPLEMENTARY TABLES

Table A5 – 1: Head teachers' profile

Factor	Categories	Percent of head teachers		
		Round 1	Round 2	Round 3
1. Designation	Head teacher	40.7	54.1	53.4
	Senior or Senior assistant teacher or assistant teacher	29.7	25.2	25.9
	Temporary qualified or unqualified teacher	20.4	13.1	15.5
	Pupil teacher or teacher aide or acting teacher or other	9.4	6.5	5.2
2. Age	≤ 29 years	18.3	9.8	8.6
	30 – 39 years	20.0	31.1	27.6
	40 – 49 years	45.0	36.1	34.5
	≥ 50 years	16.7	23.0	29.3
3. Sex	Female	52.5	57.6	53.4
	Male	47.5	42.4	46.6
4. Academic qualifications (*)	None	18.2	0	1.9
	SSPE Part 2	N/A	11.9	7.5
	Foundation upgrading course	N/A	32.2	41.5
	CXC / O levels	40.0	33.9	28.3
	Other	41.8	22.0	20.8
5. Professional qualifications (*)	None	15.0	11.9	12.3
	CPCE/Trained teacher certificate	N/A	72.9	71.9
	Diploma in education	66.7	10.2	8.8
	BEd	6.7	3.4	8.8
	Other	11.7	1.7	5.3

(*) Round 1 categories for academic and professional qualifications are not comparable to those of Rounds 2 and 3 – see text.

Table A5 – 2: Class teachers' profile

Factor	Categories	Percent of teachers		
		Round 1	Round 2	Round 3
1. Designation[41]	Head teacher, Senior or Senior assistant teacher or assistant teacher	23.4	27.4	34.4
	Temporary qualified or unqualified teacher	37.8	33.8	34.4
	Pupil teacher or teacher aide or acting teacher or other	38.7	38.9	31.3
2. Age	≤ 20 years	12.5	10.1	7.5
	20 - 29 years	49.1	49.6	43.8
	30 – 39 years	18.8	25.2	25.4
	≥ 40 years	19.7	15.1	23.8
3. Sex	Female	75.5	75.0	72.7
	Male	24.5	25.0	27.3
4. Academic qualifications	None	11.1	1.5	3.2
	SSPE Parts 1 and 2	N/A	11.2	10.1
	Foundation upgrading course	N/A	18.7	21.5
	CXC / O levels	56.5	61.2	53.2
	Other	32.4	7.4	12.1
5. Professional qualifications	None	48.6	59.3	51.9
	Trained teacher's certificate	29.7	28.6	36.8
	Certificate in education	2.7	3.6	3.0
	Other	18.9	8.5	8.3

[41] The designation of teachers is as follows: Senior Assistant-a certified teacher with 7 years of experience; Senior-a certified teacher with 5 years of experience; Assistant-a certified teacher; Temporary Qualified-teacher that has met the basic requirements but is not trained; Temporary Unqualified-a teacher who has not met the basic requirements and is not trained; Pupil-an untrained teacher under 17 years of age; Teacher Aide- an untrained teacher who assists teachers; Acting- an untrained teacher employed while a qualified teacher is found.

Table A5-3: Observed classes

		Percent of observations		
Variable	**Category**	**Round 1**	**Round 2**	**Round 3**
1. Grades observed	2	28.7	19.9	18.8
	3	28.7	15.2	12.4
	4	24.1	14.6	11.2
	5	N/A	14.6	8.2
	6	N/A	N/A	11.2
	> one grade present	18.4	35.7	38.2
2. Subjects taught	Maths	36.9	32.0	37.6
	English	42.7	21.9	12.7
	Science	10.7	8.3	10.9
	Social studies	9.7	10.7	10.3
	Other	-	27.2	28.5
3. Teaching method	Discussion	12.5	8.9	14.3
	Group work	14.4	14.9	15.5
	Student directed	5.8	4.2	2.4
	Teacher directed	53.8	69.6	62.5
	Other	13.5	2.4	5.4

Table A5 – 4: Observation details

	Round 1		Round 2		Round3	
Variable	**Median**	**Range**	**Median**	**Range**	**Median**	**Range**
No. of good desks	8	0 – 24	8	0 - 75	9.5	2 – 35
No. of bad desks	0	0 – 15	0	0 - 14	0	0 – 10
No. of books	18	0 – 255	48.5	0 - 948	125	0 – 4132
Time allocated to subject	30	15 – 70	30	15 – 99	35	15 – 75
Time utilized for subject	25	0 – 65	20	7 - 70	30	10 – 70
Class enrollment	17	2 – 110	20	1 - 115	22	3 – 98
No. present during observation	14	2 - 95	16	1 - 71	16	1 - 73

Table A5-5: Occupation of respondents

Occupations	Percent of respondents			% of heads of households	
	R 1	R 2	R 3	R 2	R 3
A. Most frequently mentioned occupations					
Farmer	40.8	37.0	45.2	46.3	48.6
Housewife (woman), Unemployed (man)	25.6	34.8	25.7	6.3	4.0
Teacher	8.0	N/A	0.2	0.4	0.9
Miner	4.5	4.9	3.2	10.4	12.5
Health professional (medex, nurse, physiotherapist)	3.5	3.3	3.2	2.5	2.7
Caterer	3.3	4.3	4.0	3.6	1.6
Fisherman, seaman	2.6	2.3	3.2	5.2	5.1
Laborer	1.7	4.7	2.0	4.7	3.1
Carpenter	0.9	3.9	0.4	3.9	2.9
B. Less frequently mentioned occupations					
Office workers, police/security persons, salespersons, hairdresser	3.1	2.3	2.2	2.7	2.5
Engineer, gov. employee, businessman, accountant, IT officer, supervisor, contractor, ship's captain, social worker	3.0	2.4	2.8	5.9	5.4
Handicraft / factory worker, logger, plumber, mechanic, welder, electrician, driver, machinist, fireman, painter	1.9	1.3	3.6	5.2	7.9
Domestic, gardener, vendor, porter	0.9	3.4	2.0	2.3	1.3
Self-employed (occupation not specified)	1.6	0.5	2.4	0.5	1.6

Table A5 – 6: Household possessions - parents' and students' responses

Item	Percent of respondents (positive responses only)		
	Round 1	Round 2	Round 3
A. Parents' responses			
Books	80.9	85.9	89.2
Newspapers / magazines	70.7	71.2	71.6
Radio	61.7	52.0	45.7
Dictionary	53.3	50.8	52.0
Calculator	49.3	44.8	45.9
Television	32.1	33.3	42.2
Boat	25.7	57.1	44.3
Telephone	21.2	50.6	57.0
Refrigerator	19.1	16.3	20.8
Computer	2.1	4.3	4.2
B. Students' responses			
Radio			51.0
Television			57.8
Refrigerator			34.4
Boat, car or tractor			21.7
Livestock			8.5