

McGovern-Dole Food for Education and Child Nutrition in Kyrgyzstan – Baseline Study on Nutritional Variables

Final Report

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Executive Summary

Objectives

In this "Baseline Study on Nutritional Variables", we address three broad research questions around nutrition in the context of the national Food for Education and Child Nutrition (FFE) program in Kyrgyzstan. The three questions are:

RQ1: What is the status of nutrition in Kyrgyz households with primary grade children?

Here, we place particular and novel emphasis on measuring and studying a) nutrition knowledge, preferences and practices among children and their caregivers and b) nutrition outcomes and home, such as dietary diversity.

RQ2: What is the impact of nutrition on child health and education among Kyrgyz children?

Here, we place particular and novel emphasis on studying a) nutrition knowledge, preferences and practices among children and parents, and b) "intrapersonal foundations" of learning in the sense of children's school participation, health and cognitive and non-cognitive skills.

RQ3: What is the impact of the FFE program on nutrition as well as on health and education among Kyrgyz children?

Here, we place particular and novel emphasis on a) identifying net links, b) uncovering the causal pathways at work, distinguishing nutritional and alternative channels (such as school feeding incentivize school attendance based on purely economic terms), and c) estimating the separate and combined impacts of hot meal provision and community- and family-based behaviour change program components.

Methodology

To maximize learning from this Baseline Study, we developed an innovative mixed-method approach that combines survey-based quantitative research with in-depth ethnographic insights. In the quantitative survey conducted in the period November 2019 till February 2020, we collected detailed information from 3035 grade 1 and grade 2 students from 154 FFE program schools, as well as their primary caregivers. Schools and children were selected in a two-stage random sampling process. In addition, we conducted two waves of qualitative research: one before the household survey to inform the quantitative design and one after the household survey to complement quantitative analysis. The qualitative research included 40 in depth conversations in 21 FFE communities, with school representatives and teachers, caregivers, children and experts of nutrition and education familiar with the FFE program. The results derived from this methodology are preliminary to the extent that they rely on baseline data only; a validation of all the preliminary causal findings requires a full set of endline data.

Results

Our baseline analysis suggests that a lot of children have good nutrition knowledge and healthy food preferences in general, but also that they eat many snacks, which are often unhealthy. Their

caregivers have often limited nutrition knowledge, but typically have healthy food preferences. Nutrition at home is now well diversified for a majority of households.

In terms of health and learning, attendance rates among Kyrgyz children are very high, they are generally in fine health, and they exhibit very good other "intrapersonal characteristics" that determine learning outcomes, such as low short-term hunger in class, high cognitive function and strong noncognitive skills. Against this encouraging background, we find that healthy nutrition plays a key role and suggests strong benefits: avoiding unhealthy snacks is strongly linked with better executive function and better literacy and numeracy scores (primarily among grade 2 children). In addition, household diets that are rich in vitamin A are strongly associated with better child health, less short-term hunger, better executive function, and higher literacy and numeracy.

Our preliminary impact analysis drawing on a novel design using baseline data of children who just started grade 2 suggests that the FFE program has a critical role for improving nutrition and fostering learning. For learning outcomes, our results indicate that purely economic and purely social impact channels are less relevant than nutritional channels. Specifically, we document with baseline data that one year of the FFE program led to improved nutritional practices at home, which may be adapted even without strongly shifting caregivers' knowledge or preferences. In turn, we observe large gains in terms of learning due to strong FFE impacts on executive function and numeracy in particular.

Quite strikingly, we observe similar differences between children from 2018 and 2019 FFE communities who just started grade 1. A potential explanation points to positive spill over effects in FFE communities, which would be an encouraging result from a programming perspective, as it would suggest that the FFE program can also benefit children who are not direct beneficiaries, i.e. who did *not* receive hot meals in the past year. Yet, this is an indicative finding only relying on baseline data only; we cannot definitively rule out using baseline data only the possibility that children, households, and/or communities differ structurally across 2018 and 2019 FFE schools.

Outlook

Both explanations emphasize the importance of a well-designed endline survey to ascertain the rigorous causal impacts of the FFE program. It facilitates impact analyses based on comparisons of students recently started grade 2 (in the fall of 2019) and grade 2 students starting in the fall of 2020 (who are the grade 1 students in the current baseline sample). Such analyses eliminate both issues complicating causal inference based on the baseline data. On the one hand, the comparison group has not been exposed to the FFE program "passively" and, on the other hand, both groups are from the same schools and community. As any impact analysis, such evaluations will also rest on certain assumptions. But together with the initial insights from this baseline study, the endline impact evaluation will provide a very compelling set of evidence of causal impacts of the FFE program and will thus be an important source of novel research and learning.

1. Introduction

In total, there are 2262 primary schools in Kyrgyzstan. 1371 out of these have now been part of a school feeding program delivered by either the government, the World Food Program or Mercy Corps. In the United States Department of Agriculture Food for Education (FFE) program implemented by Mercy Corps, the goods and services provided span multiple packages, including the provision of hot school meals, rehabilitation of physical infrastructure (like kitchens and water systems), and social and behaviour change (SBC) communication. The latter component of the intervention typically relies on local change agents who in turn work with the community members, most importantly parents of the school children.

By early 2020, 511 Kyrgyz primary schools had been served by the national FFE program. The first wave reached 154 schools from 2012 through 2017, and the second wave that started in the fall of 2018 covers 139 schools ("2018 cohort"). In a third wave, another 218 schools started receiving the program in the fall of 2019 ("2019 cohort").

In this Baseline Study on Nutritional Variables we analyse nutrition, child health and child learning in the context of 2018 and 2019 cohort schools. The study has two twin objectives. First, it is meant to serve as a valid and meaningful baseline study for an impact evaluation that assesses the causal impacts of the FFE program. The quantitative component of that impact evaluation will be based on a) baseline survey data collected for this study and b) endline survey data that will be collected later this year. Second, the baseline should maximize learning about nutrition, child health and child learning from the baseline research already, including first insights into impacts of the FFE program.

This baseline report provides findings from quantitative and qualitative analyses.

The remainder of the report has five parts:

- 1) A presentation of the research design;
- 2) A description of nutrition in Kyrgyz households with primary grade children;
- 3) Findings on the impact of nutrition on child health and education;
- 4) Findings on the impact of nutrition interventions on child health and education; and
- 5) Conclusions and recommendations for the end-of-program summative evaluation in 2021, for further research and for potential follow-on impact evaluation

2. Research design

The research design was developed in the inception phase. Guided by the Terms of Reference (ToR) for this assignment, it built on extensive consultations with Mercy Corps staff and relevant stakeholders, including during two ISDC missions to Kyrgyzstan on 10-17 May 2019 and on 6-14 June 2019. During our visits, we placed strong emphasis on understanding the details and nuances of the school selection process, the intervention packages and implementation practice, both for past years and for the future, and the mechanisms of impact.

The research design is methodologically feasible and was found to be highly relevant by all stakeholders for maximum buy-in and support in the implementation of the study. Furthermore, the developed study design will ensure maximum uptake of the research findings in the wider community of experts.

2.1 Framework and research questions

In the inception phase, we have established the broad research framework and specific research questions for the project. The selection process was primarily guided by the USDA Learning Agenda,¹ and complemented by our consultations with Mercy Corps Kyrgyzstan and other stakeholders, by statistical and practical considerations as well as by the existing academic literature. Figure 1 below illustrates the basic framework adopted for this research.



Figure 1: Research framework.

¹ US Department of Agriculture. (2016). McGovern–Dole International Food for Education and Child Nutrition Program: School Meals Learning Agenda. Washington D.C.: USDA Foreign Agricultural Service. https://www.fas.usda.gov/programs/resources/school-meals-learning-agenda.

We study three broad research questions:

RQ1: What is the status of nutrition in Kyrgyz households with primary grade children?

RQ2: What is the impact of nutrition on child health and education among Kyrgyz children?

RQ3: What is the impact of the FFE program on nutrition as well as on health and education among Kyrgyz children?

2.2 Indicators and measures

Box 1: Key study outcomes.

DON I. NEY Study Outcomes.
Research question 1 (RQ1)
Immediate outcomes - level 1: children's nutritional behaviours
Child's nutrition practices
 Child's nutrition preferences and knowledge
Immediate outcomes - level 2: nutrition at home
Dietary diversity at home
 Primary caregiver's nutrition access, preferences and knowledge
Research question 2 (RQ2)
Intermediate outcomes: health and other intrapersonal foundations of learning
School attendance
Child health
Cognitive skills
Non-cognitive skills
Ultimate outcome: learning
Literacy measures
Numeracy measures
Research question 3 (RQ3)
FFE program indicators: child level
 School meal provision over the past year (FFE cohort)
School meal provision taken up by child
FFF program indicators: caregiver level
• SBC activities in community offered to primary caregiver
 SBC activities in community taken up by primary caregiver
 SBC spots seen on TV by primary caregiver
Social behaviours and relations
Social behaviours and relations at home

• Social behaviours and relations outside homes

Box 1 provides an overview of the key outcomes analysed to investigate our research questions. To investigate nutrition (RQ1), we study two groups of immediate outcomes, children's nutritional behaviours and nutrition at home.

To assess net impacts and impact channels related to RQ2, we study additional groups of intermediate outcomes – related to health and other intrapersonal foundations of learning – and ultimate outcomes – related to learning.

Lastly, we analyse three additional groups of intervention and social indicators to study net impacts and impact channels related to RQ3: FFE program indicators at the child level, FFE program indicators at the caregiver level and social behaviours and relations.

In Appendix 1, we provide more detail on the specific measures and variables used.

2.3 Hypotheses

Based on these indicators and measures, we test three hypotheses related to RQ2:

H2-1: Better child nutrition is associated with better health

H2-2: Better child nutrition is associated with better intrapersonal foundations of learning beyond health

H2-3: Better child nutrition is associated with better learning

In turn, we test seven hypotheses related to RQ3:

H3-1: The FFE program improves child nutrition

H3-2: The FFE program improves nutrition at home

H3-3: The FFE program improves child intrapersonal foundations of learning

H3-4: The FFE program improves child learning

H3-5: The FFE program improves the social environment at home

H3-6: The FFE program improves social relationships outside the home

H3-7: FFE school meals combined with SBC communication on health and nutrition have larger impacts on nutrition, health and education than the school meals alone

2.4 Combining quantitative and qualitative research

To maximize learning from the baseline study, we developed an innovative mixed-method approach that combines survey-based quantitative research with in-depth anthropological insights. The qualitative research was conducted in two waves, as illustrated in Figure 2.

The first wave of qualitative data was critically important at an early stage to refine our specific hypotheses, assess their validity, determine their relevance in the local context, and inform the final design of the quantitative survey instruments.

A second wave of qualitative research took place once the initial statistical analysis of the survey data had been completed. The purpose of the second wave was to complement and guide the interpretation of our quantitative evidence, and specifically to validate causal mechanisms.



Figure 2: Overview of different stages of the research process.

2.5 Quantitative survey

For the quantitative analysis, we designed, prepared, and implemented a large-scale survey with grade 1 and 2 children and their primary caretakers from all oblasts. Supported by Erfolg Consult, we collected detailed information from 3035 grade 1 and grade 2 students from 154 FFE program schools, as well as their primary caregivers. Schools and children were selected in a two-stage random sampling process.

The sampling design was driven by and aimed to balance the multiple purposes of the baseline sample. Aim 1 was to produce descriptive statistics on children's nutrition and learning outcomes and their relationships, representative of children in 2019 FFE schools. Aim 2 was to produce a valid baseline for an impact evaluation based on the baseline data and endline data to be collected one year later. Aim 3 was to produce initial insights into program impacts from comparisons with 2018 FFE schools based on the baseline data alone.

To achieve these goals, we randomly selected 77 schools out of the universe of 2019 FFE schools, stratified by oblast to represent the spread across oblasts in the universe in the sample. Second, we randomly selected 77 schools out of the universe of 2018 FFE schools imposing the same

spread of the sample across oblasts as for the 2019 schools. We stratified by SBC implementation status among 2018 FFE schools to the extent possible, in order to facilitate statistically meaningful comparisons by schools with and without SBC components in addition. In the second stage we randomly selected 20 children for each school (or the maximum number available if less than 20), stratified by grade and gender.

We attached the fieldwork report on survey data collection provided by Erfolg Consult as Appendix 2.

2.6 Quantitative study sample

Table 1 provides socio-demographic background information on the quantitative study sample. As intended by the design, the largest relative shares of households across oblast live in Chuy oblast (34%) and Jalal-Abad oblast (26%),² 50% of all interviewed children are girls, 50% attend FFE 2018 program schools (and the other 50% FFE 2019 schools), and 50% are in grade 1 (and 50% are in grade 2). The average child is about seven years old and lives with about five other people (which is similar to the general population in Kyrgyzstan). Figures 3 and 4 visualize the distribution of child age and household size.

² This reflects that Chuy and Jalal-Abad oblasts have the largest relative shares of program schools.

	Mean	S.D.	Min.	Max.
Child age	7.14	0.76	3	10
Child is a girl	0.50	0.50	0	1
Household size	5.94	1.71	2	15
Main language at home is Kyrgyz	0.83	0.38	0	1
Main language at home is Russian	0.08	0.27	0	1
Main language at home is Uzbek	0.08	0.27	0	1
Grade 1	0.50	0.50	0	1
Grade 2	0.50	0.50	0	1
Oblast				
Batken	0.07	0.26	0	1
Chuy	0.34	0.47	0	1
lssyk-Kul	0.05	0.22	0	1
Jalal-Abad	0.26	0.44	0	1
Naryn	0.06	0.24	0	1
Osh	0.19	0.39	0	1
Talas	0.03	0.16	0	1
FFE program indicators: child				
FFE cohort 2019	0.50	0.50	0	1
FFE cohort 2018	0.50	0.50	0	1
Usually finishes hot meal at school	0.84	0.37	0	1
FFE 2018 program indicators: caregiver				
Ever tried a school meal	0.33	0.47	0	1
Ever participated in SBC training on nutrition	0.27	0.45	0	1
Total number of nutrition topics trained on	1.13	1.97	0	5
Ever participated in SBC training on hygiene and sanitation	0.24	0.43	0	1
Ever saw SBC message on TV	0.68	0.47	0	1
Ν	3035			

Table 1: Socio-demographic background



Figure 3: Age distribution by grade.

Figure 4: Distribution of household size.



Among primary caregivers of children who attend FFE 2018 program schools, about one third has tried a hot meal served at school, 27% ever participated in an SBC training on nutrition, 24% on one on hygiene and sanitation, and 68% have seen an SBC message on TV. Figure 5 breaks down the SBC training related to nutrition by the five main categories: breastfeeding, complementary feeding, dietary diversity, anaemia, and junk food. There are only minimal differences in attendance rates. For each category, 20-25% of caregivers ever participated in such a training.



Figure 5: Participation in SBC trainings (FFE 2018 cohort).

3. Nutrition in Kyrgyz households with primary grade children (RQ1)

3.1 Descriptive statistics at the individual and household level

Table 2 presents findings related to children's nutrition practices, preferences and knowledge. A large majority of children have a small breakfast before going to school (85%) and eat snacks during main meals (75%). Only about 18% of children never buy unhealthy snacks from a shop. On average, children eat 1.09 healthy snacks, such as fruits or vegetables, as well as 0.42 unhealthy snacks, such as chips or candy.

	Mean	S.D.	Min.	Max.
Breakfast and snacks				
Eats breakfast before school	0.85	0.36	0	1
Buys unhealthy snacks from shop	0.82	0.39	0	1
Eats snacks between meals	0.75	0.43	0	1
Eats healthy snacks	0.36	0.48	0	1
Eats unhealthy snacks	0.66	0.47	0	1
Number of snacks per day	1.52	1.40	0	8
Number of healthy snacks per day	1.09	1.05	0	6
Number of unhealthy snacks per day	0.42	0.63	0	3
Preferences and knowledge				
Snack preference score	-0.08	1.22	-2	2
Prefers healthy snacks	0.50	0.50	0	1
Food preference score	-0.11	4.03	-16	12
Prefers healthy foods	0.50	0.50	0	1
Knows that sweets are not good for health	0.72	0.45	0	1
No. of correct reasons why sweets are bad	0.71	0.49	0	3
Ν	3035			

Table 2: Children's practices, preferences and knowledge related to nutrition

We elicited children's snack preferences based on their choices when presented with selected pictures showing commonly available healthy and unhealthy snacks. The results suggest that about half of all children prefer healthy snacks. The other half prefers unhealthy snacks. Similarly, we presented children with a list of 10 relatively common foods and meals, and asked children to

tell us how much they liked each item. This again suggests that about equal shares of all children prefer healthy foods, as opposed to unhealthy foods.³

Figure 6 displays how popular certain snacks are among the children. The most frequently consumed snacks between meals are sweets, fruits and bread.



Figure 6: Snacks children eat.

Lastly, we also find that about 7 out of 10 children know that sweets and candy are not healthy, but the average child can barely name one correct reason why they are bad.

These results suggest that a lot of **children have fairly good nutrition knowledge and fairly healthy general food preferences, but also eat many snacks which are often unhealthy**.

Table 3 complements these findings from children with nutritional outcomes at home and from their main caregiver. The commonly used Household Dietary Diversity Score based on consumption on the day before the survey, suggests an average value of 8 different food groups consumed. There is no common dietary diversity indicator for primary schools, but the Minimum Dietary Diversity for Women (MDD-W) and Minimum Dietary Diversity for Infant and Young

³ The relatively equal distribution is relatively stable across regions, and therefore not primarily the result of strong difference based on location.

Child Feeding (MDD-IYCF) measures can be used in addition. Our results suggest that for 78% of all children, dietary diversity in the household, is above the critical value of 4 food groups, as measured by the MDD-W indicator. Similarly, 66% of all children are above the critical value of 4 food groups, in terms of the MDD-IYCF measure. More specifically, 95% consumed any Vitamin A-rich food in the 24 hours prior to the survey, and about 2.4 different food groups that are rich in Vitamin A. Equally high shares of respondents report having consumed iron-rich foods (92%) and foods rich in vitamin C (95%). In terms of different food groups, an average household consumes about one group of iron-rich sources and about two groups of vitamin-C rich foods.

Among main caregivers, we find that 76% rate healthy foods and meals higher than unhealthy ones and about 60% correctly identify foods that are rich in Vitamin A.

These results suggest that caregivers have often somewhat limited nutrition knowledge, but typically have healthy food preferences and nutrition at home is now sufficiently diverse for a majority of households.

	Mean	S.D.	Min.	Max.
Dietary diversity at home				
Dietary diversity score (24h)	8.18	1.43	2	12
MDD-W>4	0.78	0.41	0	1
MDD-IYCF>4	0.66	0.47	0	1
Number of vitamin A-rich food groups (24h)	2.41	1.28	0	6
Any vitamin A-rich food (24h)	0.95	0.22	0	1
Number of plant-based vitamin A-rich food groups (24h)	1.33	0.88	0	3
Any plant-based vitamin A-rich food (24h)	0.83	0.37	0	1
Number of iron-rich food groups (24h)	1.04	0.46	0	3
Any iron-rich food (24h)	0.92	0.27	0	1
Number of vitamin C-rich food groups (24h)	2.09	1.04	0	4
Any vitamin C-rich food (24h)	0.95	0.22	0	1
Caregiver				
Food preference score	2.36	3.37	-12	16
Prefers healthy foods	0.76	0.43	0	1
Good knowledge about vitamin A-rich foods	0.60	0.49	0	1
Good knowledge about vitamin C-rich foods	0.22	0.41	0	1
Good knowledge about iron-rich foods	0.49	0.50	0	1
Ν	3035			

Table 3: Nutrition at home.

3.2 Descriptive statistics at the oblast level

Figures 7, 8 and 9 presents average outcomes related to nutrition across oblasts. The height of a bar represents the average outcome calculated from all households living in the same oblast. The attached grey lines indicate 95% statistical confidence intervals. While all oblasts have dietary diversity values of well above 7, it is clearly highest in Batken (Fig. 7a). This is also reflected in the total number of vitamin A, vitamin C and iron food groups used in the average diet, which is also highest in Batken (Fig..7b, c, d). In the case of iron, we find similar average levels in Jalal-Abad and Naryn.





Perhaps somewhat surprisingly we find quite different patterns in caregivers' food preferences and knowledge (Fig. 8). While the average food preferences are fairly healthy in all oblasts, these are lowest in Batken, Osh and Talas (Fig. 8a). Our analysis suggests caregivers in Issyk-Kul oblast have the healthiest food preferences.

Like dietary diversity number of micro-nutrient food groups, average knowledge about Vitamin A is also high in Batken, but we find similar or slightly higher average in Jalal-Abad, Osh and Talas oblasts (Fig. 8b). By contrast, knowledge about vitamin C is less good across oblasts. Oblast-level

averages of good knowledge range from about 10% of caregivers in Osh to above 30% in Chuy (Fig. 8c). Knowledge about iron is about as strong as knowledge about vitamin and close to 60% of caregivers in Chuy, Issyk-Kul and Naryn oblasts have good knowledge (Fig. 8d).



Figure 8: Nutrition knowledge and preferences at home at the oblast level.

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Good knowledge about vitamin A-rich foods Batken Chuy Jalal-Abad Issyk-Ku Naryn Osh Talas

(b) Knowledge about vitamin A-rich foods.



(c) Knowledge about vitamin C-rich foods.

Osh

Naryn

Talas

(d) Knowledge about iron-rich foods.

Figure 9 presents oblast-level averages of children's nutrition practices, preferences, and knowledge. We observe strong differences across oblasts in terms of the number of interviewed children avoiding unhealthy snacks, ranging from extremely low shares in Batken and Naryn to close to 70% of children in Issyk-Kul (Fig. 9a). At the same time, however, Batken is the oblast with the highest share of children exhibiting healthy snack preferences, suggesting a discrepancy between preferences and practices (Fig. 9b). In many oblasts, a large share of children know that sweets are bad for their health (Fig. 9c) and have fairly healthy food preferences (Fig. 9d). In terms of food preferences, children in Batken and Osh oblasts display significantly less healthy food preferences than in other oblasts.



Figure 9: Children's nutrition practices, preferences and knowledge at the oblast level.

4. The linkages between nutrition and child health and education among Kyrgyz children (RQ2)

In this section, we present evidence on whether better child nutrition is associated with better health (H2-1), better child nutrition is associated with better intrapersonal foundations of learning beyond health (H2-2), better child nutrition is associated with better learning (H2-3).

4.1 Child health and learning

Table 4 presents results on an extensive list of child characteristics related to health and shortterm hunger in class, other intrapersonal foundations of learning, literacy and numeracy. Overall, major health issues seem to be relatively rare. The average child missed about one day of school in the month before the survey due to health reasons. In addition, we calculated an index measuring "short-term hunger in class", based on children's reports on eating breakfast at home and school meals during class. The index ranges from 0 to 6, where higher values indicate higher short-term hunger in class. The average value of 0.88 suggest that the large majority of all children in FFE schools are not hungry in class by now. In terms of cognitive and noncognitive functioning, we find very positive results from both objective and subjective measures. For example, most children did very well on tasks related to executive function, with a mean score of 11.4 on a scale from 0 to 14. As another example, we asked interviewers to rate how focused children were during some tasks, on a scale from 0 (not focused at all) to 10 (extremely focused). The average rating given by interviewers was 8.3, which means that a large proportion of the children were highly focused during the tasks. Taken together, these results suggest that grade 1 and 2 children in FFE program schools are generally in very good health and display very good other characteristics that determine learning outcomes, including hunger in class, cognitive function and noncognitive skills.

The bottom half of Table 4 contains statistics on three groups of educational variables: attendance rates, literacy measures and numeracy measures. In terms of attendance, children may not attend school for various other reasons than health issues, including economic reasons or help with family businesses, in which case hot meal programs can stimulate participation due to economic incentives. Yet, we find that **attendance rates among Kyrgyz children are very high**. For example, the average child missed 0.3 days of school in the last month for reasons not related to health. In fact, more than 81% percent of children did not miss any day of school in the previous month.

To determine literacy and numeracy capabilities among grade 1 and grade 2 children, we developed a range of bespoke tasks in close cooperation with Save the Children staff. It is worth noting that the primary focus here is not on the absolute level of outcomes, but rather on variation within the sample and the factors that induce variation, including the impacts of nutrition (RQ2) and the FFE program (RQ3).

	Mean	S.D.	Min.	Max.
Health and short-term hunger				
School absences due to health (last 30 days)	1.10	2.13	0	30
Any school absence due to health (last 30 days)	0.37	0.48	0	1
Estimated short-term hunger in class	0.88	1.12	0	6
Cognitive and noncogntive characteristics				
Executive function	11.43	2.88	0	14
Working memory	3.21	0.80	0	4
Inhibitory control	8.22	2.55	0	10
Grit	8.51	2.39	0	10
Focus	8.34	2.42	0	10
School attendance				
School days missed last 7 days	0.26	0.79	0	5
School days missed last 30 days	1.45	2.38	0	30
School days missed last 30 days (non-health related)	0.34	0.91	0	10
Literacy and numeracy: grade 1				
Grade 1: Words score (language of instruction)	13.55	7.16	0	20
Grade 1: Letters score (language of instruction)	0.82	0.23	0	1
Grade 1: full literacy score (standardized)	0.00	1.00	-2	1
Grade 1: full numeracy score (standardized)	-0.00	1.00	-4	1
Literacy and numeracy: grade 2				
Grade 2: reader status in Kyrgyz (yes/no)	0.90	0.30	0	1
Grade 2: reader status in Russian (yes/no)	0.72	0.45	0	1
Grade 2: can read Kyrgyz with comprehension (yes/no)	0.16	0.36	0	1
Grade 2: can read Russian with comprehension (yes/no)	0.40	0.49	0	1
Grade 2: fluency score in Kyrgyz	2.93	6.74	0	120
Grade 2: fluency score in Russian	3.50	8.59	0	138
Grade 2: accuracy score in Kyrgyz	0.11	0.17	0	1
Grade 2: accuracy score in Russian	0.13	0.19	0	1
Grade 2: full literacy score (standardized)	-0.00	1.00	-2	9
Grade 2: full numeracy score (standardized)	-0.00	1.00	-3	1
Ν	3035			

Table 4: Child health and learning.

Specifically, the absolute outcomes should not be compared to those reported in the Save the Children study on Kyrgyz grade 2 children, as these were surveyed much later in the academic year and slightly different measures were used. For relative comparisons within the sample we use standardized scores of literacy and numeracy, with zero mean and unit standard deviation.

Using our bespoke measures, we find that, on average, grade 1 children can identify about 82% of the letters of the alphabet in their language of instruction. Similarly, they recognize an average of close to 14 out of 20 words in that language. Second graders were asked to complete several tasks related to literacy in both Kyrgyz and Russian. Based on fluency assessments, we find that 90% of the children can be classified as a "reader" in Kyrgyz, and about 72% as a reader in Russian. At the same time, only about 16% can read Kyrgyz with comprehension, and about 40% can do so in Russian.⁴

4.2 Impact of unhealthy snacks on child health and learning

As we found earlier, relatively many children (66%) eat unhealthy snacks. In Table 5, we investigate the benefits of avoiding unhealthy snacks for our main health and learning outcomes. Our results suggest that those who do **not eat unhealthy snacks exhibit significantly better executive function**. In turn, we also see significantly **better literacy and numeracy scores among grade 2 children** who do not eat healthy snacks. Interestingly, we do not observe this link for grade 1 children. One explanation for this finding may be that executive function is more relevant for slightly older children.

⁴ These results should not be compared with the Save the Children Components of the USDA Food for Education Kyrgyzstan Baseline Report, due to strong differences in the sample and methodology. While both studies investigate grade 2 students, this study surveyed students much earlier in the academic year and used different instruments.

	Sample							
	Full	No unhealthy snack	Unhealthy snack	Diff	p			
Health and foundations of learning								
School absence due to health issue	0.35	0.38	0.34	0.04	0.10			
Estimated short-term hunger in class	0.85	0.86	0.84	0.02	0.77			
Executive function	11.84	12.22	11.63	0.59*	**0.00			
Focus	8.57	8.68	8.51	0.17	0.15			
Learning								
Grade 1: full literacy score (standardized)	0.01	0.03	-0.01	0.04	0.46			
Grade 1: full numeracy score (standardized)	-0.00	0.03	-0.01	0.04	0.47			
Grade 2: full literacy score (standardized)	0.00	0.11	-0.06	0.17*	**0.00			
Grade 2: full numeracy score (standardized)	0.00	0.08	-0.04	0.12*	* 0.02			

 Table 5: Impacts of snacking on child health and learning (grade 2)

Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

4.3 Impact of vitamin A-rich nutrition at home on child health and learning

To assess the impacts of nutrition at home on child health and learning outcomes, we study the correlations between all outcomes from Table 5 with the extent of vitamin A-rich food groups in the household diet. The plots in Figure 10 show how the mean outcome varies with the number of food groups. The curves clearly show that **more vitamin A-rich food groups are clearly associated with better health** (Fig. 10a), **less short-term hunger** (Fig. 10b), and **better executive function** (Fig. 10c).

In Appendix 3, we present similar analyses for food groups rich in iron and vitamin C and also find positive associations. We document particularly positive links between iron-rich food and better health and less short-term hunger (Figure A1); and between vitamin C intake and executive function and focus (Figure A3).



Figure 10: Vitamin A at home and health/other foundations of learning.

Figure 11 displays the relationships with literacy and numeracy outcomes. The graphs demonstrate a clear association of **household diets richer in vitamin A are associated with better literacy and numeracy** among grade 1 students, and also strong numeracy benefits for grade 2 students, which increase by as much as .6 standard deviations when moving across the x-axis.

In Appendix 3, we discuss similar analyses for iron and vitamin C consumption. Overall, literacy and numeracy outcomes vary very modestly with the amount of iron consumed, but there is a clear positive correlation with numeracy outcomes among grade 2 students (Fig. A2). Figure A4 reveals that vitamin C rich diets are strongly linked with better numeracy outcomes for both grade 1 and grade 2 students, and for grade 1 students also with literacy skills.



Figure 11: Vitamin A at home and learning outcomes.

5. Impacts of the FFE program (RQ3)

5.1 The impact of the FFE program on nutrition

In this section we present evidence on FFE program impacts on child nutrition (H3-1), nutrition at home (H3-2). child learning (H3-3), and intrapersonal foundations of learning (H3-4).

			Sample		
	Full	FFE	No FFE	Diff	р
Nutrition: child level					
Did not eat unhealthy snack	0.36	0.40	0.32	0.07**	**0.00
Food preference score	0.03	-0.00	0.07	-0.07	0.72
Has healthy food preferences	0.52	0.51	0.53	-0.02	0.40
Knows that sweets are not good for health	0.75	0.78	0.72	0.06**	* 0.01
Nutrition at home					
Household dietary diversity	8.20	8.39	8.02	0.37**	**0.00
Number of vitamin A-rich food groups	2.42	2.58	2.26	0.33**	**0.00
Good knowledge about vitamin A-rich foods	0.60	0.60	0.60	-0.01	0.84
Caregiver's food preference score	2.32	2.38	2.27	0.10	0.54
Health and foundations of learning					
School absence due to health issue	0.35	0.37	0.34	0.03	0.25
Estimated short-term hunger in class	0.85	0.85	0.84	0.01	0.83
Executive function	11.84	12.07	11.61	0.47**	**0.00
Focus	8.57	8.65	8.49	0.16	0.17
School days missed last 30 days (non-health related)	0.34	0.36	0.32	0.04	0.41
Learning					
Grade 2: full literacy score (standardized)	0.00	-0.00	0.01	-0.01	0.81
Grade 2: full numeracy score (standardized)	0.00	0.14	-0.13	0.26**	**0.00

Table 6: Impacts of one year of the FFE program (among grade 2 students).

Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

In the upper half of Table 6, we discuss impacts of one year of the FFE program on nutrition. We compare outcomes of grade 2 children who spent their first year of primary school in an FFE environment to those who did not (in schools where the program just started at the time of the

survey). We find strong and positive relationships of the FFE program with several nutrition outcomes.

First, we find that children in 2018 schools are significantly less likely to eat unhealthy snacks (40% versus 32%) and they have better knowledge about the negative impacts of eating sweets (78% versus 72%).

Second, our findings suggest that the FFE program is associated with healthier diets at home. In FFE contexts, households prepare significantly more diverse meals at home with a mean Household Dietary Diversity Score (HDDS) of 8.39 food groups, compared to 8.02 among other households. Specifically, this also includes a noticeable difference in the use of vitamin A-rich food groups: 2.58 versus 2.26 food groups, which is equivalent to a 14% difference. This finding is particularly encouraging in light of the strong benefits of vitamin-A rich diets documented in Section 4. Relatedly, Table A1 in Appendix 3 further suggests that the program is also associated with consuming more food groups that are rich in iron and vitamin C.

By contrast, our results suggest no statistically noticeable differences in children's and caregivers' food preferences as well as caregivers' knowledge of vitamin-A rich food groups. Table A1 reveals not differences in knowledge about iron either, and slightly higher knowledge about vitamin C.

Taken together, these results suggest that the FFE primarily led to **improved nutritional** *practices* at home.

The second wave of qualitative research confirmed that caregivers are open to partial changes in their home diet and the practices used for preparing dishes. When children explicitly ask that a meal they were served at school be prepared at home, caregivers are open and ready to fulfilling the wish. Even those households that make no adjustments to the regular diets at home revealed a willingness to change the way of preparing these meals, such as by using less oil or not frying dishes.

5.2 The impact of the FFE program on child health and learning

The bottom half of Table 6 shows results on impacts of the FFE program on learning, health and other factors that support learning. We find no significant differences in health, the short-term hunger score, the ability to focus and attendance (beyond health-related absences). This is not surprising in light of the fact that the overall levels of these outcomes are generally very high/positive (see Section 3). That is, most are in relatively good health, the ability to focus and attendance rates are mostly high, and the issue of short-term hunger does not appear to be widespread among the children in the sample.

Yet, the results document strong differences in two specific domains. First, we observe a large difference in grade 2 **numeracy**, which are close to .3 standard deviations higher among student in 2018 schools. By contrast, we see no differences in literacy scores. Second, our results show a significantly higher level of **executive function** among students in 2018 schools (12.1 versus 11.6), which might be driving the observed differences in numeracy.

Taken together, these results demonstrate that the FFE program still plays a central and critical role in fostering learning, even as the conditions of health and other intrapersonal factors related to educational outcomes are generally quite good among all children. In addition, our results suggest that purely economic impact channels are less relevant than nutritional channels. The specific Kyrgyz context, which is, in a very positive and encouraging sense, characterised by generally high rates of attendance and few non-health absences combined with very little variation due to the FFE program, suggests that economic incentives that may be created by the provision of school meals are relatively weaker than in contexts where such favourable background is not given. The second wave of qualitative research substantiated the conclusion that nutritional channels are more relevant than economic channels. For example, we also found that that school children benefiting from the FEE program were depicted as more attentive and interested in class sessions, which caregivers attributed directly to better nutrition. This adds to the conclusion of strong program impacts on intrapersonal foundations of learning. Furthermore, the qualitative interviews also revealed that nutrition has become a topic of conversation among children and with their caregivers at home, emphasizing that nutrition is indeed impacted in many positive ways and dimensions by the program.

5.3 Impacts among grade 1 students and causal interpretation of effects

The results reported in this section suggest several strong and positive effects of the FFE program on nutrition and learning outcomes. Whether these impacts can be causally attributed to the being a student in the FFE program is not straightforward, however.

As first step towards understanding the causal net effect and impact channels, we repeat the analysis among grade 2 students with grade 1 students. Grade 1 students are an interesting comparison group because they just started primary school when the baseline survey was conducted. That means that not just those from 2019 FFE schools have not been active beneficiaries of hot meals, but those from 2018 FFE schools have not been either (because they just started primary school and did not receive hot meals).

Overall, we find **significantly better outcomes among grade 1 students in 2018 schools**, too, as compared to those in 2019 schools. As shown in Table 7 the patterns are strikingly similar to the ones we observed among grade 2 students.

Similar to the results for grade 2 students, we find strong difference in nutrition outcomes that are concentrated in **practices**, rather than in knowledge and preferences.⁵ As before, we observe significantly more diverse and vitamin-A rich diets among households of students in 2018 schools, which are also slightly less likely to eat unhealthy snacks (a marginally significant difference). In addition, we also see similar differences in outcomes related to learning. Again, **executive function**

⁵ This finding is further corroborated by the results on iron and vitamin C reported in Table A2 in the appendix. There, we also find benefits for grade 1 students that are very similar to those for grade 2 students and concentrated in nutrition practices.

is substantially higher among students of 2018 schools, as are **numeracy** skills (and literacy skills in this case, too).

			Sample		
	Full	FFE	No FFE	Diff	р
Nutrition: child level					
Did not eat unhealthy snack	0.33	0.35	0.31	0.04*	0.07
Food preference score	-0.23	-0.28	-0.18	-0.10	0.64
Has healthy food preferences	0.48	0.47	0.48	-0.01	0.61
Knows that sweets are not good for health	0.70	0.73	0.66	0.07**	*0.00
Nutrition at home					
Household dietary diversity	8.16	8.32	8.00	0.32**	*0.00
Number of vitamin A-rich food groups	2.41	2.54	2.28	0.26**	*0.00
Good knowledge about vitamin A-rich foods	0.61	0.60	0.63	-0.03	0.27
Caregiver's food preference score	2.38	2.46	2.30	0.16	0.37
Health and foundations of learning					
School absence due to health issue	0.39	0.38	0.41	-0.03	0.22
Estimated short-term hunger in class	0.91	0.89	0.92	-0.03	0.60
Executive function	11.06	11.27	10.84	0.43**	*0.01
Focus	8.12	8.17	8.07	0.10	0.45
School days missed last 30 days (non-health related)	0.34	0.33	0.35	-0.02	0.69
Learning					
Grade 1: full literacy score (standardized)	0.01	0.06	-0.05	0.11**	0.03
Grade 1: full numeracy score (standardized)	-0.00	0.05	-0.05	0.09*	0.07

 Table 7: Impacts on grade 1 students in FFE program schools.

Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

A **potential explanation** points to positive spillover effects in FFE communities, which would be uplifting result from a programming perspective, as it would suggest that the FFE program can also benefit children who are not direct beneficiaries, i.e. who did *not* receive hot meals in the past year. These spillover effects could be driven by SBC components offered in the community, but also by the core program component, the provision of hot meals, as knowing and learning about them may also affect parents' behaviours (and thus child nutrition and learning), even if their child is not a direct beneficiary.

Yet, we cannot definitively rule out the possibility that children, households, and/or communities differ structurally across 2018 and 2019 FFE schools. While the baseline study was designed in a way that maximizes learning about program impacts to the extent possible, this cannot be assessed based on the baseline data.

These results have two implications. First, both explanations emphasize the importance of a welldesigned endline survey to achieve a **causal interpretation** of our main parameter of interest, the net program effect on grade 2 students. The endline survey will facilitate impact analyses based on comparisons of grade 2 students in the 2019 schools now (in the fall of 2019) and grade students in the fall of 2020 (which are the grade 1 students in the current baseline sample). Such analyses eliminate both issues complicating causal inference based on the baseline data. On the one hand, the comparison group has not been exposed to the FFE program "passively", and both groups are from the same schools and community. As any impact analysis, such evaluations will also rest on certain assumptions. But together with the initial insights from this baseline study, the endline impact evaluation will provide a very compelling set of evidence of causal impacts of the FFE program and will thus be an important source of novel research and learning.

Second, the results also raise the question of the **underlying mechanisms** creating the differences we see among grade 2 students. In particular, the findings suggest looking beyond oft-discussed program impact channels that operate at the school, such as increased in school participation due to economic motives and immediate nutritional pathways due to the intake of school meals. Rather, they highlight the potential relevance of pathways primarily operating at home. This especially includes impacts of the FFE program on caregivers based on social and behaviour change, which may result in downstream benefits on child nutrition, health and learning, as well as the impacts of dedicated SBC communication components in addition to the provision of school meals.

5.4 Social impact pathways

In this section we provide further insights into social impact pathways that may flow from the FFE program to nutrition and learning outcomes, drawing on both qualitative and quantitative research. In so doing, we provide evidence to test if the FFE program improves the social environment at home (H3-5); if the FFE program improves the factors conducive to learning outside the home (H3-6); and if FFE school meals combined with SBC communication on health and nutrition have larger impacts on nutrition, health and education than the school meals alone (H3-7).

Impacts on social relations inside the household

As shown in Table 8, the quantitative analysis only shows very little evidence for program impacts on the home environment. We observe no discernible differences across a range of indicators of social behaviours by caregivers or other household members that may support learning and of caregivers' subjective well-being and perceived stress. We actually observe that after one year of FFE, caregivers spend slightly *more* time preparing meals at home. One potential explanation for this result is that the provision of hot meals at schools does not change the amount of food prepared at home or the effort required. Rather, the nutritional channels affecting caregivers' practices at home may underpin the observed increase in time spent cooking. Our qualitative research provides a contrasting and slightly more nuanced picture from the perspective of social impacts at home. The interview suggests that the FEE program, in fact *can* meaningfully contribute to family well-being and to reduce social tensions inside households. Observed emotional impacts included parents reporting less conflicts with their children now, because children receiving a hot meal at school reduced pressure on *children*, in terms of having to eat enough for breakfast at home. Furthermore, certain caregivers did report to be calmer now while being at home or work, knowing that their children will be provided with proper meals (as compared to the previous school meal composed of tea and a bun).

			Sample		
	Full	FFE	No FFE	Diff	р
Children's books bought	2.98	3.06	2.91	0.14	0.42
At home: school books	0.98	0.99	0.98	0.00	0.70
At home: storybooks	0.72	0.76	0.69	0.07***	0.00
At home: gets read stories from books	0.56	0.57	0.55	0.02	0.55
At home: gets told stories	0.51	0.53	0.49	0.04	0.15
At home: gets help with studies	0.92	0.93	0.91	0.01	0.29
Satisfaction: life (overall)	7.66	7.68	7.64	0.04	0.74
Satisfaction: family life	8.54	8.53	8.56	-0.03	0.80
Worries: feeding child breakfast	0.46	0.47	0.45	0.02	0.76
Worries: feeding child lunch	0.86	0.90	0.82	0.07	0.57
Time spent on preparing meals	1.53	1.60	1.45	0.14***	0.00

 Table 8: FFE program impacts on home environment

Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

In addition, the FEE program's reading component could be identified to have an impact on local households during the time when caregivers and children jointly prepare for events at school, such as festivals or competitions. Caregivers and children described this period of working together on a project and towards a goal as a period when they felt closer to one another and were proud of each other. These positive impacts should be investigated further based on more detailed quantitative endline data. Using baseline data only, the program's impact on the daily reading behaviour at home remains unclear, as this appears to be rather influenced by individual constellations among caregivers such as their education, profession or interest in reading.

The qualitative interviews also revealed that the FEE program can, in fact, ease economic stress on households. Many caregivers reported that, before the program started, they provided one

child with an average of about 10-20 Soms per day to purchase food items in addition to the previous school meal of tea and a bun (which the children predominantly spent on unhealthy snacks). In particular the second wave of qualitative fieldwork showed that almost all caregivers whose children participate in the FEE program now stopped handing out this additional money to their children. Furthermore, they reported that children would not ask for these amounts anymore. This impact on household budgets must be considered even higher for those families whose children presently study in the morning shift, i.e. are provided with a hot meal between 10am and 11am, because they can reduce expenses for breakfast as well as for lunch. In contrast, those households whose children receive a hot meal in the afternoon, some as late as 3pm, still must provide breakfast and lunch at home. Again, these contrasting narratives emerging from quantitative and qualitative data provide a road map for where future endline data collection could help advance our understanding of the social, intra-household impacts of the program, which is an innovative study topic.

Impacts on social relationships outside the household

The statistics reported in Table 9 suggest that FFE impacts on social relationships outside the home are very modest. We observe few differences across a large array of indicators of engagement and satisfaction with the local school and community, pro-social behaviours of various kinds, and prosocial attitudes. All differences are fairly small in magnitude and we detect no highly significant differences.

This observation is echoed by the second wave of qualitative fieldwork. The conducted interviews confirmed that the FEE program's impact on changing social relations outside the household and in the larger communities is rather low. The WhatsApp-groups set up for each class in many communities reflect existing social relations, such as those among neighbours, rather than they would expand them, i.e. towards establishing new ties with other households. Therefore, the WhatsApp-groups could be primarily identified as a new channel for communicating general topics associated with school life, among which nutrition and reading were not mentioned as the most significant ones.

Similarly, the events associated with the FEE program's reading component reflect community activity rather than they would contribute to increase the households' involvement lastingly. In passive communities the events attracted rather few participants, whereas in active communities higher numbers were reported. As a minor point, the second wave of qualitative research interestingly revealed that Uzbek communities were particularly active in this regard, and that much about the level of community involvement appears to be associated with the leadership skills and commitment of school directors.

	Sample				
	Full	FFE	No FFE	Diff	р
School contact: perceived integration	2.12	2.12	2.12	-0.00	0.90
Books borrowed	1.39	1.48	1.30	0.19	0.49
Satisfaction: relationship with other caregivers	7.79	7.82	7.77	0.05	0.76
Satisfaction: relationship with school staff	8.62	8.61	8.64	-0.03	0.79
Satisfaction: quality of education	8.42	8.51	8.32	0.19	0.15
Satisfaction: quality of meals	8.44	8.58	8.30	0.28*	0.08
Non-financial support given to others	5.93	6.13	5.73	0.40	0.48
Non-financial support received from others	4.81	5.21	4.40	0.81	0.15
WhatsApp group: yes/no	1.00	1.00	1.00	0.00	
WhatsApp topical group: yes/no	0.22	0.25	0.20	0.05*	0.05
Cooperation	7.63	7.62	7.65	-0.03	0.84
Willingness to help in this community	7.72	7.77	7.67	0.10	0.49
Trust in this community	6.37	6.51	6.23	0.28*	0.10
Best intentions	7.74	7.70	7.78	-0.08	0.59
Altruism	8.68	8.72	8.64	0.08	0.50
Positive reciprocity	9.57	9.60	9.55	0.05	0.49
Negative reciprocity	8.28	8.23	8.32	-0.09	0.56

Table 9: FFE program impacts on relations with school and neighbors.

Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

The role of SBC program components

In Table 10, we compare outcomes among FFE 2018 grade 2 students across contexts with and without SBC components implemented.⁶ While many mean differences between households reporting SBC participation and those who did not are relatively small, the results suggest that SBC may underpin the strong impacts on nutrition practices among caregivers we observed for the overall program impacts. Most importantly, diets are significantly more diverse when caregivers participate in SBC trainings compared to when they don't. Thus, the SBC component seems to be a fundamental driver of shifts in practices induced by the FFE program.

⁶ Table A3 in Appendix 3 presents detailed, additional results on iron and vitamin C indicators.

The second wave of qualitative research also teased out differences between SBC- and non-SBC communities. Caregivers in SBC communities demonstrated to have gained new knowledge about

			Sample		
	Full	SBC	No SBC	Diff	р
Nutrition: child level					
Did not eat unhealthy snack	0.40	0.38	0.40	-0.02	0.70
Food preference score	-0.00	0.58	-0.25	0.83**	*0.01
Has healthy food preferences	0.51	0.54	0.49	0.04	0.28
Knows that sweets are not good for health	0.78	0.82	0.77	0.05	0.11
Nutrition at home					
Household dietary diversity	8.39	8.56	8.31	0.25**	0.02
Number of vitamin A-rich food groups	2.58	2.67	2.55	0.12	0.25
Caregiver knows vitamin A-rich foods	0.60	0.59	0.60	-0.00	0.93
Caregiver's food preference score	2.38	2.69	2.24	0.45*	0.08
Health and foundations of learning					
School absence due to health issue	0.37	0.42	0.35	0.07*	0.06
Estimated short-term hunger in class	0.85	0.77	0.89	-0.12	0.16
Executive function	12.07	12.07	12.08	-0.00	0.98
Focus	8.65	8.79	8.59	0.21	0.22
School days missed last 30 days (non-health related)	0.36	0.30	0.39	-0.09	0.27
Learning					
Grade 2: full literacy score (standardized)	-0.00	0.04	-0.02	0.06	0.40
Grade 2: full numeracy score (standardized)	0.14	0.23	0.10	0.14*	0.08

Table 10: Additional impacts of SBC components.

Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

nutrition, to be generally interested in this topic and to communicate with others about it. Still relatively few households revealed a willingness to utilize this knowledge and adjust their dietary (or reading) patterns at home. In contrast, caregivers in non-SBC communities showed great difficulties to imagine in which ways new knowledge on nutrition could contribute positively to their (children's) lives, or which training measures more generally they would consider necessary within their communities.

6. Conclusions

This baseline report provides interesting answers to the three research questions asked, based on the caveat that no endline data has been collected yet.

RQ1: What is the status of nutrition in Kyrgyz households with primary grade children?

Our analysis suggests that many children exhibit good nutrition knowledge and healthy food preferences, but also tend to eat unhealthy snacks. While some caregivers have limited nutrition knowledge, many have healthy food preferences and prepare well diverse diets at home.

RQ2: What is the impact of nutrition on child health and education among Kyrgyz children?

Many Kyrgyz children display very good "intrapersonal characteristics" that determine learning outcomes, such as good health, low short-term hunger in class, high cognitive function and strong noncognitive skills. At the same time, we find that healthy and diverse nutrition plays a key role and has strong benefits for learning. For example, it is associated with better executive function, literacy and numeracy, especially among grade 2 students.

RQ3: What is the impact of the FFE program on nutrition as well as on health and education among Kyrgyz children?

Our initial impact analysis based on children who just started grade 2 suggests that the FFE program has a critical role for improving nutrition and fostering learning. Specifically, we document that one year of the FFE program led to significantly improved nutritional practices at home. In turn, we observe large gains in terms of learning due to strong FFE impacts on executive function and numeracy in particular.

At the same time, we are unable to establish a causal interpretation of these effects based on the baseline data alone. Specifically, we observe similar gains in nutrition and learning among grade 1 children who were not direct beneficiaries of the program in the 12 months before the survey, i.e. who did *not* receive hot meal. This may be due to positive spill over effects in FFE communities to non-beneficiaries, which would be an amazing result from a programming and donor perspective. Yet, we cannot definitively rule out the possibility that children, households, and/or communities differ structurally across 2018 and 2019 FFE schools, and that the observed differences between second graders are (also) due to "selection" and not (just) true program impacts.

Appendix 1: Detailed overview of key study measures

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Measures	Variables
Grade 1 literacy	Letter identification in language of instruction Word recognition in language of instruction
Grade 2 literacy	Reader status in Kyrgyz Oral reading fluency in Kyrgyz Oral reading accuracy in Kyrgyz Reading comprehension in Kyrgyz Reader status in Russian Oral reading fluency in Russian Oral reading accuracy in Russian Reading comprehension in Russian
Grade 1 numeracy	Performance in number task 1 (grade 1) Performance in number task 2 (grade 1) Performance in number task 3 (grade 1)
Grade 2 numeracy	Performance in number task 1 (grade 2) Performance in number task 2 (grade 2) Performance in number task 3 (grade 2)

Intrapersonal foundations of learning

Measures	Variables
Child health and short-term hunger	Health-related absences from school
in class	Food intake before and during school
	Short-term hunger in school
Cognitive skills	Executive function
	Working memory
	Inhibitory control
Non-cognitive skills	Grit
	Focus
School participation	Absences from school
	Absences from school not related to health issues

Child nutrition

Measures	Variables
Practices	Breakfast before school Snack buying
	Consumption of healthy snacks Consumption of unhealthy snacks
Preferences and knowledge	Food preferences Snack preferences Nutrition knowledge (sweets)

Household nutrition and other behaviours at home

Measures	Variables
Dietary diversity at home	HDDS MDD-W MDD-IYCF Micronutrient intake: Vitamin A
Primary caregiver's	Food preferences Nutrition knowledge (vitamin A)

FFE program

Measures	Variables
Child	Hot meals offered at child's school Child eats and finishes hot meals at school
Caregiver SBC nutrition, hygiene and sanitation	Activities offered in primary caregivers' community Participation of primary caregiver in activities Primary caregivers' perceptions of activities Exposure to TV spots

Appendix 2: Technical report on data collection provided by Erfolg Consult

Scope of work

Within the part of the terms of reference, Erfolg Consult conducted the following scope of work:

- 1. Piloting of tool and providing the commentaries;
- 2. Programming the tool;
- 3. Preoperational stage for field stage;
- 4. Organizing and conducting of field stage;
- 5. Processing and provision of data;
- 6. Preparation and submission of a technical report on the results of the field stage.

Methodology

Goal: - to assess the nutritional outcomes of the school meals interventions in Kyrgyzstan and to conduct a baseline research as a part of a wider impact evaluation research.

Geography of study: 7 oblasts of Kyrgyz Republic.

Sample size: 154 schools/3035 respondents.

Target audience:

- Students of 1-2 grades
- Parents or guardians

Preparations for the field stage: Training and piloting

Before starting collecting information, training was conducted in two stages. After the training, the pilot of instrument was conducted in one of the villages of the Chui region. Were surveyed 10 respondents. For piloting were involved three experienced interviewers. Based on the results of the pilot survey, necessary comments to the questionnaire were suggested within the pilot report.

After finalizing the tool was organized the training for 6 days in

- - 3 days in Bishkek, where were invited interviewers of north regions.
- - 3 days in Osh was held gathering interviewers of south regions.

Trainings were conducted with participation of Customer. Two days of training covered the theoretical work, where the questionnaire for the child, for parents, cards / tasks for children and other Project documents were disassembled in detail. <u>1 day</u> of training was devoted to piloting of instrument at schools, where parents and primary school students were invited. After receiving the comment to instrument all changes were implemented and began preparational work for data collecting.

Field stage

Was implemented quantitative approach, face-to-face interview method using tablets (CAPI). Initially, 150 schools were selected by the Customer; during the field stage, some schools were replaced. The number of replaced schools is 26. The main reason was that schools did not provide students list. It was intended to cover 20 students of grades 1-2 at each school. 5 girls and 5 boys from each grade, but, in view of the fact that not all schools had a sufficient number of students, decided to cover an additional 4 schools: by N. Bakirova, Berdibekova, T. Omuralieva, B. Beishenalieva. Thus, additionally were surveyed 80 respondents from mentioned schools.

Thus, sample size of school was 154. From this:

- 77 schools from this 2018th cohorts
- 77 schools from this 2019th cohorts

	Oblasts	School number	Respondent number
1	Batken region	10	218
2	Jalal-Abad region	36	799
3	Issyk-Kul region	8	157
4	Naryn region	8	194
5	Osh region	36	571
6	Talas region	4	78
7	Chuy region	52	1018
ТО	TAL	154	3035

Table 1

A total number of respondents <u>3035</u> as it shown in the table, the number of respondents on gender and grade distribution as follows:

- 1-grade girls -747
- 1-grade boys-760
- 2-grade girls -764
- 2-grade boys 764

The sample was developed and provided by the Customer. After receiving the sample, supervisors contacted the appointed persons for the further appointment of survey. The interview took place mainly at schools. Program activists and school representatives assisted in the collection of respondents. Activists invited the parents or guardian of selected students to school to conduct a survey. The questionnaire consisted two parts for parents and for students. In addition to the main questions, the student questionnaire also contained assignments in mathematics and reading in accordance with their grades. Specially were prepared Cards for tasks and games with students.

The average duration of the survey is from 50 minutes - 1.30 hours.

For conducting the field stage were involved the next number supervisor and interviewers:

Table	2
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#	Oblast	Number of interviewers	Number of supervisors
1	Chuy oblast	9	1
2	Talas oblast	1	1
3	lssyk-kul oblast	2	1
4	Naryn oblast	1	1
5	Osh oblast	7	1
6	Jalalabad oblast	9	1
7	Batken oblast	2	1
TO	TAL	31	7

Control covered the **30%** of interviews to verify participation in the survey and the content of some responses. Back checks done by phone by head office of the Erfolg Consult. Was paid attention to questionnaires according to following indicators:

- Survey duration;
- Inconsistency of answers;
- Inaccurate answers, etc.

All necessary data was collected by phone call and corrected in the database.

38 questionnaires were not accepted, because of the next reason:

- Interviewed wrong HH, not from the sample
- Duration of the interview is too short, there were some doubts in quality of interview.

During the field phase, the following difficulties were identified that limited the field process:

Weather conditions - the field phase fell in the winter, which complicated the work of interviewers. In addition, the sample included distant schools, were difficult to reach, not all villages have a stable transport route.

Inactivity of SBC activists-one of the main difficulties was the inactivity of activists. Not all schools managed to collect the required number of students, exactly, to invite parents of students from the sample. In this case had to turn to school administration to take the required number of respondents.

Wrong student list - some schools gave the wrong list of students, that is, the list contained and retired students.

Busyness- some schools couldn't invite parents, as surveys were conducted mainly on weekdays and the employment of parents became one of the reasons for the shortage of respondents in the required number.

Sensitive questions-financial issues embarrassed some parents, they seemed that these questions covered personal information, with such parents, worked additionally again explained the confidentiality of the survey.

Data collection timeline

Table 3 presents a summary of the timeline.

Table 3

#	Activities	Time period
1	Data collection piloting and the questionnaires revise	November 2019
2	Interviewer trainings and field work arrangements	November 2019
3	Field works	25- November 2019- 3 February
		2020
4	Providing of Data collection entry program and technical report	5 - 20 February 2020

Appendix 3: Additional results related to iron and vitamin C

Research question 2: The linkages between nutrition and child health and education



Figure A1: Iron at home and health/other foundations of learning.



Figure A2: Iron at home and learning outcomes.



Figure A3: Vitamin C at home and health/other foundations of learning.



Figure A4: Vitamin C at home and learning outcomes.

Research question 3: Impacts of the FFE program

			Sample		
	Full	FFE	No FFE	Diff	р
Dietary diversity at home					-
Number of iron-rich food groups (24h)	1.04	1.06	1.02	0.04*	0.08
Any iron-rich food (24h)	0.92	0.93	0.92	0.01	0.60
Number of vitamin C-rich food groups (24h)	2.10	2.18	2.02	0.16***	0.00
Any vitamin C-rich food (24h)	0.95	0.95	0.95	0.00	0.93
Caregiver					
Good knowledge about iron-rich foods	0.52	0.53	0.51	0.01	0.60
Good knowledge about vitamin C-rich foods	0.21	0.24	0.19	0.06***	0.01

Table A1: FFE program impacts on practices and knowledge (grade 2 students).

Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

 Table A2: Impacts on practices and knowledge among grade 1 students in FFE program schools.

			Sample		
	Full	FFE	No FFE	Diff	р
Dietary diversity at home					
Number of iron-rich food groups (24h)	1.03	1.06	1.00	0.06**	0.01
Any iron-rich food (24h)	0.92	0.93	0.91	0.02	0.12
Number of vitamin C-rich food groups (24h)	2.08	2.16	2.00	0.16***	0.00
Any vitamin C-rich food (24h)	0.95	0.96	0.94	0.02*	0.06
Caregiver					
Good knowledge about iron-rich foods	0.45	0.46	0.45	0.01	0.80
Good knowledge about vitamin C-rich foods	0.22	0.26	0.19	0.07***	0.00
Dietary diversity at home Number of iron-rich food groups (24h) Any iron-rich food (24h) Number of vitamin C-rich food groups (24h) Any vitamin C-rich food (24h) Caregiver Good knowledge about iron-rich foods Good knowledge about vitamin C-rich foods	Full 1.03 0.92 2.08 0.95 0.45 0.22	FFE 1.06 0.93 2.16 0.96 0.46 0.26	No FFE 1.00 0.91 2.00 0.94 0.45 0.19	Diff 0.06** 0.02 0.16*** 0.02* 0.01 0.07***	p 0.01 0.00 0.00 0.80 0.80

Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

			Sample		
	Full	SBC	No SBC	Diff	р
Dietary diversity at home					
Number of iron-rich food groups (24h)	1.06	1.09	1.05	0.04	0.33
Any iron-rich food (24h)	0.93	0.95	0.92	0.03	0.16
Number of vitamin C-rich food groups (24h)	2.18	2.28	2.14	0.14*	0.09
Any vitamin C-rich food (24h)	0.95	0.97	0.95	0.02	0.20
Caregiver					
Good knowledge about iron-rich foods	0.53	0.59	0.50	0.09**	0.03
Good knowledge about vitamin C-rich foods	0.24	0.25	0.24	0.01	0.86

 Table A3: Impacts of SBC components on practices and knowledge.

Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.