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Anemia, diet, and cognitive development: Impact of health information on diet quality and child nutrition in rural India

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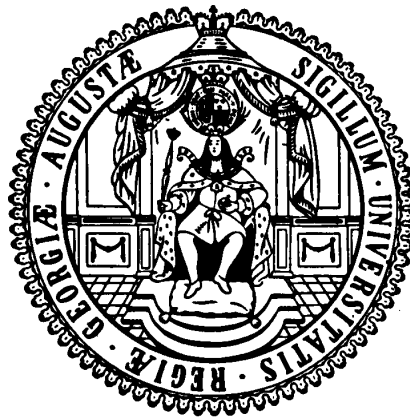
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Discussion Papers

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Impact of health information on diet quality and
child nutrition in rural India**

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Anemia, diet, and cognitive development: Impact of health information on diet quality and child nutrition in rural India

Marion Krämer¹, Santosh Kumar², Sebastian Vollmer³

Abstract

Lack of information about health risks may limit adoption of improved nutritional and healthy behavior. This paper studies the effect of nutrition information intervention on household dietary behavior, child health, and cognitive ability of children in rural India. Using experimental data and regression discontinuity design that exploits the exogenous cutoff of hemoglobin level for anemia, we find statistically insignificant treatment effects on dietary improvements, child health, and cognitive outcomes of children. Our findings suggest that nutrition information alone, even when parents are informed about the anemia status of their children, may not promote healthy behavior and factors other than information might constrain households in making nutritional investments for their children.

JEL codes: I12, I15, I18, O12

Keywords: Health information, Child health, Anemia, Cognition, Regression discontinuity, India.

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1. Introduction

Despite its importance as a determinant of human capital formation, childhood undernutrition - particularly micronutrient deficiencies (MND) - is still widespread in many low- and middle-income countries (LMICs).¹ Micronutrient deficiencies in childhood affect physical and cognitive health, resulting in less schooling and low productivity in adulthood (Strauss and Thomas, 1998; Alderman, Behrman, Lavy, and Menon, 2001; Alderman, Hoddinott, and Kinsey 2006; Glewwe, Jacoby, and King, 2001). Iron deficiency is the most common nutritional deficiency in children, resulting into anemia. Globally, iron-deficient anemia affects 42% of children under age five (WHO, 2016).

Several effective and inexpensive nutrition technologies, such as nutritional supplements, micronutrient-fortified products or bio-fortified seeds, are available to prevent MND; however, diffusion and adoption of these technologies have been limited in developing countries (Banerjee, Barnhardt, and Duflo, 2018). Adoption of these technologies, however, is very limited. Similarly, consuming a more diverse diet, an effective strategy to reduce MND, seems to be challenging to individuals despite significant potential health gains (Ogden et al., 2007; Oster, 2018). One reason for the limited adoption of health-promoting behavior could be that households are unaware of the MND risks and the potential solutions to reduce these risks. Lack of health information may limit the adoption of healthy behavior and improved dietary choices (Dupas, 2011a; Luo et al., 2012; Madajewicz et al., 2007).

This study examines the causal effect of an intervention that provided information about children's anemia status to the child's caretaker and simple ways to adjust the child's diet to reduce anemia in the state of Bihar, India. The intervention informed caretakers about the anemia status of their child and caretakers of anemic children were only encouraged to feed iron-rich food to the anemic children. We first investigate how this information intervention affects dietary practices and consumption of iron-rich foods. We subsequently examine whether the information intervention had any effects on children's health status - measured by the children's hemoglobin levels - as well as its impacts on the cognitive ability and educational outcomes of the children.

Our study setting is the state of Bihar, one of the poorest states with low human capital in India. Bihar is an important setting to explore this question as depending on age and gender, anemia in India ranges from 32% to 63% (NFHS-4, 2017). 48% of all children under age five in Bihar are stunted and 44% are underweight (NFHS-4, 2017).² Our study uses data from a

¹The most common types of MND are vitamin A deficiency, zinc deficiency, iron deficiency anemia, and iodine deficiency disorders.

²Per the 2015 Global Burden of Disease study, 10.6% of total years lived with disability were due to IDA in India.

randomized controlled trial conducted by the authors on the impacts of iron-fortified salt on anemia. In this experiment, grade two children were tested for anemia in 104 primary schools in Bihar. We use this data to roll-out another experiment related to nutrition information and anemia of the sampled children. Caretakers of anemic children (hemoglobin level ≤ 10.9 g/dl) were informed of their child's anemia status and were also given the advice to feed their child more iron-rich food items, namely green leafy vegetables and lean meats, if the household consumes meat. Non-anemic children (hemoglobin level ≥ 11.0 g/dl) were not exposed to any information intervention. We exploit the discontinuity in the information intervention based on hemoglobin level of 11.0g/dl and employ a regression discontinuity design (RDD) method to estimate the causal impacts of the information intervention on health, cognitive, and educational outcomes of the children. RDD addresses unobserved heterogeneity and omitted variable bias that might affect the knowledge of health risks and food dietary behavior.

Rigorous impact evaluation of health and nutrition information on health-related behavioral change is rare. Several empirical studies have found positive effects of information treatment on health-promoting behaviors such as water purification (Jalan and Somnathan, 2008; Madajewicz et al., 2007), reduction in risky sexual behavior (Thornton, 2008; Dupas, 2011b) and consumption of fewer calories by diabetes patients (Oster, 2018).³ These studies found that people respond to learning about their health risks and health-specific information.

In contrast to the role of information on general health risks discussed before, the literature on nutrition information in the context of anemia is less encouraging. Wong et al. (2014) find modest effects of educating parents about nutrition and anemia on children's hemoglobin levels in north-western China. In an experimental study conducted by Childs et al. (1997), existing doctor-parent contacts were used to convey information about breastfeeding and the link between iron and diet to parents of newborns in the UK; however, no effects were found on anemia after 18 months. Using a relatively small sample of about 250 newborns in Brazil, Bortolini and Vitolo (2012) found that systematic dietary home counseling had no effect on the prevalence of anemia, iron deficiency, or iron-deficient anemia.

While much of the literature relates to enhancing preventive healthcare, this study addresses the adoption of remedial behavior. In our treatment, the anemia status of a child is revealed by a diagnostic test. The hemoglobin testing makes the disorder explicit and the need for action immediate. In contrast, with preventive healthcare interventions, individuals believe

³Jalan and Somanathan (2008) found that households in a suburb of New Delhi improve water purification after learning about the contaminated drinking water. Thornton (2008) found that individuals reduce risky sexual behavior after learning about their HIV status in Malawi. Dupas (2011a) reported teenager girls practiced safer behavior after learning age-specific relative risk of HIV infection.

they will not be affected, hence, the need for preventive action might not be perceived as acute. Furthermore, individuals procrastinate preventive care if the required preventive actions are costly. There are only a few studies that link information on healthy behavior with revealing an individual's health status in the context of HIV (Thornton, 2008), malaria (Cohen et al., 2015) and diabetes (Oster, 2018). In a RCT, Luo et al. (2012) informed the parents of Chinese elementary school children about the anemia status of their child and present strategies in addressing their child's nutritional deficiency (eating balanced meals, including iron-rich products, counseling a doctor or taking iron supplements). The information was either conveyed by letter, by a single or by multiple face-to-face information session(s). The different information interventions did not have any impact on hemoglobin levels or anemia rates. We add to this literature by using a sample of rural Indian households and a very simple information intervention. An additional innovation of this study is not only the assessment of health and nutrition, but also of productive outcomes such as cognition and education. To our knowledge, this is also the first time that RDD was applied in the context of anemia and nutrition information.

Our main results confirm the findings in the previous literature that information alone is ineffective in changing nutrition-related behavior, even when combined with the revelation of a nutritional disorder of a child (Luo et al., 2012). The RDD estimates indicate that households who were informed that their child is anemic (treatment group) did not improve their dietary behavior and food consumption, particularly increased consumption of iron-rich food items. Consistent with insignificant effects on improvement in iron-rich diets, the information treatment effects on hemoglobin levels and cognitive outcomes are statistically insignificant and close to zero. Overall, our results indicate that informing parents how to mitigate anemia risk for their school-age children appears to have no effect in rural Bihar, India.

Our study contributes to a number of strands of literature. First, this study contributes to the limited literature on the effects of health information and dietary knowledge on household consumption behavior and nutrient intake in developing countries (Luo et al., 2012; Zhao et al., 2013; Shimokawa, 2013). The evidence is mixed. Luo et al. (2012) and Shimokawa (2013) find that being informed of the healthy diet and health status related to anemia and obesity, respectively, does not necessarily change dietary behavior. In contrast, Zhao et al. (2013) found that information on hypertension reduced fat intake in China.⁴ Second, this paper contributes to the literature on the effects of nutrition information on children's health (Wong et al., 2014;

⁴The effect of being informed of own health status on adoption of healthy behavior has been studied in the context of HIV (Thornton, 2008) and malaria (Cohen et al., 2015). The effects were positive in the HIV study, while no clear evidence emerged in the malaria study.

Fitzsimons et al., 2016). While Wong et al. (2014) show that providing nutrition information to parents in China had a modest impact on anemia, Fitzsimons et al. (2016) find positive impacts of nutrition information on physical growth of children in rural Malawi. Third, this study relates to the broader literature on the association between child health and cognitive ability of children in developing countries (Almond, Currie, and Duque, 2018). Our study departs from the previous literature by not only considering health and nutrition outcomes but also looking at productive outcomes such as cognition and education.

The remainder of the paper is structured as follows: in section 2, we describe the treatment, the dataset, and the methodological approach. In section 3, we present the empirical specification and we describe the results in section 4. In section 5, we present robustness checks and we discuss our findings and conclude in section 6.

2. Background, Intervention, and Data

2.1. Background

Anemia refers to a condition where the level of hemoglobin in the blood is low. Though anemia can have different causes,⁵ iron deficiency is the most common (WHO, 2001). Iron deficiency emerges from a diet that is low in iron or when iron cannot be properly absorbed from the diet (McLean et al., 2009). Anemia not only leads to low levels of physical activity (fatigue and loss of energy), but it also impairs cognitive development and work productivity. In economic terms, iron deficiency is considered to be the *costliest* micronutrient deficiency (Halterman et al., 2001; Bobonis et al., 2006). According to Horton and Ross (2003), who used data from 10 low-income countries, physical and cognitive impairment due to iron deficiency causes a median loss of 4.1% of a country's GDP. Globally, more than 20% of the world's population (about 1.62 billion people) are anemic (WHO, 2008).⁶ The low-income population is at a high-risk for iron deficiency due to a lack of dietary diversity. Moreover, their diet generally includes a large amount of rice and wheat, which inhibits the absorption of iron due to the high concentrations of phytate in these products, and the low consumption of meat from which iron can more easily be absorbed (FAO and WHO, 2002). In the Jehanabad district (state of Bihar, India), where our

⁵E.g. excessive bleeding, hookworm infections or malaria (WHO, 2001). Since all children in the data set used for the analysis are dewormed at school once a year, we are quite sure that most of the anemia observed in our study comes from iron deficiency.

⁶For the identification of an anemic individual (WHO, 2008), the authors used the age and gender specific WHO hemoglobin cutoffs of mild anemia. This is for children under 5 years: < 11.0 g/dl; children 6–11 years: < 11.5 g/dl; children 12–14 years: < 12.0 g/dl; adult males: < 13.0 g/dl; adult females (non-pregnant): < 12.0 g/dl; adult females (pregnant): < 11.0 g/dl.

study took place, the prevalence of anemia ranges from 26% for adult males to 63% for children below the age of 5 (NFHS-4, 2017).

2.2. Intervention

The analysis is based on data collected from a randomized controlled trial that evaluated the effect of the use of double fortified salt in school-lunch preparation on anemia and cognitive outcomes. The DFS intervention was done at the school level (for more details see Krämer, Kumar, and Vollmer, 2018). The study measured the hemoglobin level of second-grade children in the government funded rural primary schools. The testing was performed with an on-site hemoglobin measurement device directly in the village or at the children's homes. We exploit this existing study to implement an information treatment at the household level. All parents were informed about the anemia status of their children. The intervention in this study involved providing nutrition information to parents of the anemic children, while parents of non-anemic children received no information and thus formed the control group. Figure 2 shows the timeline of the treatment and the surveys. The hemoglobin thresholds applied are the official WHO cutoffs for moderate and severe anemia for children aged between 5 and 11 years (WHO, 2011). The following information was shared with the parents of the anemic children (treatment group):

$8 \geq \text{Hemoglobin level} \leq 10.9 \text{ g/dl}$ (moderate anemia): Parents were advised to provide more diverse diet for the child, especially the consumption of green leafy vegetables and meat if the household consumes meat (iron-rich food).

Hemoglobin level $< 8 \text{ g/dl}$ (severe anemia): In addition to the nutritional information, parents were advised to consult a doctor at the nearest health facility. If the hemoglobin level was below 6 g/dl, the interview team ensured that the child was quickly taken to the nearest health facility for medical advice.

Hemoglobin level $> 10.9 \text{ g/dl}$ (Non-anemic): No nutrition information, served as a control group.

We found very few observations (13 children, less than 1% of the sample) with a hemoglobin score below 8 g/dl and only one child with a hemoglobin score below 6 g/dl. That is why we limit the analysis to the information given for a hemoglobin value $\leq 10.9 \text{ g/dl}$.⁷

⁷For our main analysis, we include both the control and treatment groups of the RCT conducted by Krämer, Kumar, and Vollmer (2018), since we were expecting to lose too much power if we restrict our analysis to the

2.3. Data and variables

2.3.1. Data collection

From November 2014 until January 2015, a health survey, which included a diagnostic test for hemoglobin, was carried out among 2000 school-aged children in the two blocks (Modanganj and Kako of the district Jehanabad) within the Indian state of Bihar. The baseline prevalence of anemia among second-grade students was about 45%. From a list of 228 government-funded schools that exist in the two blocks, a simple random sample of 108 schools was drawn and on average, 20 children per school from the second grade were chosen for anemia testing. The sample is, therefore, representative of second-grade students in government-funded schools in the two blocks. We specifically sampled children from the second grade because they are at the beginning of a phase of rapid brain development, since the frontal lobes experience spurts of development between the ages of 7 and 9 (Anderson, 2002; Hudspeth and Pribram, 1990; Thatcher, 1991).

With the help of local enumerators and trained medical personnel, we collected socioeconomic information about the children and their households. The survey contains detailed information on feeding practices; socioeconomic and sociodemographic characteristics; access to health care; health insurance; class size; student-teacher ratio; and calories and iron content of the children's school lunches. Trained medical personnel measured hemoglobin level using blood samples collected through capillary blood at home.⁸ Additionally, children were administered cognitive and education tests at the school. After approximately two years of the intervention (August-October 2016), we conducted a follow-up survey to investigate the medium-term effects of the information treatment on health and cognitive outcomes. The follow-up sample of about 1,700 children constitutes our main analytical sample.

2.3.2 Outcome variables

The survey collected information on the child's food consumption using a food frequency table, reported by the child's care taker. Three different indicators for feeding practices were developed from this table. First, a dietary diversity score (DDS), which was calculated by summing up the number of food groups represented in the child's diet. Similar to Torheim et

control group alone. It might be the case that our estimates are downward biased due to the inclusion of the treatment group of the RCT. We therefore perform the analysis with the control group only in the appendix.

⁸Hemoglobin levels were assessed using an on-site hemoglobin measurement device called HemoCue® Hb 301 (AB Leo Diagnostics, Helsingborg, Sweden).

al. (2003) and Kennedy et al. (2010), and based on data availability, the following six food groups were included: (i) Legumes, (ii) fruits, (iii) vegetables/green leafy vegetables, (iv) eggs, (v) meat/poultry/fish, and (vi) milk/dairy products.⁹ If parents reported that their child consumes an item from one of these food groups at least several times per month, the food group was assigned the value of one. Values for all food groups were summed up, such that the DDS ranges from *zero* (no item from any food group is consumed) to *six* (at least one item from each food group is consumed). FAO (2007) reviews studies that show that DDSs are valid indicators for the adequacy of micronutrient (and macronutrient) intake. Since the hemoglobin level was always measured and the nutrition information was always given after the parents were interviewed for their feeding practices, the possibility that the feeding practices were reported biasedly is minimized. Second, feeding practices are measured by the frequency of the consumption of food items that are available in the study region and that are supposed to contain a relatively high level of iron. These food items are green leafy vegetables (one indicator) and meat (second indicator). We create categorical variables for the frequency of the consumption of these two food groups that range from 1 (*the child never consumes an item from this food group or less than once per month*) to 5 (*the child consumes an item from this food group daily*).

Cognitive ability was measured by five different cognitive tests (forward digit-span, backward digit-span, block design, Stroop-like day-and-night test, and progressive matrices). *Education outcomes* were assessed by math and reading test scores as well as the child's school attendance. Reading skills were tested on a scale from 0 to 4, ranging from a *child does not recognize letters* to *child fluently reads a short story*. For the reading assessment, the materials from the Annual Status of Education Report (ASER, 2014), developed by the Indian non-governmental Organization *Pratham*, were used. For the math assessment, the material from ASER (2014) was used as the basis, but extended to 13 different exercises at the baseline and 15 at the endline, ranging from a *child does not recognize one-digit numbers* to *child is able to solve advanced division problems*. For a detailed description of the cognitive as well as math and reading tests, please refer to Krämer, Kumar, and Vollmer (2018). Finally, the school attendance of the child for the year before the follow-up survey was recorded from the official school attendance register.

We standardized the test scores by subtracting the mean from the score at the baseline and dividing by the standard deviation at the baseline for the whole sample for each test. Hence, a standardized cognition score of 0.5 would mean that the student scored 0.5 standard deviations higher than the mean in 2014.

⁹There exists no international consent on which food groups should be included in a DDS and how these food groups are defined (FAO, 2007).

2.3.2. Sample description

Table 1 presents the baseline summary of the key characteristics of the sample. The average DDS score and the blood hemoglobin level are 3.9 and 11.03 g/dl, respectively. The cognitive outcomes and test scores are low; for example, the average math score is 4.3 on a scale of 0 to 13, whereas the reading test score is 0.74 on a scale of 0 to 4. Similarly, the block design score and digit forward span score are less than 4. Most children are Hindu in rural areas (98%). Approximately 32 % of the sampled children belong to socially disadvantaged caste groups- Scheduled Caste (SC) or Scheduled Tribe (ST). The average family size is close to 8 members and 43% of the children are female. Coverage by health insurance (38%) and the rate of institutional births (34%) are low compared to the national average. Less than 10% of the household have access to an improved source of sanitation. For school-level variables, the average enrollment rate is about 258 children and on average a typical class has 34 students.

3. Empirical Framework

3.1. The regression discontinuity design (RDD)

The study uses a regression discontinuity design to estimate the causal impacts of the information intervention on dietary behavior, hemoglobin level, cognition, and educational outcomes of children by comparing children who are just below and above the 11.0 g/dl cutoff.

The anemia status is a deterministic function of hemoglobin level, as children are categorized as anemic if the hemoglobin level is less than 11.0g/dl and children with an hemoglobin level of at least 11.0g/dl are non-anemic. Around the thresholds, the assignment to the intervention is as good as random, since the stochastic error component is continuously distributed over the baseline hemoglobin variable, i.e. the forcing variable. Individuals close to the threshold only differ in treatment status but not in other characteristics.

We use pooled normalized local linear regression (LLR) estimation approach with triangular kernel weights (Lee and Lemieux, 2010). The normalized pooled regression function is as follows¹⁰

¹⁰In a local linear regression, a straight line is fitted to the data within a predefined window with bandwidth h (i.e. locally) around the cutoff point. The choice of the window width $-h$ is described below. The treatment effect is modeled by a jump in the function at the cutoff point. We allow the regression function to differ at both sides of the cutoff by including an interaction term between X , the forcing variable, and D , the treatment dummy, but estimate both regression lines simultaneously, i.e. pooled. For convenience in the interpretation, we subtract the values of the forcing variable from the value of the cutoff point $-c$ (i.e. we normalize the forcing variable), thereby the treatment dummy, D , yields the treatment effect. We impose a triangular kernel, which gives more weight to the observations close to the cutoff.

$$\Delta Y_i = \alpha_i + \tau D_i + \beta_1(X_i - c) + \beta_2 D_i(X_i - c) + \varepsilon_i \quad \text{where } c - h \leq X \leq c + h \quad (1).$$

ΔY represents the change from 2014 to 2016 of the different outcome variables (diet, hemoglobin, cognitive ability, and education outcomes). We use the change in the outcome to control for the initial level of the outcome variable and to increase the precision of our estimates. α_i is the intercept of the function on the right side of the cutoff. β_1 is the slope of the function on the right side and β_2 is the difference between the slopes on the left and right side of the cutoff. ε_i represents the error term. D_i is a dummy that takes on the value of one if a child's hemoglobin level was ≤ 10.9 g/dl in 2014 and 0 otherwise and indicates the treatment. Hence D_i is defined as

$$D_i = \begin{cases} 0 & \text{if } X_i > 10.9. \\ 1 & \text{if } X_i \leq 10.9. \end{cases}$$

τ represents the treatment effect, e.g. the size of the discontinuity at the cutoff point and hence the main coefficient of interest. We estimate equation (1) within a narrow bandwidth (h) around the cutoff point. We apply robust standard errors clustered at the school level. This method estimates the local average treatment effect around the cutoff.

The bandwidth (h) is selected using the data-driven method that minimizes the mean squared error (MSE) for the local linear regression point estimator for independent and identically distributed data (Imbens and Kalyanaraman, 2012). This method was further developed by Calonico et al. (2016) for clustered data (henceforth CCT). Because our data is clustered at the school level, we apply the CCT approach in the local linear regression estimation approach. Since only data points close to the cutoff are included in the analysis, estimates only apply to individuals with hemoglobin values in 2014 that are close to the 10.9 g/dl cutoff. Hence, we measure the local average treatment effect for the population close to the cutoff. Only if the treatment effect would be homogeneous, i.e. it does not vary across hemoglobin values, would the estimates apply to the sample as a whole. We conduct robustness checks to various bandwidths, rectangular kernel weights, and inclusion of a vector of control variables described in Table 1. Furthermore, we impose a polynomial of order two on all data points within the bandwidth selected by the CCT procedure. Finally, we show results for different order polynomials for all data points, i.e. globally and not only for a small bandwidth around the cutoff.

3.2. The Validity of the regression discontinuity design

The RDD is a valid method for causal interpretation only if the following two assumptions are met. First, the forcing variable (the baseline hemoglobin level) should evolve smoothly across the cutoff. Second, neither the individual who assigns the treatment nor the targeted individual should be able to precisely manipulate the forcing variable (Hahn, Todd and Klaauw, 2001; Lee and Lemieux, 2010; Imbens and Lemieux, 2008). It appears that both assumptions seem to be true in our setting.

First, the cutoffs for anemia were set in terms of standard deviations from the mean of a hemoglobin distribution of a reference population (WHO, 2001). Cutoffs are thus not based on a physiological phenomenon but rather on a statistical convention. Or said differently, a child is not exposed to a sharp health risk increase between a hemoglobin value of 11 g/dl and 10.9 g/dl. The second assumption is that neither the individuals being studied nor the people who assign treatment (i.e. medical staff) are able to manipulate assignment to the treatment. The cutoff level and the knowledge about the information treatment were unknown to households and they did not have any incentive to manipulate the hemoglobin value. Furthermore, it is impossible to adjust feeding practices in a way that hemoglobin levels can be precisely determined. Furthermore, we do not see any incentive for the medical staff to have manipulated the assignment to either of the experimental groups since they received no monetary benefits for the conveyance of the treatment and also the required effort to implement the nutrition information was very minimal and low-cost. Medical personnel were additionally supervised through spot-checks and no irregularities were observed. We perform several tests to check these two conditions. First, the non-manipulation of the assignment variable is supported by the histogram (Figure 1). If individuals had precisely manipulated the forcing variable, one would see a discontinuity in frequencies around the cutoff. Medical personnel were additionally supervised through spot-checks and no irregularities were observed.

Second, if the treatment was indeed as good as randomly assigned around the threshold, baseline covariates should be equally distributed just above and below the cutoff (Lee and Lemieux, 2010). ¹¹ Column (7) in Table 2 provides the p-values for the t-test of equality of the means. Except for the hemoglobin value, which by construction is lower below and higher above the threshold, and the share of mothers that help their child with their homework, which

¹¹Hahn et al. (2001) show that continuity in the assignment variable is sufficient to obtain unbiased estimates. Therefore, the equality in means of individuals above and below the threshold is not required, however, it is likely to be the case within a small bandwidth around the cutoff point.

given a large number of t-tests might differ by chance, no statistically significant differences appear above and below the cutoff, indicating randomness around the cutoff.

4. Results

4.1. Graphical Illustration of the results

Figure 3 illustrates the potential discontinuities by plotting the change in our outcome variables from 2014 to 2016, against the normalized hemoglobin values in 2014. Due to the normalization of the forcing variable, point 0 at the x-axis is equal to a hemoglobin value of 10.9 g/dl. Section A of figure 3 shows discontinuity graphs for the feeding practice indicators (the dietary diversity score, the frequency of meat consumption, and the frequency of consuming green leafy vegetables), section B for anemia outcomes (hemoglobin levels), and section C for cognitive and education outcomes (5 different cognitive tests, math and reading test scores, and school attendance rate). For illustrative reasons, changes in outcomes are averaged over each discrete value of the forcing variables and plotted against the respective discrete values of the normalized hemoglobin values from 2014. To represent the density of the observations, the size of the dots in the graphs represents the number of observations within each discrete hemoglobin value. A linear regression line is fitted to the data points and the grey line shows the confidence intervals. In panel A, we show graphs for all data points (globally) and in Panel B we show observations within the bandwidth that is selected by the CCT procedure.

If the information treatment were effective in improving the outcomes, one would see a jump at point 0 of the x-axis. In panel A none of the graphs show a discontinuity at the cutoff, instead, all data points evolve smoothly at the cutoff, indicating that the information intervention had no impacts on any of the outcomes related to feeding practices, hemoglobin, cognition, and education. Similar results emerge when we focus on observations close to the cutoff point (Panel B). There might be slight discontinuity for some of the cognitive and educational outcomes, such as in the backward digit-span test, the block design test, and the cognitive index and school attendance. Furthermore, in some cases, we also note the wide confidence intervals due to large data variability and for a few cognitive outcomes the observed discontinuities are in an unexpected direction.

4.2. Main Results

Estimation results for Equation (1) are presented in Table 3 for feeding practices and anemia and in Table 4 for cognitive and educational outcomes. In Panel A, estimation results

are presented for the data-driven bandwidth selected by the method proposed by CCT and Panel B shows estimates for arbitrarily chosen bandwidths (0.5, 1.0, 2.0 and 2.5).

The results from the discontinuity graphs can broadly be confirmed by the regression analysis. For the feeding practice outcomes (columns 1-3, Table 3), none of the estimated coefficients are statistically significant and for the frequency of meat and green vegetable consumption, the coefficients display the unexpected sign. Regarding the anemia outcome (columns 4, Table 3), there is a statistically significant effect of the nutrition information intervention on hemoglobin. Using CCT bandwidth, the estimate predicts that the information treatment, on average, led to a negative change in hemoglobin scores by the size of 0.469 g/dl. However, the effect is only statistically significant for very small bandwidths (0.4 and 0.5) and does not stay robust across specifications in Panel B when bandwidths range from 1 to 2.5.¹²

For the cognitive measures, a few point estimates are statistically significant but most are not (columns 1-6, Table 4). Based on the estimates using the CCT bandwidth (Panel A), informing the parents of their child's anemia status and the provision of information on better feeding practices, on average, decreased the change in the *block design* test score by 0.48 standard deviations, compared to the mean in 2014. Since the cognitive index is a composite index of all five cognitive tests, the statistically significant and qualitatively large point estimate for the *block design* tests is also reflected in a decrease of the cognitive index by 0.31 standard deviations (significant at the 10% level). The coefficient for *block design* remains statistically significant for the bandwidths of 0.5, 2.0, and 2.5. The cognitive index is statistically significant only for the 0.5 bandwidth in Panel b of Table 4. However, for other indicators of cognitive outcomes, most of the coefficients show an unexpected negative sign. Since estimates for the different cognitive tests are not consistent, i.e. only one cognitive test shows statistically significant estimates (*block design*) and the direction of the coefficients for the different cognitive tests are also not uniform, we cannot draw a general conclusion regarding cognitive ability. Finding an effect on cognition but not on feeding practices and hemoglobin is puzzling, as cognitive outcomes could only be affected through a change in feeding practices and an increase in hemoglobin values. For the education outcomes (columns 7-9, Table 4), the information intervention had a statistically insignificant impact.

Together, these results indicate that information intervention about anemia risk and how to combat it had no statistically significant effects on health and cognitive outcomes of the children.

¹²One would expect standard errors to get larger with smaller bandwidths, as estimates get more imprecise, and coefficients might change because of the bias inherent in a larger bandwidth. This pattern is, however, not observed in Table 3.

4.3. Additional specifications

We examine the sensitivity of the results in Table 3 and 4 to different specifications. Tables 5 and 6 show estimates of additional specifications of equation (1); Panel A shows estimates with a rectangular kernel. In Panel B we include a set of control variables and Panel C shows results for the application of a polynomial of order two on observations with the CCT bandwidth, Panel D shows results for global estimates for different higher-order polynomials, and finally Panel E excludes hemoglobin value of 10.9 and 11g/dl.¹³ In general, the results are very similar to findings in Tables 3-4; none of the coefficients in Table 5 are statistically significant, indicating that the nutrition information intervention had no impacts on feeding practices and hemoglobin levels. Results in Table 6 confirm the findings of Table 5; the information intervention had no effects on cognitive and educational outcomes in the modified model of equation (1).

5. Robustness and heterogeneity

5.1. Robustness checks

First, the model in equation (1) includes ΔY as the outcome variable in order to control for the baseline value of the outcome variable. However, this may suffer from low power issue. Therefore, to increase power, we reestimate equation (1) and use endline value of Y as the outcome instead of ΔY . The estimated effect from this analysis is similar to the findings in Table 4 and 5 (results available upon request).

Second, if the treatment compliance was not perfect, i.e. if the information did not reach the parents or the person who was responsible for child feeding, then this might lead to an attenuation bias. We consider this risk to be rather low since the hemoglobin testing drew a lot of attention in the village and quite often many people gathered together during the testing. Thus, if the information was not taken up directly by the parents, it was very likely parents would have been informed by a neighbor, a sibling, or grandparent.

Third, the data used for this evaluation comes from a randomized trial conducted by Krämer, Kumar, and Vollmer (2018), which evaluated the effects of using iron-fortified iodized salt in the Indian school-feeding program (henceforth: *school intervention*). In general, the fact that another nutrition intervention was evaluated with the same dataset does not bias the

¹³Regression underlying Panel E are described and discussed in the robustness checks.

findings of this study since the *school intervention* was randomized at the school level and the children that were treated by the iron-fortified salt intervention were equally distributed across the hemoglobin cutoff. Table 1 shows the share of children that belonged to the treatment group in the *school intervention*, just above and below the threshold. To the left of the cutoff, 52% of the children were treated by the *school intervention* and to the right of the cutoff, this is true for 55% of the children, showing that belonging to the treatment group of the *school intervention* is quite balanced above and below the cutoff. Nevertheless, we included the information if the child was treated by the *school intervention* in the set of control variables for one of our specifications. The inclusion of this covariate did not make much of a difference in estimation results (results available upon request).

5.2. Heterogeneity: Did mothers receive the information?

It is also likely that the treatment effects depend on whether the nutritional information was directly shared with the mother versus other members of the household. Previous study shows that decisions on child health and nutrition are mostly made either by mothers or grandmothers (Thomas, 2011). To test this we estimate equation (1) for the subgroup of children that were accompanied by their mothers. Results of this regression are shown in Table 7 for the feeding practice, hemoglobin, and cognitive and education outcomes. The results are similar to previous findings. There is no statistically significant effect for any of the specifications on feeding practices. For the smaller bandwidths (CCT and 0.5), hemoglobin levels appear to be statistically significant at the 10% level of significance; however, the estimates are not robust to the larger bandwidths and different functional forms. For the cognitive outcomes, some coefficients are statistically significant; however, except for the *block design* estimates, they do not seem to be robust across the different specifications and the signs of the coefficients are also not consistent across cognitive tests. Estimates for the education outcomes are insignificant across the different specifications and mostly have the expected sign. We do not find any evidence of heterogeneous effects. These findings indicate that the treatment effects do not vary according to whether the mother or the other members of the household received the nutrition information.

5.3. Attenuation bias

Our results could also be underestimated if the medical personnel made an error in implementing the treatment around the cutoff. We address this potential concern by performing a regression where we exclude observations directly at the cutoff (10.9 and 11 g/dl). Results of the *donut* regression are shown in Panel E of Table 5 and 6 and are in line with the previous

estimates. We can also not rule out the possibility that parents of non-anemic children sometimes might have taken-up the treatment when the nutrition information was addressed to the parents of anemic children. These circumstances imply that assignment to the treatment might not be a deterministic function of the forcing variable but instead, the probability of assignment to the treatment increases at the cutoff. In such a setting, a fuzzy RDD can potentially be applied. Unfortunately, we do not know which individuals were affected by this potential imprecision in the conveyance of the treatment, such that we are not able to perform a fuzzy RDD and conduct a sharp RDD analysis.

6. Discussion

Using the RDD method, this study investigates the impact of nutrition information intervention on feeding practices, hemoglobin, and cognitive and educational outcomes of young children in rural Bihar, India. After two years of intervention, we do not find statistically significant effects on any of the measured outcomes, indicating that households do not change their dietary behavior upon receiving negative information about the health of their children.

One potential reason for our null finding might be that small effects are indeed present, that we are however unable to detect those due to the lack of power. Another reason might be the low-intensity of the intervention. Parents were informed of the anemia status of their children and were educated about iron-rich diets to increase hemoglobin levels. This information intervention was not a sustained and ongoing activity. Another reason might be that positive treatment effects, if any, only occurred immediately and diminished after two years.

Another explanation might be that parents were not able to adjust nutritional behavior due to unavailability and unaffordability of iron-rich food items. For the information intervention to be effective in changing the household's dietary behavior, the availability, and affordability of the iron-rich food products are crucial. The WHO (2001) states that improvements in nutrition build on these three pillars: the availability of micronutrient-rich food, the affordability of those food items and a change in feeding practices (i.e. utilization). However, due to data limitations, our study could only examine the last pillar of utilization. It could be possible that both availability and accessibility may have constrained parents from providing a more diverse diet for their children, even though they would have been willing to do so.

Evidence from other studies, however, shows that even when availability and accessibility are ensured, people do not necessarily respond to health information or at least not as much as one would expect. E.g. children who were educated about the adverse effects of worm infections and means to prevent infection did not adapt their health behavior (i.e. wear shoes and adopt more hygienic behavior), even though adoption should have been cheap and feasible

(Kremer and Miguel, 2007). In the context of nutrition, Banerjee, Barnhardt, and Duflo (2018) found that making iron-fortified iodized salt (DFS) available in Indian villages, and informing households with a flyer of the product's availability and its benefits, did not encourage take-up. This indicates that changing dietary patterns is complex and difficult and - even if availability and affordability are ensured - that information alone, even when a nutritional disorder is revealed, might not be sufficient to ensure utilization. Deep rooted beliefs and habits make individuals very reluctant to changing their dietary behavior.

References

- Almond, Douglas, Janet Currie, Valentina Duque. 2018. "Childhood Circumstances and Adult Outcomes: Act II." *Journal of Economic Literature*, 56 (4): 1360-1446.
- Alderman, Harold, Jere Behrman, Victor Lavy, and Rekha Menon. 2001. "Child Health and School Enrollment: A Longitudinal Analysis." *Journal of Human Resources*, 36(1): 185–205.
- Alderman, Harold, John Hoddinott, and Bill Kinsey. 2006. "Long Term Consequences of Early Childhood Malnutrition." *Oxford Economic Papers*, 58(3): 450–74.
- Anderson, Peter. 2002. "Assessment and Development of Executive Function (EF) During Childhood." *Child Neuropsychology* 8 (2): 71–82.
- ASER. 2014. "Aser Tools & Testing." <http://www.asercentre.org>.
- Banerjee, Abhijit, Sharon Barnhardt, and Esther Duflo. 2018. "Can Iron-Fortified Salt Control Anemia? Evidence from Two Experiments in Rural Bihar." *Journal of Development Economics*, 133:127-146.
- Bobonis, Gustavo J, Edward Miguel, and Charu Puri-Sharma. 2006. "Anemia and School Participation." *The Journal of Human Resources* 41 (4): 692–721.
- Bortolini, Gisele Ane, and Márcia Regina Vitolo. 2011. "The Impact of Systematic Dietary Counseling during the First Year of Life on Prevalence Rates of Anemia and Iron Deficiency at 12-16 Months." *Jornal de Pediatria* 88 (1): 33–39.
- Calonico, Sebastian, Matias D. Cattaneo, Max H. Farrell, and Rocío Titiunik. 2019. "Regression Discontinuity Designs Using Covariates." *Review of Economics and Statistics*, 101(3):442-451.
- Childs, Fiona, Anne Aukett, Phil J. Darbyshire, Susan Ilett, and L N Livera. 1997. "Dietary Education and Iron Deficiency Anaemia in the Inner City." *Archives of Disease in Childhood* 76 (2): 144–47.
- Cohen, Jessica, Pascaline Dupas, and Simone Schaner. 2015. "Price Subsidies, Diagnostic Tests, and Targeting of Malaria Treatment: Evidence from a Randomized Controlled Trial." *American Economic Review* 105 (2): 609–45.
- Dupas, Pascaline. 2011a. "Health Behavior in Developing Countries." *Annual Review of Economics* 3 (1): 425–49.
- . 2011b. "Do Teenagers Respond to HIV Risk Information? Evidence from a Field Experiment in Kenya." *American Economic Journal: Applied Economics* 3 (1): 1–34.
- FAO. 2007. "Nutrition and Consumer Protection Division. Guidelines for Measuring Household and Individual Dietary Diversity." Rome. <http://www.fao.org/3/a-i1983e.pdf>.
- FAO, and WHO. 2002. "Human Vitamin and Mineral Requirements. Report of a Joint FAO/WHO Expert Consultation, Bangkok, Thailand." Rome. <http://www.fao.org/3/a-y2809e.pdf>.

- Fitzsimons, Emla, Bansi Malde, Alice Mesnard, and Marcos Vera-Hernandez. 2016. "Nutrition, Information and Household Behaviour: Experimental Evidence from Malawi." *Journal of Development Economics*, 122:113-126.
- Glewwe, Paul, Hanan G. Jacoby, and Elizabeth M. King. 2001. "Early Childhood Nutrition and Academic Achievement: A Longitudinal Analysis." *Journal of Public Economics*, 81(3), 345–368.
- Hahn, Jinyong, Petra Todd, and Wilbert Klaauw. 2001. "Identification and Estimation of Treatment Effects with a Regression-Discontinuity Design." *Econometrica* 69 (1): 201–9.
- Halterman, Jill S., Jeffrey M. Kaczorowski, C. Andrew Aligne, Peggy Auinger, and Peter G. Szilagyi. 2001. "Iron Deficiency and Cognitive Achievement among School-Aged Children and Adolescents in the United States." *Pediatrics* 107 (6): 1381–86.
- Horton, Susan, and Jay S. Ross. 2003. "The Economics of Iron Deficiency." *Food Policy* 28 (1): 51–75.
- Hudspeth, William J., and Karl H. Pribram. 1990. "Stages of Brain and Cognitive Maturation." *Journal of Educational Psychology* 82 (4): 881–84.
- Imbens, Guido W, and Karthik Kalyanaraman. 2012. "Optimal Bandwidth Choice for the Regression Discontinuity Estimator." *The Review of Economic Studies* 79 (3): 933–59.
- Imbens, Guido W, and Thomas Lemieux. 2008. "Regression Discontinuity Designs: A Guide to Practice." *Journal of Econometrics* 142: 615–35.
- Jalan, Jyotsna, and Eswaran Somanathan. 2008. "The Importance of Being Informed: Experimental Evidence on Demand for Environmental Quality." *Journal of Development Economics* 87 (1): 14–28.
- Kennedy, Gina, Maylis Razes, Terri Ballard, and Marie Claude Dop. 2010. "Measurement of Dietary Diversity for Monitoring the Impact of Food Based Approaches." *International Symposium on Food and Nutrition Security: Food-Based Approaches for Improving Diets and Raising Levels of Nutrition*.
- Krämer, Marion, Santosh Kumar, and Sebastian Vollmer. 2018. "'Improving Child Health and Cognition: Evidence from a School-Based Nutrition Intervention in India." Courant Research Centre: Poverty, Equity and Growth - Discussion Papers 247, University of Goettingen, Gottingen, Germany.
- Kremer, Michael, and Edward Miguel. 2007. "The Illusion of Sustainability." *The Quarterly Journal of Economics* 122 (3): 1007–65.
- Lee, David S., and Thomas Lemieux. 2010. "Regression Discontinuity Designs in Economics." *Journal of Economic Literature* 48 (2): 281–355.
- Luo, Renfu, Yaojiang Shi, Linxiu Zhang, Huiping Zhang, Grant Miller, Alexis Medina, and Scott Rozelle. 2012. "The Limits of Health and Nutrition Education: Evidence from Three Randomized-Controlled Trials in Rural China." *CESifo Economic Studies* 58 (2): 385–404.

- Madajewicz, Malgosia, Alexander Pfaff, Alexander van Geen, Joseph Graziano, Iftikhar Hussein, Hasina Momotaj, Roksana Sylvi, and Habibul Ahsan. 2007. "Can Information Alone Change Behavior? Response to Arsenic Contamination of Groundwater in Bangladesh." *Journal of Development Economics*, 4 (2), 731–754.
- McLean, Erin, Mary Cogswell, Ines Egli, Daniel Wojdyla, and Bruno de Benoist. 2009. "Worldwide Prevalence of Anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993–2005." *Public Health Nutrition* 12 (4): 444–54.
- NFHS. 2017. "National Family Health Survey 4. District Fact Sheet Jehanabad Bihar." Mumbai.
- Ogden, Jane, Lubna Karim, Abida Choudry, and Kerry Brown. 2007. "Understanding Successful Behaviour Change: The Role of Intentions, Attitudes to the Target and Motivations and the Example of Diet." *Health Education Research*, 22(3), 397–405.
- Oster, Emily. 2018. "Diabetes and Diet: Purchasing Behavior Change in Response to Health Information." *American Economic Journal: Applied Economics*, 10 (4): 308–48.
- Shimokawa, Satoru. 2013. "When Does Dietary Knowledge Matter to Obesity and Overweight Prevention." *Food Policy*. 38(2): 35–46.
- Strauss, John, and Duncan Thomas. 1998. "Health, Nutrition, and Economic Development." *Journal of Economic Literature* 36 (2): 766–817.
- Thatcher, Robert W. 1991. "Maturation of the Human Frontal Lobes: Physiological Evidence for Staging." *Developmental Neuropsychology* 7 (3): 397–419.
- Thomas, Duncan. 2011. "Intra-Household Resource Allocation: An Inferential Approach." *Journal of Human Resources* 25 (4): 635–64.
- Thornton, Rebecca L. 2008. "The Demand for Learning HIV Status and the Impact on Sexual Behavior: Evidence from a Field Experiment." *American Economic Review* 98 (5): 1829–63.
- Torheim, Liv Elin, Ingrid Barikmo, Christine L. Parr, Anne Hatløy, F. Ouattara, and Arne Oshaug. 2003. "Validation of Food Variety as an Indicator of Diet Quality Assessed with a Food Frequency Questionnaire for Western Mali." *European Journal of Clinical Nutrition* 57 (10): 1283–91.
- World Health Organization (WHO). 2001. "Iron Deficiency Anaemia: Assessment, Prevention and Control." http://www.who.int/nutrition/publications/micronutrients/anaemia_iron_deficiency/WHO_NHD_01.3/en/index.html.
- . 2008. "Worldwide Prevalence of Anaemia 1993–2005. WHO Global Database on Anaemia." Geneva.
- . 2011. "Haemoglobin Concentrations for the Diagnosis of Anaemia and Assessment of Severity." Geneva.

———. 2016. Global Health Observatory Data Repository/World Health Statistics.

Wong, Ho, Yaojiang Shi, Renfu Luo, Linxiu Zhang, and Scott Rozelle. 2014. "Improving the Health and Education of Elementary Schoolchildren in Rural China: Iron Supplementation Versus Nutritional Training for Parents." *Journal of Development Studies*, 50(4): 502–19.

Zhao, Meng, Yoshifumi Konishi, and Paul Glewwe. 2013. "Does Information on Health Status Lead to a Healthier Lifestyle? Evidence from China on the Effect of Hypertension Diagnosis on Food Consumption." *Journal of Health Economics*, 32(2): 367-385.

Figure 1: Distribution of baseline hemoglobin values

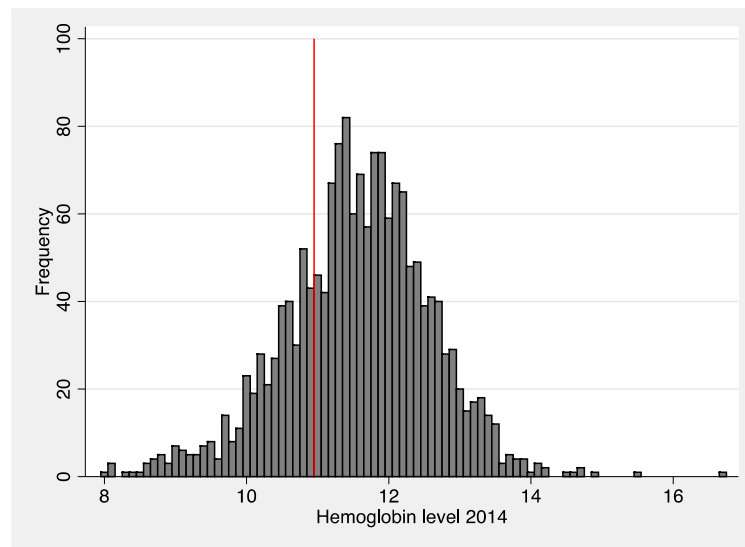


Figure 2: Timeline of data collection and the treatment

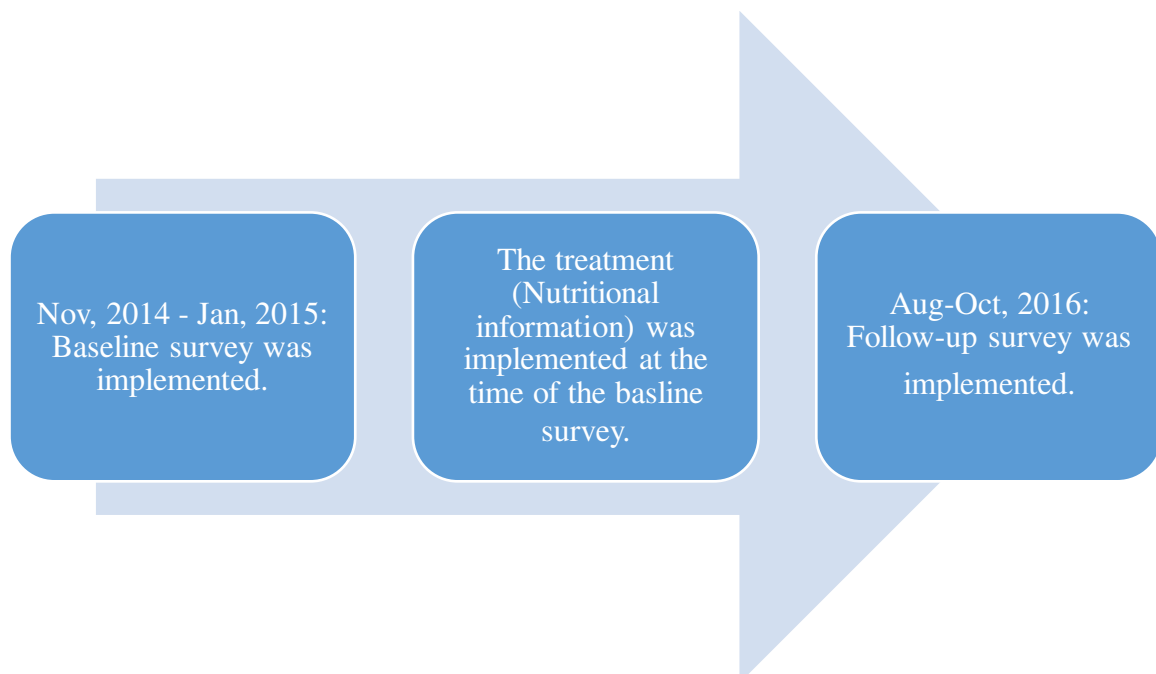
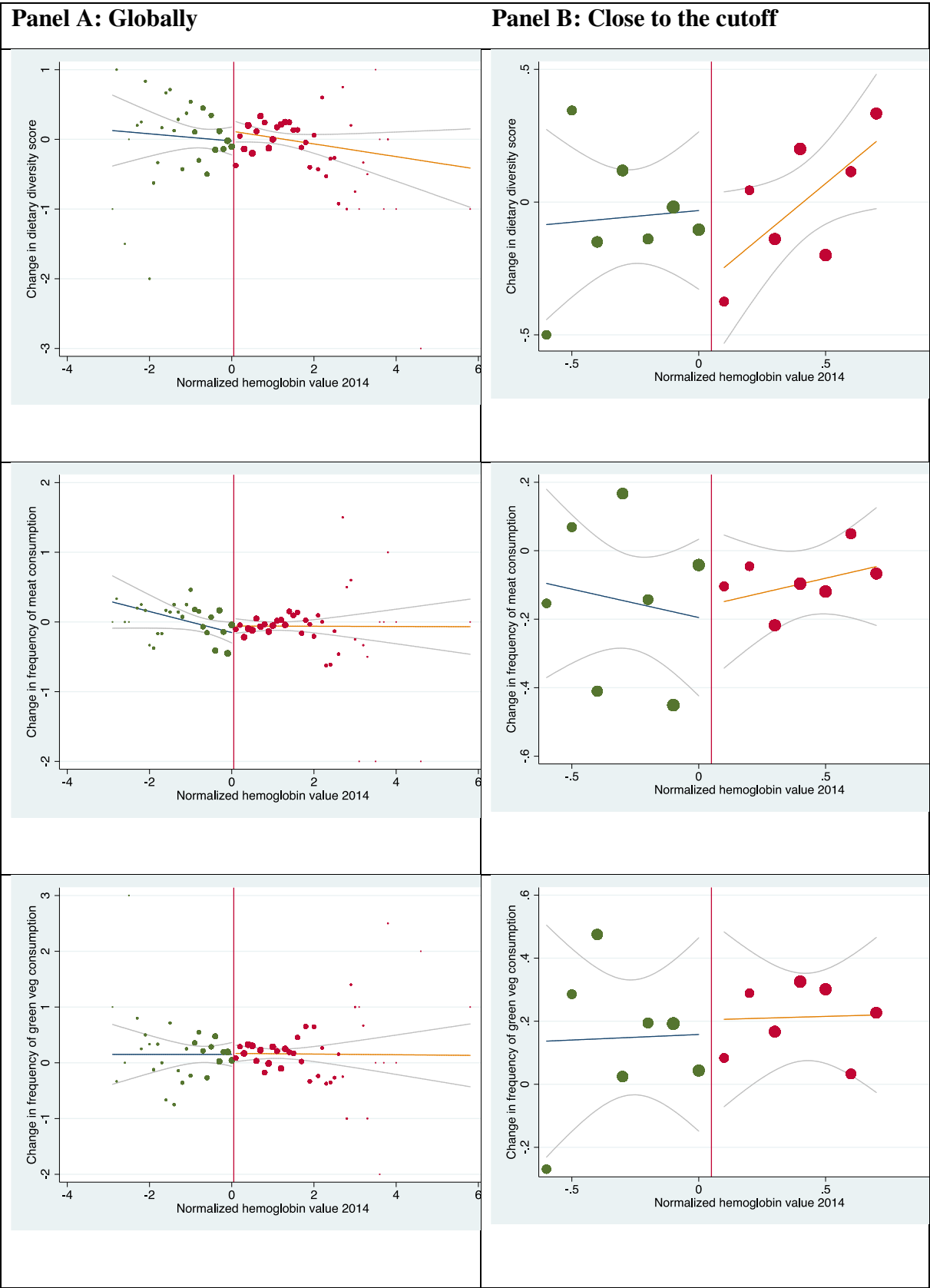
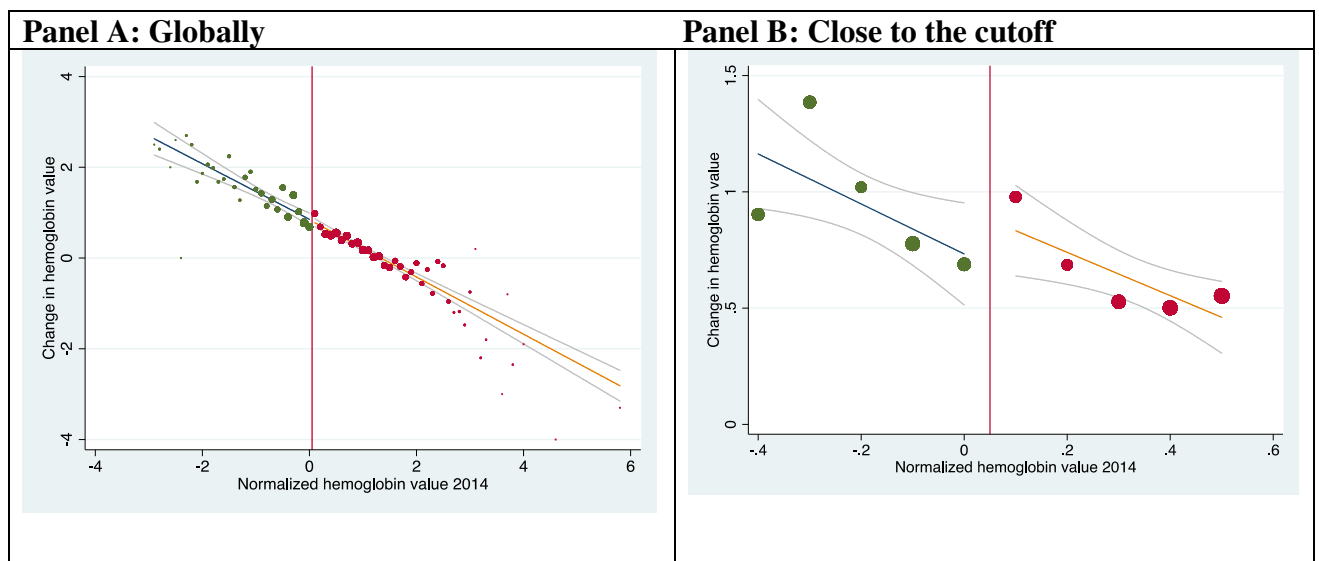


Figure 3: Discontinuity graphs

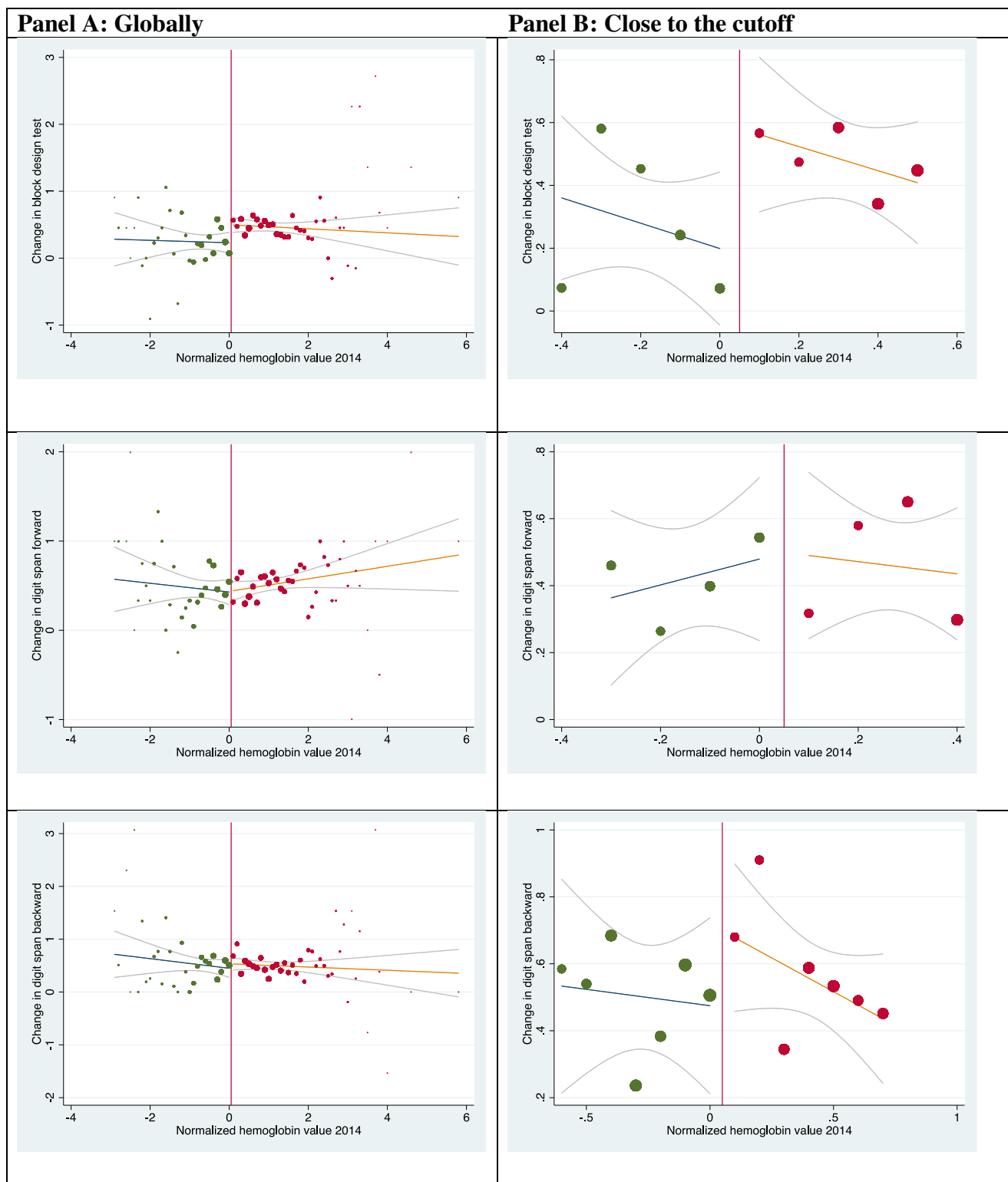
A. Feeding practices

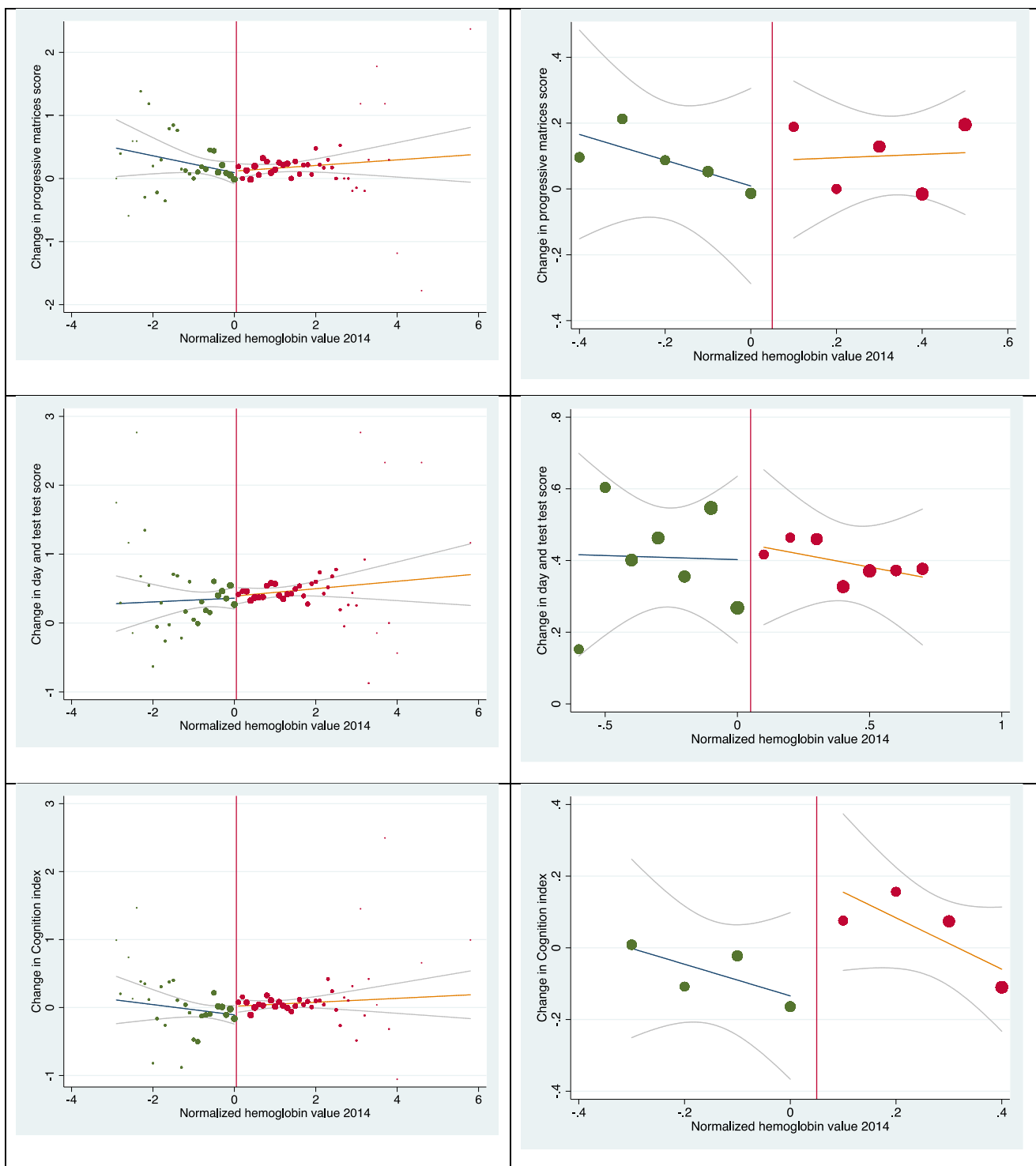


B. Anemia outcomes



C. Cognitive and education outcomes





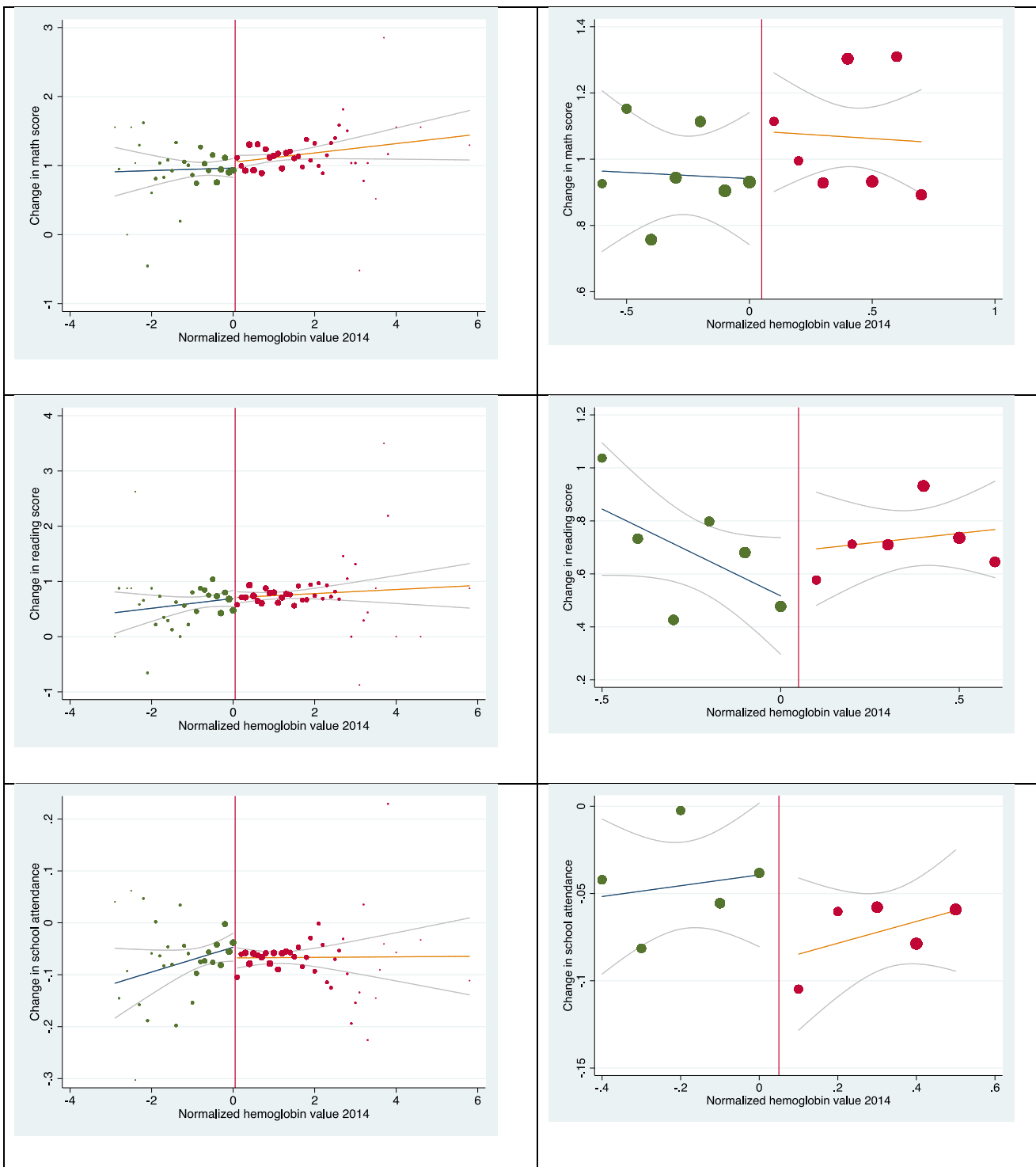


Table 1: Summary statistics of the full sample

	Mean (1)	SD (2)	N (3)
Outcome variables			
Feeding practices			
Dietary Diversity Score	3.85	1.18	517
Frequency of meat consumption	1.79	0.85	516
Frequency of green veg consumption	3.41	1.03	509
Hemoglobin			
Hemoglobin	11.02	0.29	517
Cognition			
Block design	3.58	2.2	506
Digit span forward	3.99	0.97	507
Digit span backward	0.97	1.24	507
Progressive matrices	4.85	1.56	507
Day and night	5.06	3.3	507
Cognitive index	-0.09	0.93	506
Education			
Math	4.34	3.65	507
Reading	0.74	1.02	507
School attendance	0.79	0.16	490
Covariates			
Treatment group from school intervention	0.54	0.50	517
Religion (Muslim HH)	0.02	0.15	517
SC/ST	0.32	0.47	517
Rural HH	0.98	0.14	517
HH size	7.47	3.14	517
Years schooling father	5.01	4.77	508
Years schooling mother	1.45	2.91	514
Asset index	-0.12	0.93	509
Institutional delivery	0.34	0.47	514
Health insurance	0.38	0.49	512
Diarrhea	0.05	0.21	517
Improved sanitation	0.07	0.26	517
Male child	0.43	0.50	517
Help with homework	0.15	0.36	512
Time physical care	45.78	25.29	517
School meetings	0.65	0.47	516
Father at home	0.89	0.32	516
Distance to school	10.21	6.12	517
Number of meals	3.07	1.03	517
Cut meals	0.82	0.38	517
Iron supplementation	0.19	0.39	510
Maternal health knowledge	0.37	0.48	517
Total enrollment	258.91	153.5	517
Class size	33.61	17.06	517
Student teacher ratio	38.62	11.6	517
Calories of MDM per child	68.22	21.82	517
Iron in MDM per child	0.77	0.29	517

Notes: This table presents baseline summary statistics as well as p-values for difference in means t-tests between children just above and just below the cutoff of 10.9 g/dl. All variables shown are child level variables from the baseline. Standard errors are clustered at the school level. SD: Standard deviation, N: Number of observations, MDM: Middy Meal.

Table 2: Sample statistics and covariates balance (Hemoglobin sample)

	Left side			Right side			P-value
	10.5-10.9 g/dl hemoglobin			11.0-11.4 g/dl hemoglobin			
	(1)	(2)	(3)	(4)	(5)	(6)	
Mean	SD	N	Mean	SD	N		
Outcome variables							
Feeding practices							
Dietary Diversity Score	3.80	1.20	204	3.88	1.17	313	0.446
Frequency of meat consumption	1.83	0.91	203	1.77	0.81	313	0.393
Frequency of green veg consumption	3.38	1.00	200	3.44	1.06	309	0.558
Hemoglobin							
Hemoglobin	10.71	0.14	204	11.23	0.14	313	0.000***
Cognition							
Block design	3.76	2.21	199	3.46	2.19	307	0.133
Digit span forward	3.98	1.00	200	4.01	0.95	307	0.666
Digit span backward	0.96	1.29	200	0.98	1.22	307	0.879
Progressive matrices	4.87	1.73	200	4.84	1.46	307	0.881
Day and night	5.04	3.28	200	5.09	3.33	307	0.865
Cognitive index	-0.07	0.96	199	-0.10	0.92	307	0.721
Education							
Math	4.30	3.78	200	4.38	3.57	307	0.807
Reading	0.73	0.99	200	0.75	1.04	307	0.809
School attendance	0.78	0.16	195	0.80	0.16	295	0.196
Covariates							
Treatment group from school intervention	0.52	0.50	204	0.55	0.50	313	0.552
Religion (Muslim HH)	0.03	0.17	204	0.02	0.14	313	0.451
SC/ST	0.32	0.47	204	0.31	0.46	313	0.804
Rural HH	0.98	0.16	204	0.98	0.13	313	0.492
HH size	7.39	3.04	204	7.53	3.22	313	0.618
Years schooling father	4.84	4.86	201	5.13	4.73	307	0.510
Years schooling mother	1.44	2.89	203	1.46	2.93	311	0.940
Asset index	-0.15	0.97	200	-0.10	0.89	309	0.558
Institutional delivery	0.37	0.48	201	0.33	0.47	313	0.272
Health insurance	0.42	0.49	202	0.35	0.48	310	0.143
Diarrhea	0.04	0.21	204	0.05	0.21	313	0.841
Improved sanitation	0.07	0.26	204	0.07	0.26	313	0.998
Male child	0.40	0.49	204	0.45	0.50	313	0.260
Help with homework	0.10	0.30	201	0.19	0.39	311	0.006***
Time physical care	47.25	28.92	204	44.83	22.62	313	0.287
School meetings	0.66	0.48	203	0.65	0.48	313	0.878
Father at home	0.88	0.33	203	0.89	0.31	313	0.613
Distance to school	10.03	6.28	204	10.33	6.02	313	0.583
Number of meals	3.09	0.92	204	3.07	1.10	313	0.874
Cut meals	0.82	0.38	204	0.82	0.38	313	0.944
Iron supplementation	0.16	0.37	201	0.21	0.41	309	0.151
Maternal health knowledge	0.36	0.48	204	0.37	0.48	313	0.914
Total enrollment	252.83	153.7	204	262.88	153.56	313	0.467
Class size	32.62	16.37	204	34.26	17.50	313	0.286
Student teacher ratio	38.89	11.76	204	38.46	11.52	313	0.679
Calories of MDM per child	66.96	20.15	204	69.05	22.85	313	0.288
Iron in MDM per child	0.75	0.29	204	0.78	0.30	313	0.297

Notes: This table presents baseline summary statistics as well as p-values for difference in means t-tests between children just above and just below the cutoff of 10.9 g/dl. All variables shown are child level variables from the baseline. Standard errors are clustered at the school level. SD: Standard deviation, N: Number of observations, MDM: Midday Meal.

Table 3: The average treatment effect of nutrition information on child health and feeding practices (different bandwidths)

	Dietary diversity score	Frequency of meat consumption	Frequency of green veg consumption	Hemoglobin
	(1)	(2)	(3)	(4)
A. Main results				
Optimal Bandwidth (CCT)	0.229 (0.249)	-0.062 (0.188)	-0.052 (0.211)	-0.469** (0.218)
Bandwidth	0.7	0.7	0.8	0.4
N	733	733	818	517
B. Alternative bandwidths				
Bandwidth 0.5	0.263 (0.294)	-0.106 (0.226)	0.051 (0.284)	-0.335* (0.20)
N	543	543	543	517
Bandwidth 1.0	0.126 (0.197)	-0.079 (0.150)	-0.098 (0.190)	-0.105 (0.145)
N	1,022	1,022	1,022	969
Bandwidth 2.0	-0.010 (0.145)	-0.077 (0.120)	0.016 (0.150)	-0.046 (0.109)
N	1,606	1,606	1,606	1,509
Bandwidth 2.5	-0.044 (0.130)	-0.076 (0.112)	0.016 (0.140)	-0.015 (0.102)
N	1,708	1,708	1,708	1,609

Notes: N: Number of observations. Each cell represents a different regression. The RD coefficients are estimated by fitting a local linear regression using a triangular kernel to the right and the left of the cutoff without including the baseline covariates. All specifications allow for different slopes to the left and the right of the cutoff and standard errors clustered at the school level are in parentheses. Panel A corresponds to the optimal bandwidth while Panel B corresponds to alternative bandwidth. *, **, *** denote significance at the 10%, 5% and 1% level, respectively.

Table 4: The average treatment effect of nutrition information on cognition (different bandwidths)

	Cognitive outcomes						Educational outcomes		
	Block design	Digit span forward	Digit span backward	Progressive matrices	Day and night	Cognitive index	Math	Reading	Attendance
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A. Main results									
Optimal Bandwidth (CCT)	-0.480**	0.137	-0.246	-0.149	-0.096	-0.310*	-0.104	-0.054	0.056
	(0.232)	(0.234)	(0.187)	(0.185)	(0.183)	(0.183)	(0.163)	(0.195)	(0.036)
Bandwidth	0.5	0.4	0.7	0.5	0.7	0.4	0.7	0.6	0.6
N	514	395	691	514	691	395	691	602	563
B. Alternative bandwidth									
Bandwidth 0.5	-0.480**	0.015	-0.262	-0.149	-0.121	-0.300*	-0.107	0.017	0.058
	(0.232)	(0.193)	(0.216)	(0.185)	(0.222)	(0.156)	(0.200)	(0.221)	0.039
N	514	514	514	514	514	514	514	514	482
Bandwidth 1.0	-0.260	0.028	-0.212	-0.043	0.025	-0.140	-0.108	-0.120	0.044
	(0.165)	(0.127)	(0.157)	(0.151)	(0.148)	(0.116)	(0.132)	(0.133)	(0.028)
N	955	955	955	955	955	955	955	955	899
Bandwidth 2.0	-0.294**	0.092	-0.124	-0.032	0.030	-0.101	-0.104	-0.069	0.024
	(0.118)	(0.101)	(0.118)	(0.126)	(0.124)	(0.095)	(0.101)	(0.098)	(0.022)
N	1,488	1,488	1,488	1,488	1,488	1,488	1,487	1,487	1,405
Bandwidth 2.5	-0.290***	0.064	-0.103	-0.029	0.026	-0.101	-0.096	-0.040	0.019
	(0.109)	(0.091)	(0.111)	(0.118)	(0.113)	(0.088)	(0.094)	(0.094)	(0.020)
N	1,584	1,584	1,584	1,584	1,584	1,584	1,583	1,583	1,493

Notes: N: Number of observations. Each cell represents a different regression. The RD coefficients are estimated by fitting a local linear regression using a triangular kernel to the right and the left of the cutoff without including the baseline covariates. All specifications allow for different slopes to the left and the right of the cutoff and standard errors clustered at the school level are in parentheses. Panel A corresponds to the optimal bandwidth while Panel B corresponds to alternative bandwidth.

*, **, *** denote significance at the 10%, 5% and 1% level, respectively.

Table 5: Additional specifications: Treatment effects on child health and feeding practices

	Dietary diversity score	Frequency of meat consumption	Frequency of green veg consumption	Hemoglobin
	(1)	(2)	(3)	(4)
A. Rectangular kernel	0.274 (0.235)	-0.037 (0.172)	-0.126 (0.198)	-0.193 (0.193)
B. With controls	0.071 (0.259)	-0.079 (0.185)	-0.039 (0.224)	-0.434 (0.235)
C. Local polynomial 2nd order	0.152 (0.236)	-0.040 (0.211)	-0.073 (0.265)	-0.320 (0.205)
D. Global polynomial regressions				
Polynomial 1st order	-0.170 (0.109)	-0.095 (0.100)	0.000 (0.126)	0.011 (0.093)
Polynomial 2nd order	-0.033 (0.166)	-0.104 (0.134)	-0.014 (0.172)	0.004 (0.115)
E. Donut (excluding Hb value 10.9 and 11)	-0.001 (0.251)	-0.014 (0.202)	-0.137 (0.295)	-0.047 (0.241)

Notes: N: Number of observations. Each cell represents a different regression. The RD coefficients are estimated by fitting a local linear regression using a triangular kernel to the right and the left of the cutoff without including the baseline covariates. All specifications allow for different slopes to the left and the right of the cutoff and standard errors clustered at the school level are in parentheses. Panel A corresponds to the optimal bandwidth while Panel B corresponds to alternative bandwidth. *, **, *** denote significance at the 10%, 5% and 1% level, respectively.

Table 6: Additional specifications: Treatment effects on cognitive and educational outcomes

	Cognitive outcomes						Educational outcomes		
	Block design	Digit span forward	Digit span backward	Progressive matrices	Day and night	Cognitive index	Math	Reading	Attendance
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A. Rectangular Kernel	-0.401*	-0.029	-0.244	-0.075	-0.048	-0.361**	-0.145	-0.163	0.053
	(0.208)	(0.219)	(0.184)	(0.183)	(0.166)	(0.173)	(0.142)	(0.171)	(0.034)
B. With controls	-0.436*	0.016	-0.264	-0.122	-0.122	-0.357**	-0.029	0.025	0.066
	(0.241)	(0.228)	(0.212)	(0.194)	(0.200)	(0.173)	(0.168)	(0.198)	(0.034)
C. Local polynomial	-0.509**	0.024	-0.170	-0.075	-0.059	-0.266*	-0.104	-0.115	0.049
2nd order	(0.231)	(0.172)	(0.179)	(0.171)	(0.164)	(0.138)	(0.146)	(0.184)	(0.033)
D. Global polynomial regressions									
Polynomial 1st order	-0.268***	-0.005	-0.083	-0.032	-0.030	-0.126	-0.081	-0.011	0.011
	(0.096)	(0.074)	(0.100)	(0.105)	(0.096)	(0.080)	(0.086)	(0.093)	(0.017)
Polynomial 2nd order	-0.322**	0.115	-0.052	-0.071	0.069	-0.080	-0.094	-0.053	0.021
	(0.126)	(0.102)	(0.127)	(0.140)	(0.140)	(0.103)	(0.108)	(0.109)	(0.023)
E. Donut (excluding Hb value 10.9 and 11)	-0.193	-0.468**	-0.230	0.072	0.186	-0.234	-0.056	-0.153	0.027
	(0.266)	(0.221)	(0.210)	(0.251)	(0.214)	(0.184)	(0.168)	(0.229)	(0.040)

Notes: N: Number of observations. Each cell represents a different regression. The RD coefficients are estimated by fitting a local linear regression using a triangular kernel to the right and the left of the cutoff without including the baseline covariates. All specifications allow for different slopes to the left and the right of the cutoff and standard errors clustered at the school level are in parentheses. Panel A corresponds to the optimal bandwidth while Panel B corresponds to alternative bandwidth. *, **, *** denote significance at the 10%, 5% and 1% level, respectively.

Table 7: Heterogeneous effects: Whether mothers received the information treatment

	CCT Bw	Bw 0.5	Bw 1.0	Bw 2.0	Bw 2.5	Rectangular kernel	With controls	Local polynomial
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Panel A : Child health and feeding practices</i>								
Dietary diversity score	0.279 (0.292)	0.355 (0.319)	0.175 (0.216)	0.009 (0.161)	-0.022 (0.145)	0.154 (0.267)	0.131 (0.309)	0.295 (0.274)
Frequency of meat consumption	-0.072 (0.206)	-0.098 (0.247)	-0.114 (0.168)	-0.104 (0.129)	-0.093 (0.120)	-0.072 (0.187)	-0.038 (0.210)	-0.037 (0.235)
Frequency of green veg consumption	0.010 (0.275)	0.010 (0.275)	-0.158 (0.195)	-0.045 (0.160)	-0.033 (0.151)	-0.049 (0.253)	-0.043 (0.274)	-0.094 (0.277)
Hemoglobin	-0.388* (0.225)	- (0.252)	-0.093 (0.147)	-0.049 (0.111)	-0.016 (0.104)	-0.359 (0.222)	-0.346 (0.245)	-0.314 (0.226)
<i>Panel B: Cognitive outcomes</i>								
Block design	-0.440* (0.243)	- (0.243)	-0.256 (0.171)	-0.265** (0.128)	-0.260** (0.118)	-0.355 (0.217)	-0.444 (0.260)	-0.451* (0.246)
Digit span forward	0.067 (0.241)	-0.052 (0.203)	-0.004 (0.141)	0.077 (0.110)	0.050 (0.098)	-0.133 (0.226)	-0.104 (0.243)	-0.9 (0.178)
Digit span	-0.266 (0.225)	-0.267 (0.239)	-0.246 (0.175)	-0.142 (0.130)	-0.116 (0.123)	-0.272 (0.220)	-0.292 (0.240)	-0.180 (0.220)
Progressive	-0.147 (0.196)	-0.147 (0.196)	-0.052 (0.165)	-0.041 (0.134)	-0.034 (0.124)	-0.099 (0.196)	-0.183 (0.187)	-0.035 (0.183)
Day and night	-0.115 (0.206)	-0.141 (0.221)	0.047 (0.155)	0.046 (0.128)	0.033 (0.115)	-0.073 (0.201)	-0.164 (0.220)	-0.125 (0.195)
Cognitive index	-0.318* (0.188)	- (0.164)	-0.154 (0.127)	-0.100 (0.103)	-0.100 (0.095)	-0.419 (0.183)	-0.430 (0.179)	-0.264 (0.159)
<i>Panel C : Educational outcomes</i>								
Math	-0.159 (0.146)	-0.153 (0.193)	-0.152 (0.126)	-0.147 (0.097)	-0.139 (0.088)	-0.150 (0.136)	-0.065 (0.151)	-0.146 (0.154)
Reading	-0.045 (0.222)	-0.045 (0.222)	-0.177 (0.133)	-0.115 (0.098)	-0.078 (0.095)	-0.106 (0.209)	-0.028 (0.213)	-0.094 (0.205)
Attendance	0.056 (0.039)	0.058 (0.042)	0.043 (0.029)	0.027 (0.022)	0.021 (0.021)	0.053 (0.037)	0.076* (0.037)	0.043 (0.035)

Notes: Each cell represents a different regression. Unless otherwise indicated in Panels A-C, the RD coefficients are estimated by fitting a local linear regression using a triangular kernel to the right and left of the cutoff. All specifications allow for different slopes to the left and the right of the cutoff and standard errors are clustered at the school level. *, **, *** denote significance at the 10%, 5% and 1% level, respectively.

Table 8: Minimal detectable effects for different bandwidth

	Bandwidths						Effect size in other nutrition interventions
	0.3	0.5	1.0	1.5	2.0	2.5	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Panel A: Child health and feeding practices</i>							
Dietary diversity	1.776	1.361	0.97	0.906	0.876	0.843	
Frequency of meat consumption	1.409	0.991	0.667	0.613	0.605	0.579	
Frequency of green vegetable consumption	2.081	1.66	1.318	1.186	1.109	1.051	
Hemoglobin	0.871	0.724	0.601	0.545	0.563	0.551	0.136* ¹ 0.151 ² 0.275 ³ 0.202** ⁴ 0.416** ⁴
<i>Panel B: Cognitive outcomes</i>							
Block design	1.202	0.922	0.698	0.699	0.667	0.639	0.012 ¹ 0.045 ²
Digit span forwards	1.246	0.99	0.655	0.599	0.585	0.555	-0.105 ¹ -0.135 ²
Digit span backwards	1.278	0.996	0.788	0.715	0.691	0.668	0.009 ¹ -0.23 ²
Progressive matrices	1.123	1.211	0.849	0.76	0.713	0.692	0.070 ¹ 0.112 ²
Day and night	1.32	1.134	0.862	0.754	0.723	0.683	0.116 ¹ 0.210 ²
Cognitive index	0.919	0.91	0.69	0.634	0.601	0.58	0.028 ¹ 0.058 ²
<i>Panel C: Educational outcomes</i>							
Math	1.273	1.054	0.79	0.729	0.701	0.663	0.112 ¹ 0.197* ²
Reading	1.253	1.039	0.711	0.664	0.635	0.603	0.129 ¹ 0.182* ²
Attendance	0.265	0.19	0.156	0.147	0.143	0.136	-0.005 ¹

1 Effect size from the evaluation of the school intervention by Krämer, Kumar, and Vollmer (2018).

2 Effect size from the evaluation of the school intervention by Krämer, Kumar, and Vollmer (2018) at 90% school attendance.

3 Effect size in Luo et al. (2012), Information experiment 2.

4 Effect size in Luo et al (2012), Experiments 1 and 2, multivitamin supplement treatment arm.

*, **, *** denote significance at the 10%, 5% and 1% level, respectively.

A. Appendix

Table A.1: Average treatment effect on the sample excluding the DFS treatment group

	Dietary diversity score	Frequency of meat consumption	Frequency of green veg consumption	Hemoglobin
	(1)	(2)	(3)	(4)
A CCT Bandwidth	0.444 (0.562)	-0.127 (0.546)	-0.040 (0.841)	-0.298 (0.258)
Bandwidth	0.4	0.4	0.3	0.6
N	172	172	122	266
B Alternative bandwidth				
Bandwidth 0.5	0.413 (0.520)	-0.098 (0.469)	-0.038 (0.667)	-0.340 (0.285)
N	225	225	225	227
Bandwidth 1.0	0.176 (0.349)	-0.034 (0.285)	-0.118 (0.443)	-0.190 (0.210)
N	421	421	421	420
Bandwidth 2.0	0.103 (0.256)	-0.075 (0.206)	0.097 (0.292)	-0.109 (0.168)
N	692	692	692	682
Bandwidth 2.5	0.090 (0.226)	-0.087 (0.190)	0.093 (0.257)	-0.072 (0.154)
N	743	743	743	735
C Rectangular Kernel	0.482 (0.569)	-0.089 (0.515)	-0.189 (0.778)	-0.238 (0.242)
D With controls	0.451 (0.698)	-0.068 (0.515)	0.208 (0.808)	-0.237 (0.220)
E Local polynomial				
2nd order	0.195 (0.434)	0.008 (0.368)	-0.121 (0.698)	-0.201 (0.226)
F Global polynomial regressions				
Polynomial 1st order	-0.095 (0.185)	-0.152 (0.176)	0.096 (0.196)	-0.075 (0.133)
Polynomial 3rd order	0.169 (0.345)	0.106 (0.287)	-0.049 (0.468)	-0.152 (0.225)
G Donut (excluding Hb value 10.9 and 11)	-0.014 (0.526)	0.054 (0.306)	-0.562 (0.765)	0.073 (0.236)

Notes: N denotes number of observations. Each cell represents a different regression. Unless otherwise indicated in panels A-E, the RD coefficients are estimated by fitting a local linear regression separately using a triangular kernel. All specifications allow for different slopes to the left and the right of the cutoff and standard errors are clustered at the school level. *, **, *** denote significance at the 10%, 5%, 1% level respective.

Table A.2: Average treatment effect on cognition and education for sample excluding the DFS treatment

	Cognitive outcomes						Educational outcomes		
	Block design	Digit span forward	Digit span backward	Progressive matrices	Day and night	Cognitive index	Math	Reading	Attendance
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A CCT Bandwidth	-0.202	0.047	-0.541**	0.069	0.474*	-0.204	0.287	0.422	0.055
	(0.418)	(0.443)	(0.258)	(0.314)	(0.242)	(0.289)	(0.307)	(0.262)	(0.0410)
Bandwidth	0.5	0.3	0.7	0.5	0.6	0.4	0.5	0.5	0.7
N	243	131	328	243	284	187	243	243	307
B Alternative bandwidth									
Bandwidth 0.5	-0.202	-0.363	-0.607*	0.069	0.510*	-0.178	0.287	0.422	0.069
	(0.418)	(0.298)	(0.324)	(0.314)	(0.278)	(0.233)	(0.307)	(0.262)	(0.054)
N	243	243	243	243	243	243	243	243	229
Bandwidth 1.0	-0.189	-0.145	-0.378*	0.117	0.467**	-0.041	0.161	0.194	0.042
	(0.263)	(0.193)	(0.207)	(0.239)	(0.191)	(0.165)	(0.185)	(0.156)	(0.036)
N	448	448	448	448	448	448	448	448	423
Bandwidth 2.0	-0.432**	-0.083	-0.193	0.108	0.203	-0.126	-0.104	0.036	0.023
	(0.174)	(0.131)	(0.154)	(0.178)	(0.161)	(0.123)	(0.120)	(0.116)	(0.026)
N	777	777	777	777	777	777	776	777	731
Bandwidth 2.5	-0.319	-0.036	-0.223	0.139	0.336*	-0.038	0.039	0.120	0.036
	(0.207)	(0.173)	(0.181)	(0.203)	(0.189)	(0.147)	(0.153)	(0.131)	(0.032)
N	614	614	614	614	614	614	613	614	577
C Rectangular kernel	-0.115	-0.124	-0.456*	0.166	0.417*	-0.298	0.210	0.332	0.046
	(0.344)	(0.444)	(0.236)	(0.284)	(0.223)	(0.273)	(0.294)	(0.252)	(0.039)
D With controls	-0.318	-0.210	-0.495*	0.014	0.442	-0.119	0.421	0.681**	0.046
	(0.445)	(0.495)	(0.294)	(0.280)	(0.291)	(0.346)	(0.398)	(0.268)	(0.048)
E Local polynomial									
2nd order	-0.298	-0.239	-0.658*	0.129	0.406*	-0.153	0.280	0.236	0.049
	(0.403)	(0.294)	(0.340)	(0.279)	(0.224)	(0.202)	(0.265)	(0.217)	(0.044)
F Global polynomial regressions									
Polynomial 1st order	-0.403**	-0.138	-0.098	0.072	0.132	-0.135	-0.155	0.018	0.011
	(0.158)	(0.098)	(0.136)	(0.163)	(0.141)	(0.112)	(0.103)	(0.125)	(0.024)

Polynomial 2nd order	-0.459** (0.198)	-0.009 (0.136)	-0.127 (0.199)	0.080 (0.199)	0.269 (0.189)	-0.080 (0.142)	-0.075 (0.146)	0.013 (0.132)	0.032 (0.030)
G Donut (excluding Hb value 10.9 and 11)	-0.007 (0.342)	-1.292*** (0.392)	-0.415 (0.439)	0.194 (0.436)	0.384 (0.313)	-0.146 (0.217)	0.192 (0.302)	0.186 (0.262)	0.034 (0.049)

Notes: N: Number of observations. Each cell represents a different regression. Unless otherwise indicated in Panels A-E the RD coefficients are estimated by fitting a local linear regression separately using a triangular kernel. All specifications allow for different slopes to the left and the right of the cutoff and standard errors are clustered at the school level. *, **, *** denote significance at the 10%, 5% and 1% level, respectively.

Table A.3: Minimal detectable effects for different bandwidth (no difference in outcome variable)

	Bandwidths						Effect size in other nutrition interventions
	0.3	0.5	1.0	1.5	2.0	2.5	
<i>Panel A: Child health and feeding practices</i>							
Dietary diversity	1.308	1.028	0.822	0.76	0.741	0.712	
Frequency of meat consumption	0.842	0.653	0.522	0.488	0.477	0.459	
Frequency of green vegetable consumption	1.627	1.37	0.997	0.888	0.848	0.809	
Hemoglobin	0.87	0.732	0.547	0.51	0.513	0.495	0.136* ¹ 0.151 ² 0.275 ³ 0.202** ⁴ 0.416** ⁴
<i>Panel B: Cognitive outcomes</i>							
Block design	1.254	0.829	0.65	0.62	0.581	0.552	0.012 ¹ 0.045 ²
Digit span forwards	1.205	0.894	0.592	0.574	0.541	0.518	-0.105 ¹ -0.135 ²
Digit span backwards	1.429	1.057	0.831	0.728	0.682	0.66	0.009 ¹ -0.23 ²
Progressive matrices	0.779	0.582	0.499	0.462	0.423	0.41	0.070 ¹ 0.112 ²
Day and night	1.457	1.121	0.861	0.749	0.71	0.676	0.116 ¹ 0.210 ²
Cognitive index	0.919	0.91	0.69	0.634	0.601	0.58	0.028 ¹ 0.058 ²
<i>Panel C: Educational outcomes</i>							
Math	1.273	1.054	0.79	0.729	0.701	0.663	0.112 0.197* ²
Reading	1.253	1.039	0.711	0.664	0.635	0.603	0.129 ¹ 0.182* ²
Attendance	0.265	0.19	0.156	0.147	0.143	0.136	-0.005 ¹

¹ Effect size from the evaluation of the school intervention by Krämer, Kumar, and Vollmer (2018).

² Effect size from the evaluation of the school intervention by Krämer, Kumar, and Vollmer (2018) at 90% school attendance.

³ Effect size in Luo et al. (2012), Information experiment 2.

⁴ Effect size in Luo et al. (2012), Experiments 1 and 2, multivitamin supplement treatment arm.

*, **, *** denote significance at the 10%, 5% and 1% level, respectively.