The Effects of Mainstreaming Nutrition and Early Childhood Development under BRAC's MNCH Programme

A Mixed-methods Impact Evaluation in Bangladesh

Thomas de Hoop, Fakir Md Yunus, Sabeth Munrat, Shelby Fallon, Farzana Sehrin, Joshua Sennett, Saira Parveen Jolly, Bachera Aktar and Ruhina Binta A Ghani

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ACRONYMS

AIR	American Institutes for Research
ANCOVA	Analysis of Covariance
ASQ	Ages and Stages Questionnaire
CSA for SUN	Civil Society Alliance for Scaling Up Nutrition
DFID	Department for International Development
ECD	Early Childhood Development
FAO	Food and Agriculture Organization
FCI	Family Care Indicator
IYCF	Infant and Young Child Feeding
MNCH	Maternal, Newborn, and Child Health
NEEP	Nutritional Embedding Evaluation Program
PSM	Propensity Score Matching
RCT	Randomised Controlled Trial
RIDIE	Registry for International Development Impact Evaluations
SS	*Shasthya shebhika*
SK	*Shasthya kormi*
WHO	World Health Organization

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EXECUTIVE SUMMARY

Malnutrition is one of the most serious global health problems. Stunting, wasting, and micronutrient deficiencies contribute to nearly 3.1 million child deaths annually (Black *et al.* 2013). In addition, more than 200 million children are not fulfilling their potential in cognitive development due to the high prevalence of stunting and the number of people living in absolute poverty (Grantham-McGregor *et al.* 2007).

BRAC Bangladesh is mainstreaming nutrition and early childhood development (ECD) under BRAC's Maternal, Newborn, and Child Health (MNCH) programme to enhance nutritional status and child cognitive and physical development. The nutrition component of the MNCH programme is designed to reduce malnutrition among pregnant-lactating women and young children. In some trial areas, the mainstreaming of nutrition is complemented with a comprehensive ECD intervention to improve knowledge of caregivers on how to stimulate the cognitive and physical development of children.

BRAC has mainstreamed nutrition under the MNCH programme since 2010. This component aims to fulfil its objectives through several strategies that focus on building the capacity of community health workers, establishing an effective community based integrated nutrition service delivery, and raising awareness and empowering communities to improve infant and young child feeding (IYCF) and breastfeeding practices. BRAC trains two types of community health workers (*Shasthya shebhikas* and *Shasthya kormis*) and BRAC programme staff in delivering messages about appropriate IYCF and breastfeeding practices.

To determine the impact of the mainstreaming of nutrition, we used a propensity score matching design that includes 1600 households with children under two years old in 40 beneficiary *mouzas* (administrative district that corresponds to a specific land area in Bangladesh) and 40 comparison *mouzas*. To identify the impact of the ECD programme on children's cognitive and motor skills and nutrition outcomes, we used a cluster-randomised controlled trial (RCT) that includes 3,120 households with children under two years old in 78 treatment *mouzas* and 78 control *mouzas*.

Our findings indicate that the mainstreaming of nutrition under BRAC's MNCH programme reduces the likelihood of stunting by seven percentage points, but we do not find evidence for positive programme impacts on reductions in stunting. The positive impacts appear to stem from improvements in the primary caregivers' bargaining power, IYCF practices, antenatal care, and postnatal care that are caused by the programme. However, we find no evidence that the programme improved breastfeeding practices. We find evidence that programme impact appears to depend on whether the primary caregiver has completed primary school; we find no evidence for positive programme impacts on either stunting or wasting for households with primary caregivers who have not finished primary school while the positive programme impacts on stunting appear to be almost exclusively driven by households with primary caregivers who have finished primary education at a minimum.

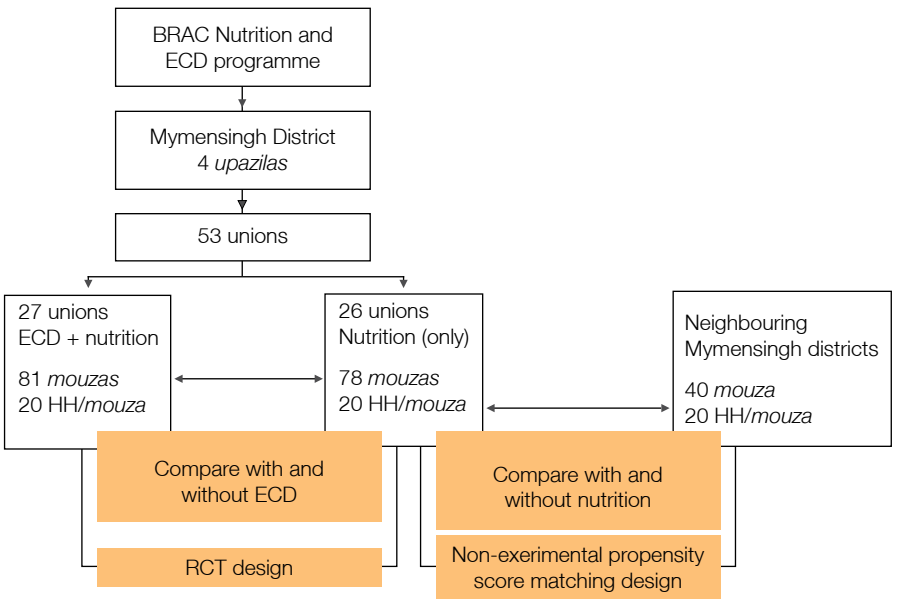
INTRODUCTION

BRAC's impact assessment group is partnering with American Institutes for Research (AIR) in designing and implementing a mixed-methods impact evaluation of the mainstreaming of nutrition and early childhood development (ECD) under BRAC's Maternal, Newborn, and Child Health (MNCH) programme in the district of Mymensingh in Bangladesh. AIR and BRAC are implementing a two-stage evaluation design that starts with an impact evaluation with baseline and end line data collection and then follows with process evaluation to inform programme design and implementation. To determine the impact of the nutrition component of the MNCH programme, we use a propensity score matching design that includes 1600 households with children less than two years old in 40 beneficiary *mouzas* (administrative units that correspond to a specific land area in Bangladesh) and 40 comparison *mouzas*. To identify the impacts of the ECD programme on children's cognitive and motor skills and nutrition outcomes, we use a cluster-randomised controlled trial (RCT) that includes 3,120 households with children less than two years old in 78 treatment *mouzas* and 78 control *mouzas*.

This report presents the results of the impact evaluation of the mainstreaming of nutrition under BRAC's MNCH programme and the baseline results of the impact evaluation of BRAC's ECD programme in Mymensingh, Bangladesh. The purpose of the evaluation is to learn if and how the programmes impact the lives of pregnant women and children less than two years old for an array of outcomes including infant and young child feeding (IYCF) practices, breastfeeding practices, antenatal and postnatal care seeking behaviours, parenting practices, anthropometric outcomes and children's cognitive and motor skills. For this purpose we examine the outcomes along the causal chain of the theory of change of mainstreaming nutrition and ECD under the MNCH programme as well as the assumptions underlying the theory of change. The evaluation of BRAC's ECD programme is a two-year mixed-methods cluster-RCT, while the evaluation of the nutrition component of BRAC's MNCH programme in Mymensingh is a two-year mixed-methods non-experimental design.

Figure 1 below summarises the evaluation design for both the cluster-RCT to determine the impact of BRAC's ECD programme and the non-experimental design to determine the impact of mainstreaming nutrition under BRAC's MNCH programme. We randomly assigned the ECD programme to 27 of the 53 eligible unions (the smallest local government units in Bangladesh) and then randomly selected three *mouzas* per union and 20 households (with children under two years old) per *mouza* in those 27 unions for the household-level data collection. We also randomly selected three *mouzas* per union and 20 households per *mouza* in the 26 remaining control unions. Importantly, each of the 53 eligible unions already received the nutrition component of the MNCH programme before the random assignment. The mainstreaming of nutrition under BRAC's MNCH Programme started in 2010. To identify the impact of the nutrition component of the MNCH programme we selected comparison *mouzas* in the neighbouring districts of Mymeningh. These districts include Gazipur, Jamalpur, and Kishoreganj.

Fig 1.
Summary evaluation design



BACKGROUND

Malnutrition is one of the most serious global health problems. Stunting, wasting, and micronutrient deficiencies contribute to nearly 3.1 million child deaths annually (Black *et al*. 2013). Advancing the knowledge base about the effects of nutrition and ECD programmes on nutrition outcomes is particularly important in Bangladesh. Although Bangladesh has established itself as an emerging economy with a vibrant growth rate and promising future prospects, the country has been less successful in combating malnutrition: in 2014, 33% of the children aged below five years were underweight (inadequate weight for age), 36.1% were stunted (inadequate length/height for age), and 14.3% were wasted (inadequate weight for height) (Bangladesh Demographic and Health Survey, 2013; International Food Policy Research Institute, 2015).

Although households and individuals from all geographic areas and economic groups in Bangladesh are affected by malnutrition, the highest prevalence rates are found in rural areas, urban slums and in the poorest economic quintile. The national anaemia survey from 2013 reported that the prevalence of anaemia among Bangladeshi preschool age children is 33%, and is highest in rural areas (37%) (International Centre for Diarrhoeal Disease Research, UNICEF, GAIN and IPHN 2013). Alam *et al*. (2010) also report that in rural Bangladesh nearly one third of adolescent girls (aged 13-18) suffer from chronic energy deficiency and almost half of them are stunted.

The growth and development of young children are fundamental for their future. Stunting, wasting and underweight are signs of undernutrition, which presents significant threats to human health including increased risk of mortality (Black *et al*. 2008; Black *et al*. 2013). Undernutrition puts children at an increased risk of death and severe illness due to common childhood infections, such as pneumonia, diarrhoea, malaria, HIV and AIDS and measles. A child who is severely underweight is 9.5 times more likely to die of diarrhoea than a child who is not, and for a stunted child the risk of death is 4.6 times higher (UNICEF 2013). Undernutrition also leads to impaired cognitive development so nutrition and ECD outcomes are associated with each other (Bardham *et al*. 2013). Further evidence shows that undernutrition can result in decreases in school enrolment (Miguel and Kremer 2004; Martorell *et al.* 2010) and subsequent losses in labour productivity

(Baird *et al.* 2015). Studies among cohorts of children from Brazil, Guatemala, India, the Philippines and South Africa and long-term evidence from Guatemala also indicate that stunting is significantly associated with and may cause reductions in learning outcomes (Maluccio *et al.* 2009; Martorell *et al.* 2010). This evidence demonstrates the importance of designing and implementing development programmes that are effective in improving nutrition outcomes.

The consequences of undernutrition are particularly severe during children's first 1,000 days of life (Almond and Currie 2010). Medical literature indicates that in utero development is strongly associated with outcomes later in life (Barker 1993). Furthermore, evidence from Brazil, Guatemala, India, the Philippines and South Africa indicates that weight gain during the first two years of life improves school performance later on in childhood, but there appears to be no relationship between weight gain after the first two years of life and school performance (Martorell *et al.* 2010). Barham *et al.* (2013) also show that a conditional cash transfer programme in Nicaragua had strong positive effects on the cognitive development of children who were exposed to the programme starting in utero and up to age two 7 years after the introduction of the conditional cash transfer programme.

Optimal IYCF practices can also contribute to improvements in nutrition outcomes. IYCF include initiating breastfeeding within one hour of birth, exclusive breastfeeding for the first six months of life and continued breastfeeding up to the age of two. In addition, breastfeeding needs to be complemented with complementary feeding practices starting at six months of age. For children under six months old breast milk contains all the nutrients that an infant requires. In fact, the risk of dying from pneumonia and diarrhoea is more than 10 times as likely for infants who are not breastfed compared to children who are exclusively breastfed (UNICEF 2013). Similarly, infants who are not breastfed are 14 times more at risk of death than exclusively breastfed children (Black *et al.* 2008).

For infants older than six months, reduced dietary diversity is also a strong predictor of stunting in rural Bangladesh. The inclusion of a variety of food groups into complementary foods thus contributes significantly to improvements in child nutritional status (Rah *et al.* 2010). Several studies demonstrate evidence for reductions in stunting and better health outcomes that result from appropriate, adequate and safe complementary foods for children of 6 months and older (Bhutta *el al.* 2008; Dewey and Seth 2011). A recent WHO study across 14 low-income countries also found evidence for reductions in the risk of stunting and underweight as a result of the introduction of a minimum acceptable diet with dietary diversity (Bhutta *et al.* 2013). Unfortunately, however, complementary foods are often introduced too early or too late or with insufficient quality and quantity. Mothers' nutritional status before and during pregnancy also influences maternal and child outcomes as maternal malnutrition leads to poor fetal growth and low birthweight.

Community-based interventions to improve maternal, newborn, and child health are now widely recognised as important strategies to deliver key maternal and child survival interventions (Haines *et al.* 2007). In these programmes, a full spectrum of care is delivered

including provision of basic antenatal, natal, and postnatal care, as well as preventive essential newborn care and breastfeeding counselling. Interventions to improve maternal nutrient intake include supplementation with iron, folic acid or multiple micronutrients and provision of food and other supplements where necessary. Evidence suggests that supplementation with multiple micronutrients, such as iron, zinc and folic acid, during pregnancy is associated with increases in birthweight of approximately 10 per cent in low-income countries (Fall *et al.* 2009). Community-based education and communication programmes can also encourage appropriate behaviours to improve nutrition. However, while 81 per cent of pregnant women benefit from at least one antenatal visit globally (UNICEF 2012), the coverage of specific interventions and the quality of antenatal care are variable. In Bangladesh, only 55% of pregnant women report having at least one antenatal care visit and only 26% of pregnant women report having at least four antenatal care visits, which is the recommended number by the WHO (UNICEF 2013).

Studies consistently show that the behaviour of primary caregivers, cultural beliefs, and access to health care are important factors associated with under nutrition (Ayaya *et al.* 2004). In Bangladesh, cultural norms present a challenge to decreasing undernutrition as these norms discourage the use of breast milk for the first three days after birth. The importance of cultural norms is exemplified by the low percentage of caregivers in Bangladesh who practice exclusive breastfeeding for the first six months of their child's life and the high percentage of caregivers who use complementary feeding practices in the first six months of life of their children (BDHS 2013). Several studies present evidence that programmes that included counseling or educational interventions increased the rate of exclusive breastfeeding for children less than six months old among mothers in low- and middle-income countries (Imdad *et al.* 2011; Haroon *et al.* 2013). Thus, increasing women's knowledge of appropriate practices to improve the nutrition of their children and the rest of the family may be an important step towards changing their behaviour. Programmes that focus on behaviour change may contribute to decreases in stunting and the prevalence of underweight among children <2 years old. However, it is important to not only target primary caregivers, particularly in the context of Bangladesh. White and Masset (2007) demonstrate that behaviour-change focused nutrition programmes in Bangladesh may not be successful if they only target primary caregivers with limited decision-making power. In Bangladesh, mothers-in-law may have more decision-making power about breastfeeding and IYCF practices than primary caregivers (White and Masset 2007).

To evaluate the mainstreaming of nutrition under BRAC's MNCH programme we rely on a similar approach as in the evaluations of the Alive & Thrive (A&T) programme in Bangladesh and other countries (Menon *et al.* 2014; Frongillo *et al.* 2016). These evaluations rely on a theory-based approach in which indicators are developed on the basis of a comprehensive theory of change, control or comparison groups are determined in a rigorous manner and impact evaluations are complemented by process evaluations in order to assess the process of implementation. The A&T programme (1) provided standards of service delivery, supervision and coaching, and incentives to service providers in order to improve the supply of quality IYCF services and (2) targeted pregnant women, mothers of

children under two, family members, peers, and community leaders through harmonised messages, community mobilisation, interpersonal communication, and media outreach to increase demand and practice. Evaluation results showed that the activities such as home visits, antenatal care sessions and postnatal care visits, health forums, community mobilisation sessions, and media campaigns led to increased counseling on IYCF practices and increased exposure to IYCF messaging. These outputs in turn led to improved practices in exclusive breastfeeding, as well as enhanced minimum dietary diversity and strengthened health systems (Menon *et al.* 2014). Furthermore, results indicate that the programme had a positive effect on children's language and motor development (Frogillo *et al.* 2016). However, the results of the evaluation did not demonstrate evidence for reductions in stunting and wasting as a result of the A&T programme (Menon *et al*. 2014). The current evaluation of the nutrition component of BRAC's MNCH programme serves to determine whether the programme resulted in reduction in stunting and wasting in addition to changes in behaviour. Furthermore, we will assess the additive effects of the ECD programme on nutrition and child development outcomes after subsequent rounds of household-level survey data collection.

Individual nutrition interventions with a focus on behaviour change have been the subject of careful evaluation work in various settings, including Bangladesh all of which has contributed to a strong evidence base for their effectiveness in improving nutrition outcomes. However, the evidence base for large-scale interventions such as BRAC's MNCH programme is much more limited, and the implementation and coordination challenges are considerable. A robust, mixed-methods evaluation, focusing on both impact and process, is therefore especially important in this context.

It is also crucial to derive global knowledge on how to create complementary effects of nutrition and ECD programmes on nutrition and child development outcomes, particularly in Bangladesh. ECD refers to the development processes that occur during a child's first eight years of life and can be considered a strong predictor of a child's developmental trajectory. (Evans, Meyers, and Ilfeld 2000) ECD contributes to all domains of a child's life including physical and social development and mental improvement. (Irwin, Siddiqi, and Hertzman 2007). However, in Bangladesh caregivers seldom have enough knowledge about adequate caregiving practices (Chinen *et al*. 2014).

Observational studies have found that parent stimulation behaviours are associated with children's later cognitive skills, both in the United States and in developing countries (Barros, Matijasevich, Santos, and Halpern 2010; Bradley RH, Corwyn RF, Burchinal M, McAdoo HP, Coll 2001; Lugo-Gil and Tamis-LeMonda 2008; McLoyd 1998; Phillips and Shonkoff 2000; Zaslow *et al*. 2006), which suggests that improving parent-child interactions may increase children's cognitive skills. Furthermore, some programmes that are effective in improving nutrition outcomes may have positive effects on children's cognitive skills. However, evidence from Mozambique suggests that this may not always be the case for ECD programmes without a nutrition component. The preschool programme showed strong positive effects on children's cognitive skills, but the study

did not find evidence for positive and statistically significant effects on anthropometric outcomes (Martinez *et al.* 2012).

A number of parenting interventions have been implemented in developing countries, including Bangladesh, to encourage parents to engage in supportive and stimulating interactions with their children. In a comprehensive literature review of parenting interventions in low- and middle-income countries (which were designed to promote development in children less than four years old through stimulation), almost all studies found positive effects on child developmental outcomes (20 out of the 21 studies that measured this outcome), and most found positive effects on parenting practices as well (14 out of the 16 studies with this outcome) (Baker-Henningham and Boo 2010). The review found that the most disadvantaged children tended to benefit most from these interventions. The authors caution, however, that the studies they reviewed were small-scale efficacy studies with intensive training and implementation support, which means that the findings may not generalise to scaled-up programmes.

Evaluations of Bangladeshi parenting interventions have also found positive effects on children's cognitive skills. One of the studies (Hamadani *et al*. 2010) randomly assigned communities to either a control group or a group that received a stimulation-focused parenting intervention (with regular group meetings as well as regular home visits to mothers). The study found positive impacts on children's cognitive skills and mothers' knowledge about parenting, although there was no effect on children's nutrition status or growth. Other studies of similar parenting programmes targeted at severely malnourished Bangladeshi children found that the parenting intervention had positive effects on both children's cognitive outcomes and child weight for age in comparison with a time-lagged control group of malnourished children in the same location the year before the intervention (Nahar *et al*. 2012). However, there is currently insufficient evidence about the complementary effects of ECD and nutrition programmes on child development and nutrition outcomes. We will examine these complementary effects in more detail in the current study.

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PROGRAMME DESCRIPTION

THE MAINSTREAMING OF NUTRITION UNDER BRAC'S MATERNAL, NEWBORN, AND CHILD HEALTH PROGRAMME

The nutrition component of the MNCH programme is designed to reduce malnutrition among pregnant-lactating women and young children. Its goal is to reduce mortality and morbidity, particularly among poor and socially excluded populations. In some trial areas, the mainstreaming of nutrition is complemented with a comprehensive ECD intervention to improve knowledge of caregivers on how to stimulate the cognitive and physical development of children by, for example, emphasising the importance of good parenting practices. The mainstreaming of nutrition under BRAC's MNCH Programme started in Mymensingh in 2010 . BRAC implements the MNCH programme in 14 districts, but this study only estimates the impact of the programme in the district of Mymensingh

The nutrition component of the MNCH programme aims to fulfil its objectives through several strategies that focus on building the capacity of community health workers, establishing an effective community based integrated nutrition service delivery, and raising awareness and empowering communities to improve feeding practices. To achieve these objectives BRAC trains two types of community health workers, *Shasthya shebhikas* and *Shasthya kormis*. *Shasthya kormis* are professional community health workers. *Shasthya Shebhikas* can be considered volunteer community health workers, but are incentivised to conduct home visits by financial rewards that depend on their performance to a certain extent. *Shasthya shebhikas* and *Shastya kormis* are supposed to visit households with children up to 12 months every month and households with children up to 24 months every 3 months.

In addition to the health workers, BRAC programme staff also delivers messages about appropriate infant and young child feeding and breastfeeding practices. These messages are delivered in three ways:

- Interpersonal communication through home visits

- Health forum (including a courtyard session)
- Social mobilisation (social gathering)

The messages focus on several areas associated with improvements in nutrition outcomes. These areas include iron, zinc, folic acid, and Vitamin A supplementation, micronutrient supplementation, promotion of best practices in breastfeeding and complementary feeding, promotion of diverse diets for pregnant and lactating women, growth monitoring, and the promotion of antenatal and postnatal care visits. Home visits are an important component of the messages.

Community health workers also keep track of all deliveries in their catchment areas. The community health workers record the name of all births in their registers and maintain a follow-up system for all children up to five years of age. Community health workers also provide postnatal care through home visits. During these visits they check mothers and babies for physical problems and teach mothers and caregivers about maternal care and nutrition, newborn care, and breastfeeding. During the very first postnatal care visit within 48 hours, community health workers weigh the baby. Primary caregivers are then taught about special care (frequent breast feeding, thermal care and infection prevention) if the baby weighs less than 2.5 kg. Community health workers also ensure intake of vitamin 'A' supplementation by the mothers after delivery.

The antenatal and postnatal care visits of community health workers also serve for counselling on maternal nutrition. The mothers receive counselling on appropriate IYCF practices, exclusive breastfeeding, and the preparation of home based age specific complementary food for infants of six months and older. In addition, the mothers receive training about the preparation of low-cost age-specific balanced diets using locally available foods. Community health workers are supposed to follow-up with each infant once in every month and each child aged 1 to 5 years once in every four months. The community health workers monitor each child's development against milestones following a checklist during home visits. Under the MNCH programme, community health workers are responsible for several other tasks in addition to antenatal and postnatal care and communicating about IYCF practices. BRAC implements a different nutrition programme outside our study area, in which community health workers are solely responsible for nutrition messaging and antenatal and postnatal care.

BRAC'S EARLY CHILDHOOD DEVELOPMENT PROGRAMME

In some trial areas, the nutrition component of the MNCH programme is complemented with a comprehensive ECD intervention to improve knowledge of caregivers on how to stimulate the cognitive and physical development of children. The ECD programme stimulates cognitive development by building the capacity of ECD promoters and community health workers, for example by training ECD promoters in delivering messages about parenting practices.

ECD promoters also provide parenting counseling to expecting couples. These trainings take place during the 1st, 2nd and 3rd trimester of the pregnancy. The parenting counseling sessions focus on maternal nutrition, maternal mental health, the development of the fetus, effects of maternal health and care on fetal and child development, the importance of ECD and the role of the father and other family members.

After the delivery, community health workers also educate parents and caregivers of the newborns on interactive care to stimulate proper growth and development of the neonates. The components of parenting education focuses on maternal nutrition, maternal mental health, mother-child interaction, development against milestones; and age specific interactive care and stimulation for child development. In addition, community health workers teach primary caregivers massage and bathing techniques through practical demonstrations.

BRAC also organises group meetings for primary caregivers to teach them about parenting. These so-called courtyard sessions focus on parenting for children aged 1-36 months old. The courtyard sessions are run by an adolescent girl selected in consultation with the community and trained as ECD counselor to run the parenting sessions. BRAC organises separate sessions for parents of children of 1 to 6 months old, 7 to 12 months old, 13 to 24 months old and 25 to 36 months old. The training consists of practical demonstrations of appropriate, age-specific interactive care with an emphasis on child development and nutrition. In the group sessions the ECD counselors play the role of a facilitator. They help the parents to prepare low-cost toys and other learning materials. The parenting education focuses on mother-child interaction, development against milestones; age-specific interactive care and feeding, stimulation and play for child development, injury prevention, and disability.

BRAC also sets up temporary playing centres in the courtyard in consultation with parents of children aged 13-36 months. Each playing centre moves by rotation to different corners of the community in line with community preferences. Young mothers are then trained to assist the ECD promoters in managing the playing centres. Each centre operates twice a week. During this time children of the appropriate age group obtain the opportunity to play with age-appropriate materials to stimulate their development.

Importantly, the ECD programme does not serve to replace the nutrition component of BRAC's MNCH programme. The theories of change underlying the programmes suggest that the programmes can create synergies with each other. We will discuss these theories of change in more detail in the next section.

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THEORY OF CHANGE

BRAC and AIR believe that policy-relevant research and evaluation should be based on a theory of change that maps out the causal chain between activities, inputs, outputs, outcomes, and impacts, as well as the assumptions underlying the theory of change (White 2009). To motivate our study design, we developed a theory of change that covers both intermediate improvements in the knowledge and practices of primary caregivers and the final nutrition and early childhood development outcomes. We developed the theory of change based on discussions with BRAC programme staff and first presented the theory of change during a presentation of the evaluation design in Dhaka. We present the theory of change underlying the nutrition component of BRAC's MNCH programme in Fig 2.

The theory of change shows that the nutrition component of BRAC's MNCH programme can positively affect children's nutrition and child development outcomes through multiple pathways. First, the training of community health workers, both *Shasthya shebhikas* and *Shasthya kormis*, can contribute to the knowledge and capacity of community health workers on how to encourage primary caregivers to adopt appropriate IYCF and breast-feeding practices. Home visits by community health workers can, in turn, increase the knowledge of primary caregivers about these practices as well as the number of antenatal and postnatal care visits. Next, improvements in knowledge can result in the adoption of appropriate IYCF, and breastfeeding practices by primary caregivers. These changes in behaviour can then lead to improvements in children's health, and child development outcomes, which can eventually result in improvements in children's anthropometric outcomes, such as the likelihood of stunting and wasting.

There are, however, several assumptions that underlie these mechanisms. For example, women need to have sufficient time available and sufficient bargaining power in the household to adopt the nutrition, infant and young child feeding, and breastfeeding practices that are recommended by community health workers. In addition, water and sanitation practices should not reverse the positive effects of the programme on nutrition outcomes. It is also important that *Shasthya shebhikas* and *Shasthya kormis* have sufficient incentives to conduct home visits in order to be able to provide messages

about infant and young child feeding practices, breastfeeding practices, and antenatal and postnatal care visits.

There are also several factors that could affect the effects of mainstreaming nutrition under BRAC's MNCH programme. We include these factors as moderators in the theory of change. The effect of the nutrition component of BRAC's MNCH programme could, for example, be different for children of different age groups or by gender.

In addition to the theory of change underlying the mainstreaming of nutrition we also present a theory of change underlying the ECD programme. The ECD programme can contribute to improvements in nutrition and child development outcomes through improvements in parenting practices. Specifically, the ECD programme trains ECD promoters and community health workers in delivering messages about appropriate parenting practices during home visits and sets up temporary playing centres. Home visits by ECD promoters and community health workers can, in turn, increase the knowledge of primary caregivers about parenting practices. Next, improvements in knowledge can result in the adoption of appropriate parenting practices by primary caregivers. These changes in behaviour can then lead to improvements in child development outcomes, which can eventually result in improvements in children's anthropometric outcomes. Furthermore, the temporary playing centres can contribute directly to improvements in children's cognitive and motor skills.

In addition, community health workers provide antenatal care and postnatal during the home visits. During these visits the community health workers check mothers and babies for physical problems and teach mothers and caregivers about maternal care and nutrition, newborn care, and breastfeeding. Hence, the antenatal and postnatal care visits can also influence nutrition outcomes through additional education and care for mothers of newborn children. We present the theory of change underlying the ECD programme in Figure 3. The theory of change is essentially an extension of the theory of change underlying the nutrition component of the MNCH programme because BRAC believes that the implementation of the ECD programme can increase the effectiveness of mainstreaming nutrition under the MNCH programme.

Just like for the nutrition component of the MNCH programme there are several assumptions that underlie the mechanisms presented in the theory of change of the ECD programme. Perhaps most importantly, it is not straightforward that improvements in parenting practices translate into improvements in child development outcomes. Furthermore, improvements in child development outcomes may not translate into improvements in nutrition outcomes.

To identify the outcome measures for the impact evaluation, we defined indicators for each step along the causal chain of the theory of change of the nutrition component of BRAC's MNCH programme and BRAC's ECD programme. These indicators include measures of the knowledge and behaviour of primary caregivers as well as the health, nutrition, and early childhood development outcomes of each child of 0-24 months old. We present these indicators in Table 1.

Table 1. Indicators

Definition of Impact Indicators	Definition and Unit (If Applicable)
Stunting: Nutritional status of children 0–24 months old	Anthropometric indicator of z-score of height for age
Undernutrition: Nutritional status of children 0–24 months old	Anthropometric indicator of z-score of weight for age
Wasting: Nutritional status of children 0–24 months old	Anthropometric indicator of z-score of weight for height
Early Cognitive Development of Children 0-24 Months Old	Index of early cognitive development based on ages and stages questionnaire
Gross Motor Development of Children 0-24 Months old	Index of gross motor development based on ages and stages questionnaire
Fine Motor Development of Children 0-24 Months old	Index of fine motor development based on ages and stages questionnaire
Diarrhoea incidence of children 0–24 months old	Diarrhoea occurrence in last 2 weeks of children under 2 years old
Fever incidence of children 0–24 months old	Fever occurrence in last 2 weeks of children under 2 years old
Upper respiratory illness incidence of children 0–24 months old	Occurrence of cough with rapid breathing in last 2 weeks
Early initiation of breastfeeding	Proportion of children 0–24 months old who were put to the breast within 1 hour of birth
Exclusive breastfeeding under 6 months	Proportion of infants 0–5 months old who are fed exclusively with breast milk
Continued breastfeeding at 1 year	Proportion of children 12–24 months old who are fed breast milk
Introduction of solid, semi-solid or soft foods	Proportion of children 6–24 months old who started complementary feeding at 6 months of age
Minimum dietary diversity	Proportion of children 6-24 months old who receive complementary food from 4 or more food groups
Intake of multiple micronutrient supplements, such as iron and folate	Proportion of children 6–24 months old who take multiple micronutrient supplements, such as iron, zinc and folate
Fully vaccinated	Proportion of children 12–24 months old who have received BCG (Bacillus Calmette–Guérin vaccine; 1 dose), OPV (oral polio vaccine; 3 doses), DPT (diphtheria, pertussis, and tetanus; 3 doses), and measles vaccination (1 dose)
Antenatal care	Proportion of mothers who sought antenatal care from a health professional Proportion of mothers who sought antenatal care from a health professional at least 4 times

[Table 1. contd...]

[...Table 1. contd]

Definition of Impact Indicators	Definition and Unit (If Applicable)
Knowledge about early initiation of breastfeeding	Proportion of respondents who report children should be put to the breast within 1 hour of birth
Knowledge about exclusive breastfeeding under 6 months	Proportion of respondents who report children under 6 months should be exclusively breastfed
Knowledge about exclusive breastfeeding	Proportion of respondents who report correct definition of exclusive breastfeeding
Knowledge about introduction of solid, semi-solid or soft foods	Proportion of respondents who have knowledge of complementary feeding
Knowledge about minimum meal frequency	Proportion of respondents who report the correct number of times a child should be fed
Knowledge about minimum dietary diversity	Proportion of respondents who report children 6–24 months old should receive food from four or more food groups

Fig 2.

Theory of change mainstreaming nutrition under BRAC's maternal, newborn, and child health programme

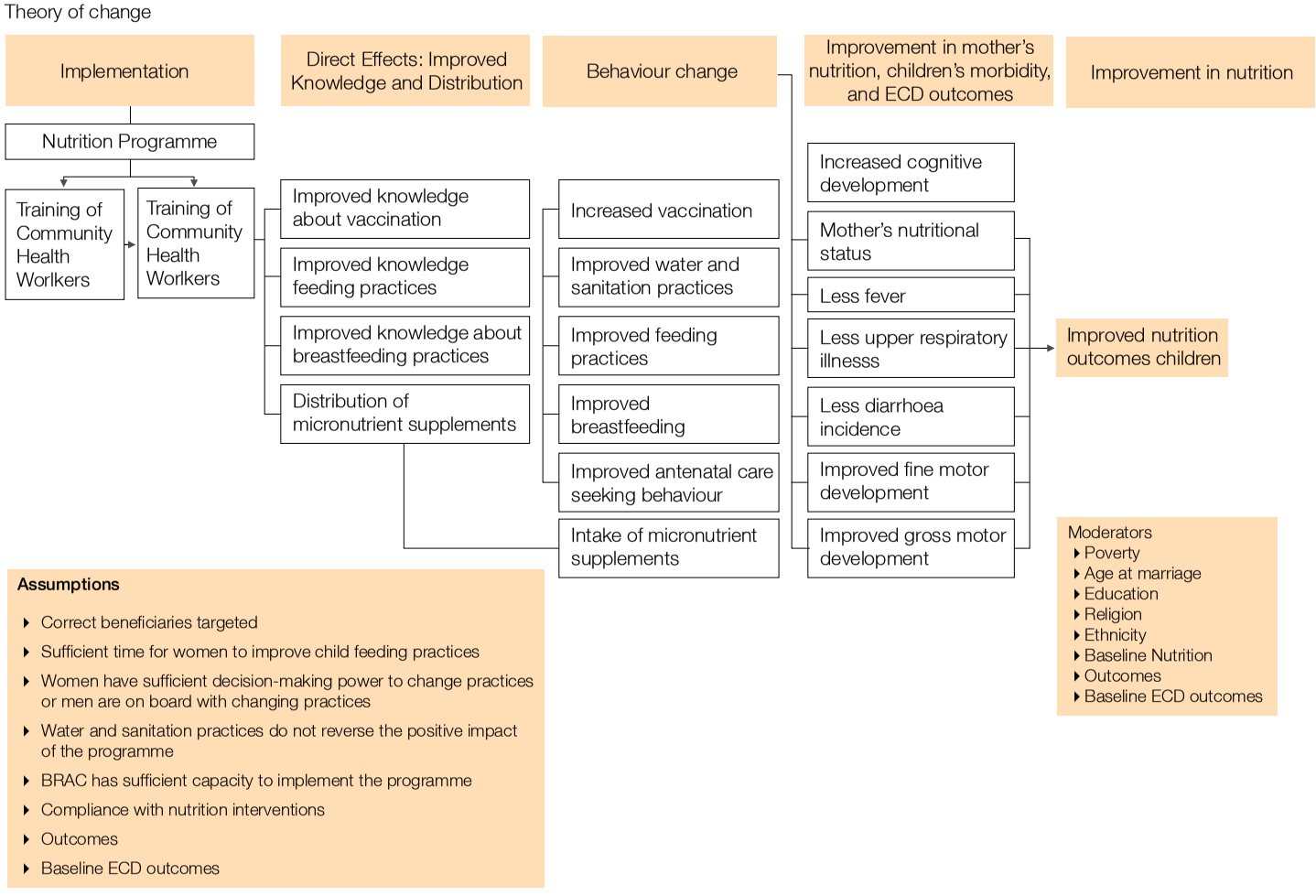
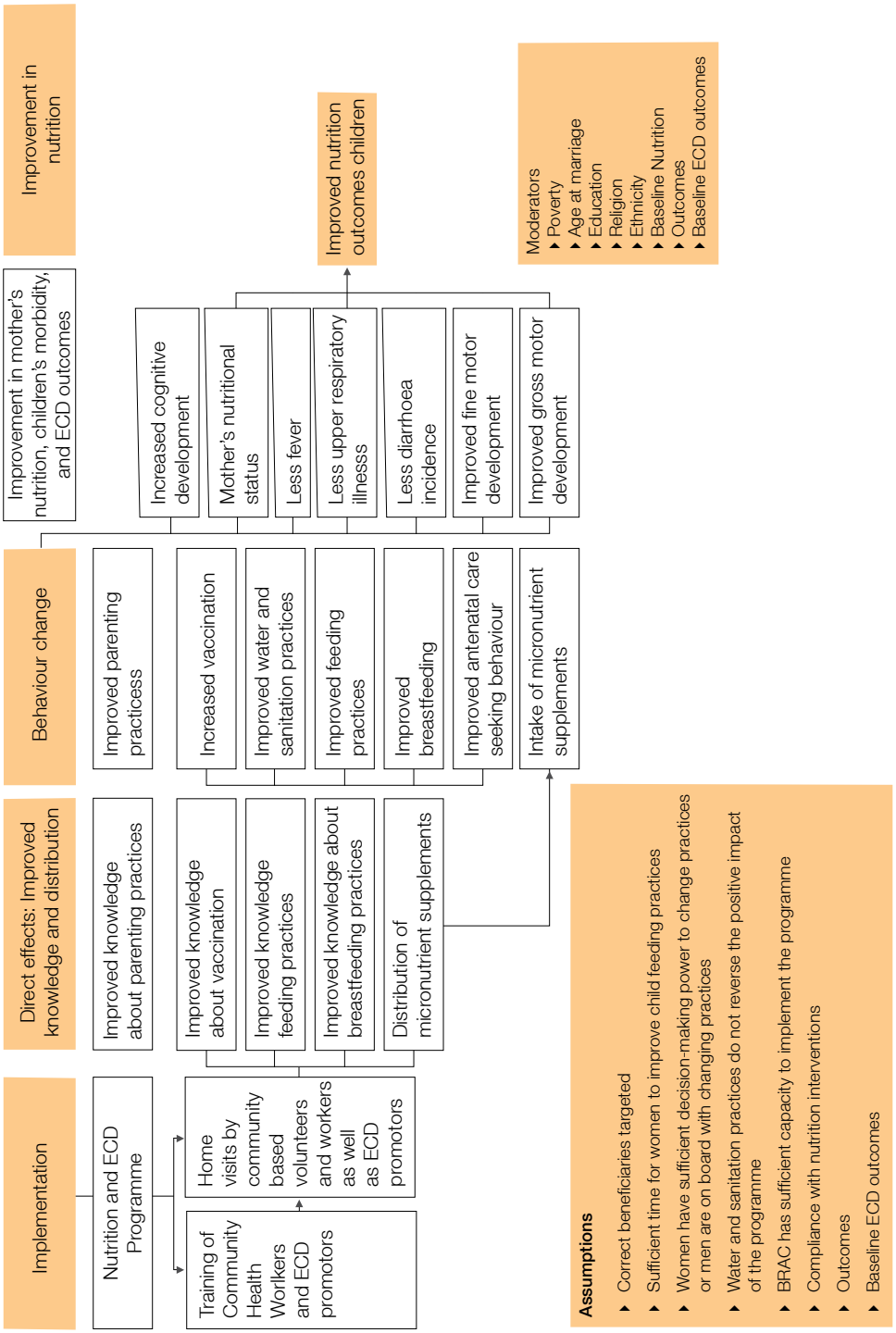


Fig 3.
Theory of Change BRAC's ECD and Nutrition Programme

Theory of change



EVALUATION QUESTIONS

The research questions that guide the evaluation are based on the theory of change. They fall into three categories:

Impact of the nutrition programme along the causal chain of the theory of change

1. Nutrition outcomes
   - What is the effect of the nutrition component of BRAC's MNCH programme on children's nutrition outcomes?

2. Children's Development
   - What is the effect of the nutrition component of BRAC's MNCH programme on children's development?

3. Dietary Diversity
   - What is the effect of the nutrition component of BRAC's MNCH programme on dietary diversity?

4. Food Security
   - What is the effect of the nutrition component of BRAC's MNCH programme on food security?

5. Adequate Caregiving Practices
   - What is the effect of the nutrition component of BRAC's MNCH programme on infant and young child feeding practices?
   - What is the effect of the nutrition component of BRAC's MNCH programme on breastfeeding practices?
   - What is the effect of the nutrition component of BRAC's MNCH programme on antenatal and postnatal care seeking behaviour?

- What is the effect of the nutrition component of BRAC's MNCH programme on parenting practices?

Impact of the ECD Programme Along the Causal Chain of the Theory of Change

1. Nutrition outcomes
   - What is the complementary effect of BRAC's ECD programme on children's nutrition outcomes?

2. Children's Development
   - What is the complementary effect of BRAC's ECD programme on children's development?

3. Dietary Diversity
   - What is the complementary effect of BRAC's ECD programme on dietary diversity?

4. Food Security
   - What is the complementary effect of BRAC's ECD programme on food security?

5. Adequate Caregiving Practices
   - What is the complementary effect of BRAC's ECD programme on infant and young child feeding practices?
   - What is the complementary effect of BRAC's ECD programme on breastfeeding practices?
   - What is the complementary effect of BRAC's ECD programme on antenatal and postnatal care seeking behaviour?
   - What is the complementary effect of BRAC's ECD programme on parenting practices?

Fidelity of Implementation of BRAC's nutrition and ECD programmes

1. Is the nutrition component of BRAC's MNCH programme implemented as planned?
   - What are the challenges to implementing the nutrition component of BRAC's MNCH programme as planned?

2. Is BRAC's ECD programme implemented as planned?
   - What are the challenges to implementing BRAC's ECD programme as planned?

EVALUATION DESIGN

EARLY CHILDHOOD DEVELOPMENT PROGRAMME EVALUATION: A CLUSTER-RANDOMISED CONTROLLED TRIAL DESIGN

We implemented a cluster-RCT design to determine the impact of the ECD programme, where 27 of the 53 eligible unions are randomly assigned to the ECD programme or control group (where the nutrition programme will continue to be implemented just like in the treatment group). BRAC programme staff had selected 4 *upazilas* with 53 Unions that were eligible for the ECD programme before the random assignment.

A well-designed and well-implemented RCT is the most powerful research design for drawing conclusions about the impact of development programmes on specific outcomes. An RCT draws from a pool of comparable geographic areas and then randomly assigns some to a treatment group that receives the intervention and others to a control group that does not receive the intervention, against which comparisons can be made. An RCT permits us to directly attribute any observed differences between the treatment and control households to the intervention; otherwise, other unobserved factors, such as motivation, could have influenced members of a group to move into a treatment or a control group (Duflo, Glennester and Kremer 2007). To increase comparability across the treatment and control, we stratified by *upazila*. In other words, we randomly assigned unions within *upazila*.

Following the random assignment, we randomly sampled three *mouzas* for the data collection in each of the selected unions.[1] We determined the sample size on the basis of power calculations for a three-level cluster-randomised controlled trial where households

[1] Of the beneficiary unions one union only included two *mouzas* and another union only included one *mouza*. For these unions we sampled 20 households in each of the *mouzas* in the union. As a result the number of *mouzas* in the treatment and the control group is equal for the cluster-randomised controlled trial of the ECD programme.

are clustered within *mouzas* and *mouzas* are clustered within unions. On the basis of our sample of 3,120 households in 156 *mouzas*, we have 80 per cent power for detecting a treatment effect of 0.19 SMD when we assume an intraclass correlation of 0.001 for *mouzas* clustered in unions, 0.10 for households clustered in *mouzas*, an R-squared of 0.20 and account for stratification at the *upazila* level. We based the estimates of the intraclass correlations on the data on stunting and wasting collected for the impact evaluation of Save the Children's early childhood stimulation programme in Bangladesh (Chinen *et al.* 2014).

We used a two-stage design for the sampling of households within *mouzas*. Of the *mouzas* that only include one village we randomly sampled 20 households with children under two years old per *mouza*. However, several of the *mouzas* in our sample are comprised of more than one village. In those cases we randomly sampled 10 households per village in *mouzas* that consist of two villages. In *mouzas* that consist of three villages we randomly sampled seven households in the two villages with the largest population and six households in the *mouzas* with the smallest population. Of the *mouzas* with more than three villages we first randomly sampled three villages and then used the same sampling approach as in the *mouzas* with three villages.

THE IMPLACT OF THE NUTRITION COMPONENT OF BRAC'S MATERNAL, NEWBORN, AND CHILD HEALTH PROGRAMME: A PROPENSITY SCORE MATCHING DESIGN

Propensity score matching can be considered a good alternative for assessing the impact of development programmes if randomisation is not feasible or desirable, particularly when the risk of selection bias is small and a host of baseline characteristics that help explain the outcome measure of interest are available for beneficiaries and non-beneficiaries. The basic idea of propensity score matching is that the impact of a development programme can be determined by comparing the outcomes of beneficiaries with the outcomes of non-beneficiaries who resemble the beneficiaries on observable characteristics. Such matching involves comparing beneficiaries and non-beneficiaries who are comparable in terms of observable characteristics.

To identify the impact of the mainstreaming of nutrition under the MNCH programme, we use a similar propensity score matching strategy as Newman *et al.* (2002) in their evaluation of the impact of the Bolivian social investment fund. We rely on Bangladeshi Census data to match beneficiary *mouzas* to *mouzas* in neighbouring districts with similar observable characteristics. These characteristics include *mouza*-level census data on the population size, the sex ratio among the population, the average household size, the percentage of the population in specific age groups, marriage and divorce rates, literacy rates for men and women, education attendance rates for boys and girls in different age groups, disability rates, employment rates across agriculture, industry, and services, the ethnic and religious composition of the population, the quality of housing, access to clean water and sanitation, the percentage of the population with electricity, and house

ownership rates. The census data are surprisingly rich, which gives us the opportunity to match the beneficiary *mouzas* to statistically identical comparison *mouzas*. We will describe our propensity score matching strategy in more detail in the next section.

Matching and sampling with census data

We relied on census data from the districts of Mymensingh, Gazipur, Jamalpur, and Kishoreganj districts and BRAC's administrative data about the allocation of the nutrition component of the MNCH programme to select appropriate comparison *mouzas* for the impact evaluation of the mainstreaming of nutrition under the MNCH programme. For this purpose we first created a *mouza*-level dataset with descriptive statistics using publicly available census data in pdf format, which we transferred to Excel and Stata.

To identify comparison *mouzas* we selected *mouzas* from the districts of Gazipur, Jamalpur, and Kishoreganj because these districts are neighbouring districts of Mymensingh. Stratification by geographic area can contribute to increasing the performance of propensity score matching in identifying an appropriate counterfactual. Thus, the stratification will contribute to the identification of an appropriate counterfactual. Originally, we also anticipated including Census data from the districts of Netrokona and Sherpur in the analysis because these districts neighbour Mymensingh as well. However, the *mouzas* in Netrokona and Serpur are not likely to be as comparable to the relevant districts in Mymensingh as the *mouzas* in Gazipur, Jamalpur, and Kishoreganj. We decided to exclude Netrokona and Serpur from the analysis because the districts do not neighbour the *upazilas* that were eligible for BRAC's ECD programme.

We also relied on BRAC's administrative data to identify appropriate comparison *mouzas*. First, we only considered *mouzas* that benefit from BRAC's EHC programme as appropriate comparison *mouzas* because BRAC's MNCH programme is an add-on to BRAC's EHC programme. Thus, *mouzas* that do not benefit from BRAC's EHC programme cannot be considered an appropriate counterfactual. Therefore, we excluded comparison *mouzas* that do not benefit from BRAC's EHC programme before the start of the propensity score matching procedure. Second, we only considered *mouzas* in Gazipur, Jamalpur, and Kishoreganj districts that do not benefit from the mainstreaming of nutrition under BRAC's MNCH programme as appropriate comparison *mouzas*. Some unions in the Gazipur, Jamalpur, and Kishoreganj districts, however, also receive BRAC's MNCH programme. We excluded these unions before the start of our propensity score matching procedure. We also excluded the beneficiary *mouzas* of the ECD programme before the start of our propensity score matching procedure. These *mouzas* can still be considered appropriate areas to determine the impact of the nutrition component of BRAC's MNCH programme before the start of the ECD programme. However, we decided to exclude these areas from the analysis before the start of the propensity score matching because we will no longer be able to rely on the data from these areas to determine the impact of the nutrition component of the MNCH programme after the start of the ECD programme. Thus, impact estimates in which we include these areas will not be valid after our follow-up survey in 2017.

Finally, we excluded all beneficiary areas of the MNCH programme in Mymensingh that were ineligible for the ECD programme before the start of the propensity score matching analysis. These *mouzas* can be considered appropriate areas to determine the impact of the nutrition component of BRAC's MNCH programme. However, these areas would not be able to serve as control areas for BRAC's ECD programme. For this reason, we decided to remove these areas from our sample before the start of the propensity score matching procedure.

We then decided to sample 40 beneficiary *mouzas* and 40 comparison *mouzas* for the impact evaluation of the nutrition component of BRAC's MNCH programme. We determined the sample size on the basis of power calculations for a clustered nonexperimental design where households are clustered within *mouzas*. On the basis of our sample of 1,600 households in 80 *mouzas*, we would have 80 per cent power for detecting a treatment effect of 0.19 SMD when we assume an intraclass correlation of 0.07 for households clustered in *mouzas*, an R-squared of 0.20 and account for stratification at the *upazila* level. We based the estimates of the intraclass correlations on the data on child development outcomes collected for the impact evaluation of Save the Children's early childhood stimulation programme in Bangladesh (Chinen *et al.* 2015).

RESULTS OF THE MATCHING

We started our propensity score matching procedure with 892 observations at the mouza level. These 892 *mouzas* included 154 *mouzas* from Mymensingh and 738 comparison *mouzas*. The 738 potential comparison *mouzas* were comprised of 314 *mouzas* from Gazipur, 172 *mouzas* from Jamalpur, and 252 *mouzas* from Kishoreganj. This relatively large sample enables us to eliminate a large number of *mouzas* before the start of the data collection in order to improve the comparability of beneficiary and comparison *mouzas*.

Although the sample consisted of a large number of potential comparison areas, an initial analysis of the data indicates that the beneficiary *mouzas* are statistically significantly different from the potential comparison areas in many ways. Of the 31 variables we include in our propensity score matching procedure, 18 variables are statistically significantly different across the beneficiary and comparison *mouzas* before the propensity score matching procedure. This finding demonstrates the importance of using propensity score matching to determine the impact of mainstreaming nutrition under BRAC's MNCH programme. A random sample of comparison households would not have enabled us to identify a comparison group that is statistically equivalent to the beneficiary areas. We summarise the differences between the treatment and comparison areas in Table 2, which shows the differences in observable characteristics between beneficiary and comparison areas before the matching. This table also shows the variables we included in our logit model to estimate the propensity score. Figure 4 demonstrates the distribution of propensity scores for the treatment and the comparison group before the matching. The figure shows that the propensity score is considerably higher for the beneficiaries. Hence, the beneficiaries and non-beneficiaries are certainly not comparable before the propensity score matching procedure.

The propensity score matching procedure enables us to increase the internal validity of the impact evaluation, but the large differences between the beneficiary and potential comparison areas before the matching suggest that the external validity of our impact evaluation may be limited. The findings of our impact evaluation will mostly apply to the geographic areas in Mymensingh that are eligible for BRAC's MNCH and ECD programmes.

However, these areas are quite dissimilar from other *mouzas* in Mymensingh and the rest of Bangladesh. These differences limit the external validity of our impact evaluation. We mitigate this concern by examining the impacts of the intervention along the causal chain of the theory of change. This approach contributes to the external validity of the findings, because mechanisms can more easily be extrapolated to other contexts than the effects of a specific intervention (Ludwig *et al.* 2011).

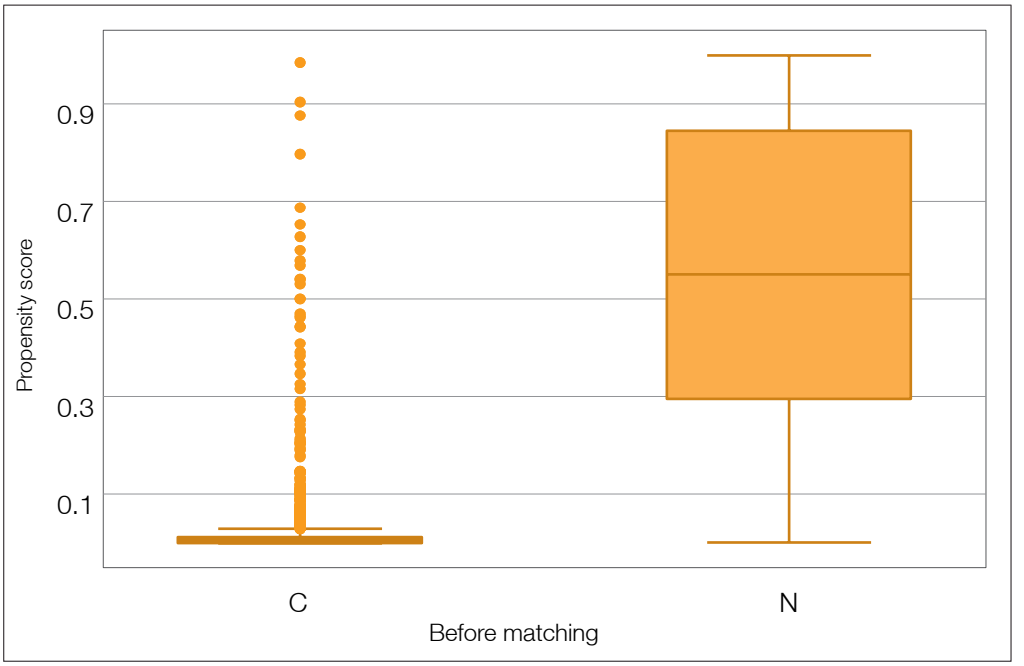
Table 2.

Characteristics of beneficiary and comparison mouzas before matching

Variables	Comparison *mouzas*		Treatment *mouzas*		T-C	Diff	p value	Standardised Mean Difference (SMD)
	Mean	N1	Mean	N2	Diff	SE		
#Households/Union	4741.48	738	3036.50	154	-1434.98	387.85	0.00	-0.60
#Villages/*mouza*	2.16	738	1.57	154	-0.58	0.20	0.01	-0.23
#Households/*mouza*	809.41	738	1171.49	154	362.08	126.91	0.01	0.36
Mouza population	3560.39	738	5201.53	154	1641.14	570.39	0.00	0.37
Household size	4.33	738	4.37	154	0.05	0.03	0.16	0.16
Mouza sex ratio	96.98	738	97.17	154	0.19	0.67	0.77	0.03
Population 0-4 years	10.93	738	12.06	154	1.13	0.23	0.00	0.53
Population 5-9 years	13.59	738	14.91	154	1.32	0.30	0.00	0.54
Married	67.57	738	67.65	154	0.08	0.38	0.84	0.02
Widowed	8.93	738	7.98	154	-0.95	0.25	0.00	-0.35
Male literacy	47.51	738	41.54	154	-5.97	1.52	0.00	-0.45
Female literacy	45.00	738	40.52	154	-4.48	1.43	0.00	-0.34
Female 6-10 years enrolled in school	0.54	738	0.56	154	0.02	0.01	0.01	0.17
Male 6-10 years enrolled in school	0.51	738	0.50	154	-0.01	0.00	0.00	-0.27
Female employed	0.06	738	0.03	154	-0.02	0.01	0.02	-0.23
Male employed	0.81	738	0.81	154	-0.00	0.01	0.66	-0.05
Male employed in agriculture	0.74	738	0.78	154	0.04	0.03	0.11	0.20
Female employed in agriculture	0.37	738	0.39	154	0.02	0.03	0.52	0.07
Male employed in industry	0.07	738	0.05	154	-0.02	0.01	0.04	-0.20
Female employed in industry	0.16	738	0.14	154	-0.03	0.03	0.33	-0.11
Muslim population	0.93	738	0.98	154	0.05	0.01	0.00	0.39
Pucca structure house	2.40	738	2.38	154	-0.02	0.85	0.98	-0.00
Semi-*pucca* structure	11.77	738	9.95	154	-1.82	1.21	0.13	-0.16
Water-sealed sanitary conditions	16.13	738	8.52	154	-7.62	1.85	0.00	-0.43
Non-water-sealed sanitary conditions	40.26	738	28.55	154	-11.71	1.90	0.00	-0.53
Tap Water	1.66	738	1.25	154	-0.40	0.85	0.64	-0.07
Tube well	94.25	738	93.21	154	-1.05	1.10	0.34	-0.11
Electricity	51.92	738	41.87	154	-10.05	3.77	0.01	-0.36
Own house	95.66	738	97.20	154	1.54	0.95	0.11	0.19

Standard errors clustered at union level

Fig 4.
Propensity scores before matching



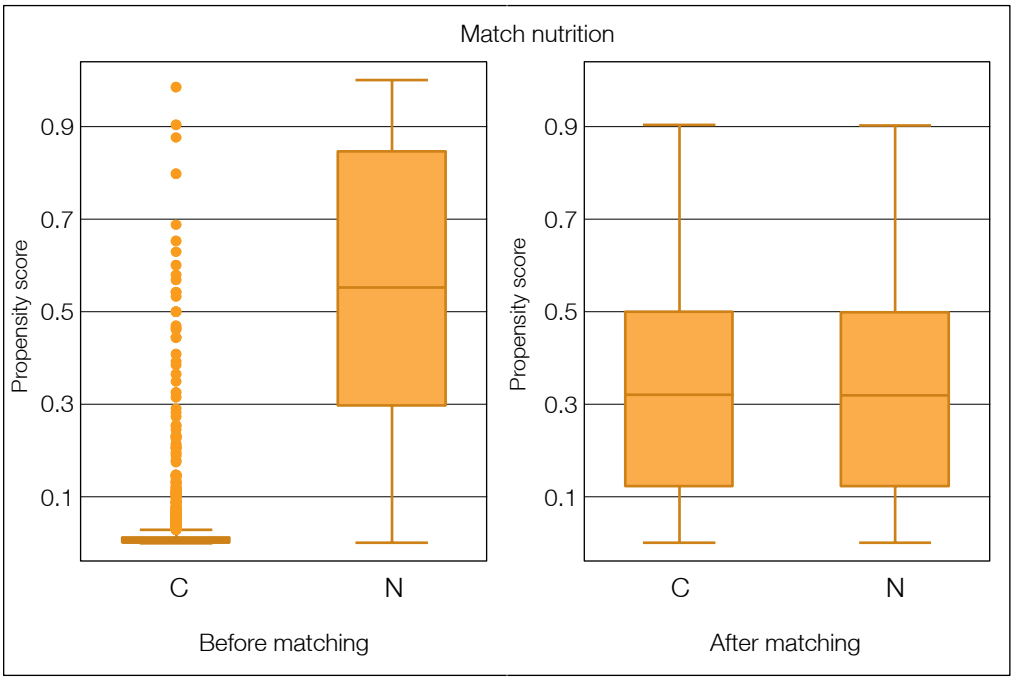
C displays the propensity score distribution for the beneficiary areas, while N shows the propensity score distribution for areas that benefit from the nutrition component of BRAC's MNCH programme.

Our propensity score matching procedure enabled us to sample comparison areas that are almost statistically identical to the beneficiary areas. We were able to achieve balance in observable characteristics by relying on a nearest neighbour propensity score matching procedure without replacement and a caliper of 0.12 standard deviations of the propensity score. We used a caliper of 0.12 standard deviations because this value was the lowest we could use to sample 40 comparison *mouzas*. This approach enabled us to exclusively sample comparison *mouzas* that fall within 0.12 standard errors of the propensity score from their nearest neighbour. The nearest neighbour of a comparison household can be defined as the beneficiary household that is most similar to the comparison household in terms of the propensity score. Figure 5 demonstrates that the distribution of the propensity scores after matching is close to identical for the beneficiary and comparison *mouzas*. In addition, Table 3 shows that there are no statistically significant differences at the *mouza*-level after propensity score matching. Nonetheless, we need to remain careful in the interpretation of the results. Although the differences between beneficiary and comparison *mouzas* are no longer statistically significant, there remain several differences that are larger than 0.3 standard deviations, which may be a reason for concern. In

our descriptive statistics we will examine the differences between beneficiaries and non-beneficiaries at the household-level.

Fig 5.

Propensity scores before and after matching



C displays the propensity score distribution for the beneficiary areas, while N shows the propensity score distribution for areas that benefit from the nutrition component of BRAC's MNCH programme.

Table 3.

Characteristics of beneficiary and comparison *mouzas* after matching

Variables	Comparison *mouzas*		Treatment *mouzas*		T-C Diff	Diff SE	p-value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Households Union	3355.18	40	3212.95	40	-142.23	615.72	0.82	-0.07
Villages *mouza*	1.95	40	1.38	40	-0.58	0.44	0.20	-0.30
Household *mouza*	1234.18	40	818.88	40	-415.30	284.16	0.15	-0.33
Mouza population	5519.25	40	3576.95	40	-1942.30	1267.33	0.13	-0.35
Household size	4.39	40	4.32	40	-0.07	0.06	0.31	-0.23
Mouza Sex ratio	97.19	40	97.06	40	-0.13	1.58	0.93	-0.02
Population 0-4 years	12.38	40	11.85	40	-0.53	0.40	0.19	-0.31
Population 5-9 years	15.14%	40	14.38%	40	-0.76	0.45	0.09	-0.38
Married	67.10	40	67.84	40	0.75	0.80	0.35	0.20
Widowed	9.18	40	8.33	40	-0.85	0.50	0.09	-0.40
Male literacy	41.44	40	42.21	40	0.78	2.98	0.79	0.06
Female literacy	41.32	40	41.05	40	0.27	2.78	0.92	-0.02
Female 6-10 years enrolled in school	0.58	40	0.55	40	-0.02	0.02	0.23	-0.26
Male 6-10 years enrolled in school	0.50	40	0.51	40	0.01	0.01	0.45	0.18
Female employed	0.04	40	0.03	40	-0.01	0.01	0.38	-0.21
Male employed	0.81	40	0.80	40	-0.01	0.02	0.65	-0.11
Male employed in agriculture	0.73	40	0.78	40	0.05	0.05	0.36	0.22
Female employed in agriculture	0.36	40	0.41	40	0.05	0.07	0.47	0.16
Male employed in industry	0.07	40	0.06	40	-0.01	0.02	0.82	-0.05
Female employed in industry	0.18	40	0.12	40	-0.06	0.05	0.19	-0.30
Muslim population	0.96	40	0.98	40	0.01	0.01	0.35	0.20
Pucca structure house	1.10	40	1.23	40	0.13	0.36	0.72	0.09
Semi-pucca structure	9.28	40	10.17	40	0.89	1.90	0.64	0.11
Water-sealed sanitary conditions	7.45	40	9.36	40	1.91	2.20	0.39	0.19
Non-water-sealed sanitary conditions	30.57	40	31.01	40	0.44	4.85	0.93	0.02
Tap Water	0.32	40	0.51	40	0.19	0.24	0.43	0.19
Tubewell	96.91	40	94.91	40	-2.00	1.31	0.13	-0.34
Electricity	54.21	40	45.35	40	-8.86	7.00	0.21	-0.33
Own house	97.36	40	98.14	40	0.77	0.56	0.17	0.32

Standard errors clustered at union level

OVERVIEW OF HOUSEHOLD-LEVEL SURVEY DATA COLLECTION

To ensure high-quality and valid data, BRAC and AIR emphasised the importance of the process and timing of data collection, making sure that the data collection was culturally appropriate, and consistently implemented. A team of Bangladeshi enumerators experienced in household surveys and fluent in the local language where they worked were trained on the instrument and then assisted with pilot testing in the field in Dhaka before moving into their assigned communities for data collection.

For the purpose of our study we collected data from 3,980 households with children under two years of age. Our respondents included mothers or primary caregivers when the mother was not a household member. We collected the data on android powered tablets running the CommCare application. CommCare is a mobile based online data collection platform developed by Dimagi Inc., a US based social business that brings simple and affordable open source software for use in low-income-countries and communities. CommCare runs on the Open Data Kit (ODK) platform. We chose CommCare because of its simple interface, which allowed non-programmers like ourselves to develop a digital questionnaire relatively easily. The application also allowed for real time data monitoring; the latter helped us to minimise errors in the field.

The first part of the enumerator training took place in May 2015 and lasted 10 days. The training included a description of the nutrition component of BRAC's MNCH programme and BRAC's ECD programmes by staff of the BRAC Health Nutrition and Population Programme. We then went question by question through the entire paper version of the questionnaire with the enumerator team. This approach enabled us to convey to the team, the exact type of data we were looking to collect before introducing the electronic data collection tools. The feedback from the enumerators allowed us to modify and refine the questionnaire, to make it more enumerator-friendly. Enumerators also engaged in role play and mock interviews to prepare them for real life scenarios. In addition, the training included one day during which enumerators were trained in and participated in

the measurement of the weight and height of children under three years old. We brought in a mother and a child below two years old for the purpose of this part of the training.

We introduced the enumerators to the Android tablet for testing the CommCare application after finishing the training through the entire paper version of the questionnaire. This process helped the enumerators familiarise themselves with the new system. We also received a lot of feedback from the enumerators during this part of the training, which we incorporated into the digital questionnaire.

Following the training we conducted a pilot in slums in urban Dhaka. Both BRAC and AIR staff participated in the enumerator training and the pilot. The pilots sought to ensure that enumerators and primary caregivers understood the goals of the questions, understood questions in the same way, and that questions were contextually relevant. During the pilot testing, we also explored whether any questions made respondents feel uncomfortable or hesitant about their answers. Finally, the pilot served to check how long it takes to complete the survey and interviews in real time.

We recruited 34 enumerators for five months from May-September in 2015 to collect the data. The enumerators were originally recruited in May 2015, and we had planned on deploying them to the field in late June 2015. However, after the initial round of training we decided to postpone the field data deployment because of Ramadan, the holy month of fasting for Muslims. During this month, proper data collection would not have been possible as a majority of our enumerators and respondents would be fasting, and this would have compromised the quality of the data. Furthermore, we required more time for preparation of the data collection in order to refine the digital questionnaires, and give the enumerators more time to adapt to the new system. We therefore, postponed the data collection until the end of July, following Ramadan and Eid-ul-Fitr.

We resumed our training after the Eid holidays in July 2015. The second round of the training served as a refresher course for the enumerators. As the team was already familiar with the questionnaire, we started off with the android tablets. We went through the application extensively, identifying areas of potential problems and improvements. We made additional modifications to the digital questionnaire during this time, incorporating the feedback received from the training sessions. We also deployed the enumerators for some additional pilot tests around Dhaka city. This allowed us to observe data collection under real world conditions, and also identify further areas where the enumerators could potentially run into problems. The pilot tests went off smoothly and we developed the final version of the CommCare questionnaire for field deployment.

The enumerator teams were deployed to the field on July 27, 2015 and started collecting data from July 28 onwards. Our team of 34 enumerators travelled to the districts of Mymensingh, Jamalpur, Kishoreganj and Gazipur interviewing households with at least 1 child under 2 years old, and collecting information related to child and maternal health/ nutrition, parental knowledge on child nutrition and feeding, as well as information on motor skills and cognitive development. During the data collection we found out that one

of the sampled *mouzas* did not or no longer exist. One other *mouza* was not accessible because it was a military camp. We replaced these *mouzas* with randomly selected *mouzas* within the same *upazila* because both *mouzas* were part of the treatment group for the ECD intervention.

To identify all households with children under two years old we designed a sampling strategy that enabled random sampling within the village. Each enumerator pair first received a random number between 5 and 10 to identify a house that is "random number" households away from the BRAC Branche Office. Second, the enumerator identified four households (each enumerator team consists of five enumerator pairs) that fall within the sampling pattern (counter clockwise, every number of houses) to conduct an interview. When the family was not at home, the enumerator had to revisit the household at least three times throughout the day to complete the survey before deciding to interview the counterclockwise neighbour of the household instead. When the family did not have a child below two years old, the enumerator had to interview the counterclockwise neighbour. Every day a community health workers or BRAC field management staff back-checked whether the assigned households were visited indeed. For this purpose enumerators numbered the houses in the identified villages with chalk. BRAC field management staff supervised the data collection in the field and conducted back checks to validate the quality of the sampling strategy. In addition, BRAC impact assessment staff conducted three field visits to ensure the quality of the data collection.

Data coming in from the field were examined daily by the BRAC and AIR teams. We developed Stata dofiles to examine the most common errors and discrepancies. Following the analysis in Stata, errors and discrepancies in data were noted at the end of each day, and shared with the relevant teams for correction. The most common errors we identified were duplicate submissions and incorrect entries in the 'Ages and Stages' (ASQ) component of the questionnaire. In the ASQ component, the questions were age group specific, and errors occurred when the enumerators selected the incorrect age for the child being tested (Bricker *et al.* 2009). Some of these errors were also caused by the incorrect entering of birth dates. We also encountered cases where the children's height and weight were implausible. The team of enumerators addressed and corrected most of the errors in the field. However, some cases could not be addressed until later. After our data collection wrapped up on September 2, 2015, we sat with the enumerators to identify the remaining errors. After short-listing these errors we hired a smaller team of our best performing enumerators and redeployed them to the field. During this second round of data collection, the team went and collected data only on the questionnaire sections containing errors. For example, we re-implemented the ASQ component in those households where at first the wrong age-specific questions were asked.

This study follows ethical standards for data collection. Potential respondents were given the option to refuse to participate in the study and understood that their refusal would not affect their ability to benefit from any programme that might be introduced into the area. They were also told that they could refuse to answer any question and that their

information would remain anonymous, with no identifying information shared with anyone outside of the research team. The research design and protocols were all reviewed and passed ethical clearance from two independent ethical review boards (one in the U.S. and one in Bangladesh).

DESCRIPTIVE STATISTICS

This section serves to present the descriptive household-level statistics for the evaluations of the nutrition component of BRAC's MNCH programme and BRAC's ECD programme. We present descriptive statistics along the causal chain of the theory of change, including a description of background characteristics. The analysis includes descriptions of household-level demographic characteristics, housing conditions, land ownership, asset ownership, education and literacy, IYCF practices, breastfeeding practices, child health, vitamin supplementation, anthropometric outcomes, and children's cognitive and motor skills. We present comparisons between beneficiary and comparison or control households for all of these variables and for both programme evaluations.

We first present the descriptive statistics for the nutrition component of the MNCH programme. It is important to keep in mind that the results presented in this section only provide indications for the effectiveness of the programme. The results of this section do not yet enable addressing counterfactual questions. For this purpose we have to rely on the results of the sections on propensity score matching, which will serve to determine the impact of mainstreaming nutrition under the MNCH programme along the causal chain of the theory of change.

Following the presentation of the descriptive statistics for the evaluation of the nutrition component of the MNCH programme we present the descriptive statistics for the ECD programme. These descriptive statistics will assess whether the randomisation was successful in creating equivalence in observable characteristics. In addition, the baseline values can provide indications on the potential for positive impacts of the ECD programme. Below we present the descriptive statistics separately by category for both the nutrition component of the MNCH programme and the ECD programme.

DESCRIPTIVE STATISTICS FOR THE NUTRITION COMPONENT OF BRAC's MNCH PROGRAMME

Background characteristics of the family

The background characteristics suggest that treatment and comparison households for the evaluation of the nutrition component of BRAC's MNCH programme are close to equivalent in observable characteristics. Table 4 summarises background characteristics of the respondents for both treatment and comparison households. None of the differences are statistically significant.

The background characteristics also suggest that the sample is only slightly different from a representative household in rural Bangladesh. First, the average household size is slightly higher than 5, which is somewhat larger than the average household size of 4.50 in rural Bangladesh (Bangladesh Bureau of Statistics, 2010). Furthermore, the head of the household is, male in 96 per cent of the cases, which is larger than the average percentage (85 per cent) in rural Bangladesh (Bangladesh Bureau of Statistics, 2010). Respondents are almost universally Muslim and Bengali. In almost all cases the mother of the youngest child is alive and part of the household. Finally, on average, the youngest child in the household had 1.25 siblings.

Table 4.
Social and demographic characteristics of household

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Size of household	5.26	803	5.11	792	-0.15	0.10	0.16	-0.09
Male head of household	0.96	803	0.96	792	0.01	0.01	0.47	0.04
Mother in law is part of household	0.15	803	0.17	792	0.02	0.02	0.35	0.05
Mother of youngest child is alive	1.00	801	1.01	787	0.00	0.00	0.71	0.02
Mother of youngest child is part of HH	0.99	798	0.99	787	0.00	0.00	0.98	-0.00
Per cent of household male	0.48	803	0.49	792	0.01	0.01	0.30	0.05
PCG religion: Muslim	0.98	803	0.98	792	0.00	0.01	0.88	-0.01
PCG ethnicity: Bengali	1.00	803	1.00	792	0.00	0.00	0.32	0.05
Number of siblings of youngest child	1.25	803	1.25	792	0.00	0.07	0.97	0.00

Notes: Standard errors are clustered at the *mouza* level.

Housing characteristics

Our descriptive statistics indicate that although the wall of the housing materials is generally in a good condition, only a small minority of the households have houses with floors and walls that are constructed with high-quality materials.[2] This finding indicates that the majority of the households in our sample live in poor housing conditions. These poor housing conditions may make the households more vulnerable to shocks that can adversely affect nutrition outcomes. Clean water, hygienic practices and sanitation are also closely associated with nutrition outcomes. Our findings indicate that the large majority of the households in our sample have access to drinking water on their premises. However, the majority of the households does not have access to adequate plumbing. Table 5 shows the descriptive statistics with an emphasis on housing, water, and sanitation.

The results suggest that in general beneficiary and comparison households have similar housing conditions. We only find two differences in housing conditions that are statistically significant at the 90 per cent level. However, the differences in observable characteristics are marginal even when the differences are statistically significant. None of the differences between beneficiary and comparison households is larger than 0.30 standard deviations. This finding indicates that beneficiaries and comparison households are close to statistically identical in observable housing characteristics.

Table 5.
Housing characteristics

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Family owns homestead	0.94	800	0.95	787	0.01	0.02	0.50	0.04
Walls of purchased/good materials	0.90	800	0.81	787	-0.09	0.05	0.08	-0.25
Floor of purchased/good materials	0.17	800	0.13	787	-0.04	0.03	0.21	-0.11
Drinking water on household premises	0.88	800	0.81	787	-0.07	0.03	0.05	-0.18
Household has adequate plumbing	0.36	800	0.37	786	0.01	0.04	0.91	0.01
Time it takes to collect drinking water outside of household	1.59	800	2.06	787	0.47	0.49	0.34	0.09

Notes: Standard errors are clustered at the *mouza* level.

[2] Cement, cement tiles, and carpet can be considered high-quality materials for the floor, while tin, ceramic tiles, and cement can be considered high-quality materials for the roof. Tin, bricks, stone with cement, and cement can be considered high-quality materials for the wall.

Land ownership and use

Lack of land is also closely associated with poverty in Bangladesh. We find that less than 50 per cent of the households in our sample owns land. Furthermore, the average household in our sample owns less than 0.5 acre (1 decimal is approximately 0.01 acre) of land. The majority of this land is used for farming. Furthermore, a small percentage of the households in our sample use their land for home gardening, which may contribute to improvements in nutrition outcomes. The limited land ownership in our sample again demonstrates the level of poverty of the households in our sample.

Interestingly, the percentage of households that uses land and spends some time on home gardening is statistically significantly higher among the beneficiaries of the nutrition component of BRAC's MNCH programme. The programme includes a component that encourages home gardening in order to stimulate food security. Although we cannot determine yet whether the larger focus on home gardening can be attributed to the programme it is interesting to see that the beneficiaries are involved in home gardening to a larger extent. We do not find other statistically significant differences associated with the ownership and use of land between treatment and comparison households. This finding indicates that there is balance in observable characteristics associated with the ownership and use of land.

Table 6.

Land ownership and types of land use

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Household owns land other than homestead land	0.41	801	0.46	785	0.06	0.03	0.08	0.11
Area of land (in decimals)	43.44	802	41.41	785	-2.03	5.20	0.70	-0.02
Hours spent on production of crops in last 2 weeks	0.57	802	0.92	785	0.36	0.31	0.25	0.07
Household uses land for home gardening	0.08	801	0.15	785	0.06	0.02	0.00	0.20
Area of land used for home gardening (decimals)	2.71	802	2.37	785	-0.34	0.80	0.67	-0.03
Hours spent on home gardening in last two weeks	0.06	802	0.31	785	0.25	0.09	0.00	0.18
Land used for farming beyond home gardening	0.32	802	0.37	785	0.05	0.03	0.19	0.10
Area of land used for farming beyond home gardening (decimals)	31.92	802	29.84	785	-2.08	4.67	0.66	-0.03
Hours spent on farming beyond home gardening in last two weeks	0.51	802	0.62	785	0.11	0.27	0.68	0.02

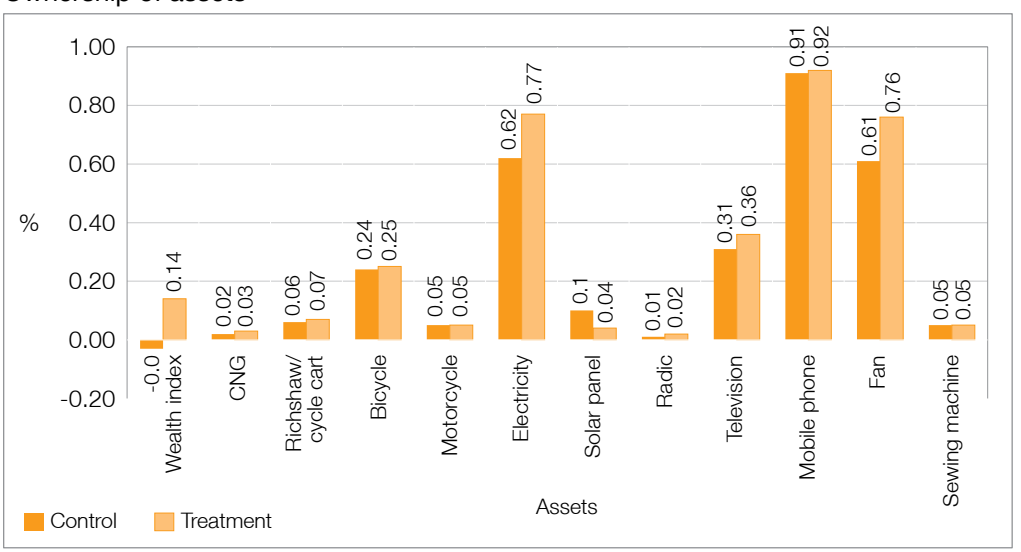
Notes: Diff is the average difference between Treatment and Comparison, and SE is the standard error of this difference clustered at the *mouza* level.

Asset and livestock ownership

The data on asset ownership and use suggest there are some small but statistically significant differences in asset and livestock ownership between the treatment and comparison households. As recommended by Filmer and Pritchett (2001) we created an asset index using principal component analysis that included ownership of bicycles, televisions, DVD players, and furniture among others. The asset data suggest that the majority of the households in our sample is poor with limited access to assets. For example, less than 40 per cent of the households in our sample owns a television and only a bit more than 20 per cent of the households in our sample owns a bicycle.

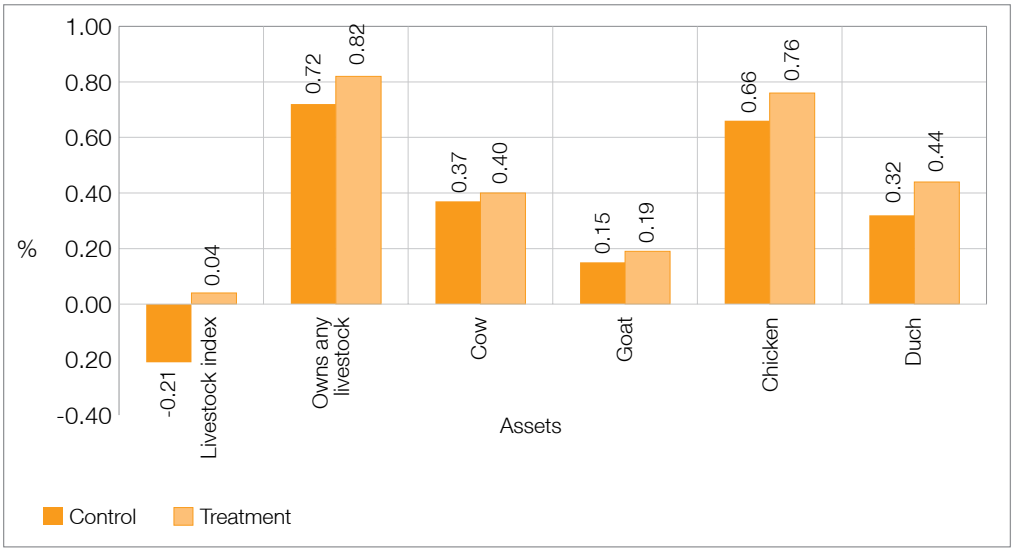
Although we find no statistically significant differences in the asset index between beneficiaries and non-beneficiaries, a further analysis of our data indicates that there are small but statistically significant differences in asset ownership between beneficiaries and non-beneficiaries. For example, of the beneficiaries 77 per cent has access to electricity, while only 62 per cent of the comparison households has access to electricity. The difference in access to electricity appears to be compensated by differences in access to solar power. Of the comparison households, 10 per cent has access to solar power, while only 4 per cent of the beneficiary households has access to solar power. Furthermore, a larger percentage of the beneficiaries owns a bench or a fan. However, although the differences are statistically significant, the differences are only small. Only one of the differences (for electric fan ownership) is larger than 0.30 standard deviations. Hence, our results suggest that the beneficiary and comparison households are similar to each other in terms of assets ownership. Figure 6 summarises the asset ownership for beneficiary and comparison households.

FIG 6.
Ownership of assets



We also find some small but statistically significant differences in livestock ownership between beneficiary and comparison households. Our results indicate that beneficiary households own more livestock than comparison households. Specifically, beneficiary households are more likely to own goats, chickens, and ducks. The differences are small, however. None of the statistically significant differences is larger than 0.3 standard deviations. Hence, we conclude that beneficiary and comparison households are similar to each other in terms of livestock ownership. Figure 7 summarises the livestock ownership for beneficiary and comparison households.

Fig 7.
Ownership of Livestock



Education and literacy

Education is a sector in which Bangladesh has achieved considerable progress in recent years. Chronic malnutrition during childhood especially for poor children is considered one of the key reasons for late enrollment in school, which in turn may lead to poor education outcomes. Findings from a study in rural Bangladesh indicate that children who completed their primary education have 20% more earning capacity than children who did not complete their primary education (Save the Children 2015). In Bangladesh, the school enrollment rate in the age group 6-10 years is 84.75%, on average, and 83.79% in rural areas. These statistics suggest that education may no longer be one of key constraints for chronic malnutrition.

Our findings indicate that treatment and comparison households are also very similar in terms of observable characteristics associated with education. We only find two statistically significant differences between the treatment and comparison group. However, these differences are smaller than 0.20 standard deviations, which indicates that these differences are unlikely to bias the impact estimates. Nonetheless, we will control for these differences in our propensity score matching procedure.

Our findings also show that the average school enrollment in our sample is close to the average school enrollment in Bangladesh. Of the children 6 to 9 years old in our sample, approximately 85 per cent are enrolled in school, while approximately 90 per cent of the children of 10-13 years old in our sample are enrolled in school. Finally, of the children of 14-17 years old, 68 per cent is enrolled in school (Table 7).

The results also demonstrate that the heads of household are somewhat higher educated than their spouses. Of the heads of household in our sample approximately 15 per cent did not finish any schooling, while approximately 40 per cent of their spouses did not finish any schooling. The literature suggests that such differences in education may limit the bargaining power of the spouse in the household, which could create barriers toward the effectiveness of the mainstreaming of nutrition under BRAC's MNCH programme.

Table 7.

Education status of primary care givers and children

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Standardised Mean Difference
	Mean	N1	Mean	N2				
% children 6-9 yrs currently enrolled in school	0.84	298	0.85	324	0.01	0.03	0.86	0.02
% children 10-13 yrs currently enrolled in school	0.89	216	0.90	240	0.01	0.03	0.86	0.02
% children 14-17 yrs currently enrolled in school	0.68	128	0.61	129	-0.06	0.07	0.34	-0.14
PCG highest education: no class	0.15	803	0.16	792	0.02	0.02	0.49	0.04
PCG highest education: some primary	0.15	803	0.16	792	0.01	0.03	0.71	0.03
PCG highest education: primary	0.59	803	0.53	792	-0.06	0.03	0.07	-0.12
PCG highest education: secondary/*dakhil*	0.11	803	0.13	792	0.02	0.02	0.25	0.07
PCG highest education: higher secondary/*alem*	0.01	803	0.03	792	0.01	0.01	0.05	0.10
Spouse of PCG highest education: no class	0.40	803	0.35	792	-0.06	0.04	0.12	-0.11

[Table 7. contd...]

[...Table 7. contd]

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Spouse of PCG highest education: some primary	0.13	803	0.17	792	0.04	0.03	0.12	0.12
Spouse of PCGhighest education: primary	0.34	803	0.30	792	-0.04	0.03	0.25	-0.08
Spouse of PCG highest education: secondary/*dakhil*	0.06	803	0.10	792	0.04	0.02	0.01	0.17
Spouse of PCG highest education: higher secondary/ *alem*	0.02	803	0.03	792	0.01	0.01	0.27	0.05

Notes: Diff is the average difference between Treatment and Comparison, and SE is the standard error of this difference clustered at the *mouza* level.

Shasthya shebika and *Shasthya kormi* home visits

The nutrition component of the MNCH programme aims to improve infant and young child feeding and breastfeeding practices and encourage antenatal and postnatal care visits by letting community health workers (*Shasthya shebhikas* and *Shasthya kormis*) conduct home visits to communicate with households about these practices. Table 8 shows that approximately 41 per cent of the beneficiary households reported a home visit from a *Shasthya kormi* and 37 per cent reported a visit from a *Shasthya shebhika* in the month before the survey. This percentage is approximately 2.75 times as high as in the comparison group, which is not surprising. Comparison households only receive visits from community health workers in the context of the EHC programme. However, the percentage in the treatment group is lower than expected, since BRAC recommends visits from *Shasthya shebhikas* or *Shasthya kormis* to all households with children<6 months old. Our descriptive statistics suggest that this goal is not achieved.

It is possible that *Shasthya shebhikas* and *Shasthya kormis* currently do not receive sufficient incentives to conduct home visits to each of the beneficiary households with children less than six months old. BRAC is currently considering a move to a social enterprise model where *Shasthya shebhikas* and *Shasthya kormis* receive financial incentives to encourage appropriate infant and young child feeding practices. It is possible that the effectiveness of the nutrition component of the MNCH programme increases after the move to social enterprise model. However, it will be important to test this assumption using a rigorous impact evaluation design.

Although we find large and statistically significant differences between beneficiary and comparison households we cannot yet interpret the difference as an impact of the programme. To identify the impact of the programme we rely on the results of the propensity score matching. Nonetheless, the results suggest that mainstreaming nutrition

under BRAC's MNCH programme results in a considerable increase in the number of home visits by community health workers relative to the comparison group where households only receive visits from community health workers in the context of the EHC programme.

Table 8.

Visits by community health workers

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Shasthya kormi visited household in last month	0.15	800	0.41	786	0.26	0.05	0.00	0.59
Shasthya shebika visited household in last month	0.13	799	0.37	786	0.24	0.05	0.00	0.55
Number of *Shasthya shebika* visits in last month	0.17	800	0.68	786	0.51	0.09	0.00	0.52
Shasthya kormi visited household in last month	0.11	799	0.33	786	0.22	0.05	0.00	0.53
Number of *Shasthya kormi* visits in last month	0.13	800	0.47	786	0.34	0.08	0.00	0.53

Notes: Diff is the average difference between Treatment and Comparison, and SE is the standard error of this difference clustered at the *mouza* level.

We find some evidence that *Shasthya shebhika* and *Shasthya kormi* visits are primarly targeted toward households with the youngest children, but our data also suggest that the visits are not entirely in line with BRAC's guidelines. BRAC's guidelines suggest that households with children younger than six months need to be visited by a community health worker every month. However, the survey data indicate that of the youngest children only close to 60 per cent received a visit from a *Shasthya shebhika* in the month before the survey, while a bit more than 40 per cent of the households with the youngest children received a visit from a *Shasthya kormi* in the month before the survey. Figure 8 and 9 demonstrate that this percentage declines exponentially with the age of the child. Hence, our findings indicate that community health worker visits are targeted toward households with the youngest children. This finding shows the importance BRAC attaches to targeting the children that are most at risk of nutrition deficiencies. However, the number of visits is not in accordance with BRAC's guidelines regarding the number of visits of community health workers. We do not find evidence for other factors that are strongly associated with the visits by *Shasthya shebhikas* and *Shasthya kormis*.

Fig 8.
Relationship between age and visits by *Shasthya shebhikas*

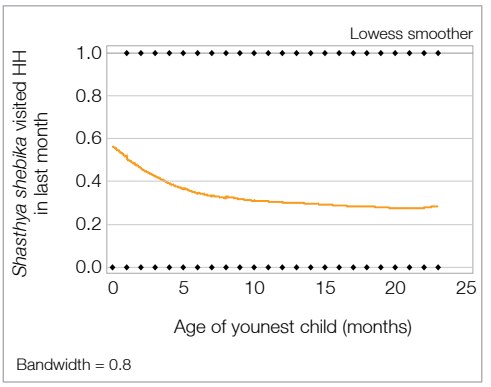
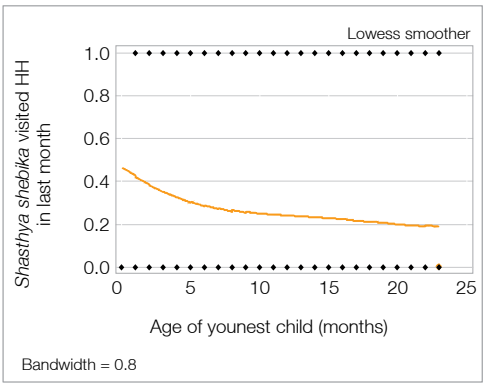


Fig 9.
Relationship between age and visits by *Shasthya kormis*

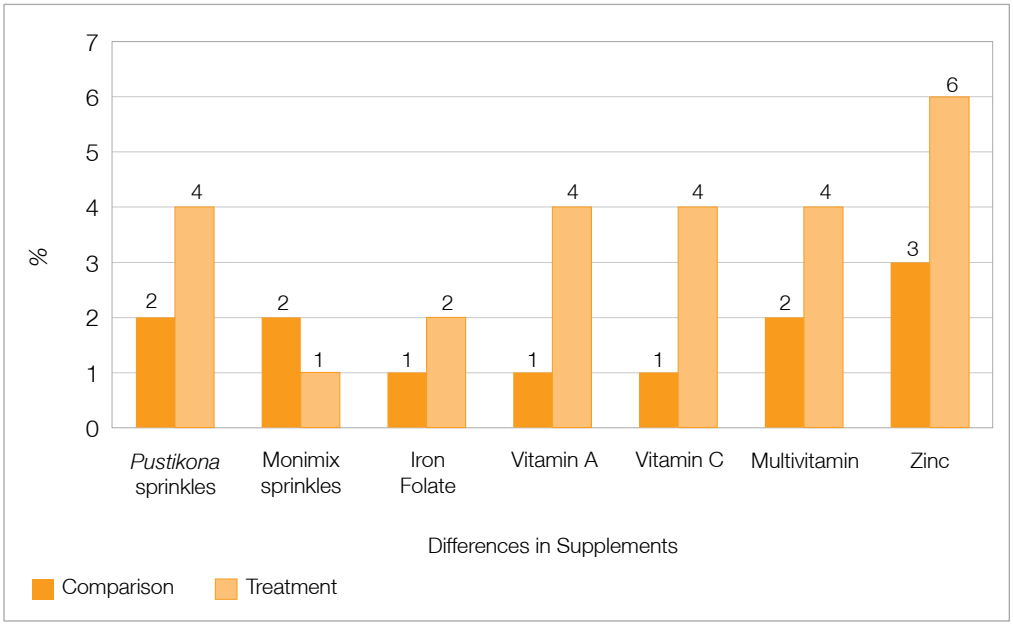


Intake of vitamin and mineral supplement

Community health workers are responsible for the sale of micronutrients and the encouragement of the intake of multivitamins and zinc tablets, but our data suggest that the sale of micronutrients and multivitamins is lower than anticipated. Although beneficiaries have a statistically significant larger intake of micronutrients and multivitamins, the intake is only marginal. Among beneficiary households the intake of micronutrients or vitamins does not move above five per cent in the two weeks before the survey regardless of the type of micronutrient or vitamin. This finding indicates that BRAC needs to reconsider its strategy regarding the sale of micronutrients and multivitamins. Possibly, *Shasthya shebhikas* and *Shasthya kormis* do not have sufficient financial incentives to sell these items. BRAC is currently considering moving to a social enterprise model for the nutrition component of its MNCH programme. It is possible that such a design may be effective in increasing the sales of micronutrients and multivitamins. However, it will be important to test this using a rigorous impact evaluation design. Possibly, the demand for micronutrients and multivitamins among poor rural households is simply not sufficient. Figure 10 shows an overview of the intake of micronutrients and multivitamins among the beneficiary and comparison households.

Fig 10.

Intake of micronutrients and multivitamins taken by children in the last two weeks between treatment and control



Knowledge about infant and young child feeding and breastfeeding practices

We also examined the knowledge about IYCF and breastfeeding practices among beneficiary and comparison households. The findings indicate that there are significant knowledge constraints toward some IYCF and breastfeeding practices. Primary caregivers gave the wrong answer to several questions about IYCF in more than 50 per cent of the cases. Furthermore, beneficiary households are more likely to give incorrect responses to questions about the intake of water for children younger than 6 months old. We will explore this finding in more detail in our propensity score matching analysis. Table 9 demonstrates the descriptive statistics on the knowledge of primary caregivers about IYCF and breastfeeding practices among beneficiary and comparison households.

Table 9.
Knowledge about breastfeeding and IYCF

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Per cent of Correct Responses to Feeding Recommendation Questions	0.54	803	0.53	792	-0.01	0.01	0.38	-0.08
Newborn breastfeeding: Correct Answer	0.95	803	0.95	792	-0.00	0.01	0.74	-0.02
Feeding infant under 6 months: Correct Answer	0.97	803	0.96	792	-0.01	0.01	0.51	-0.05
Breastfed baby needs water: Correct Answer	0.67	803	0.47	792	-0.20	0.05	0.00	-0.41
Age to introduce food: Correct Answer	0.75	803	0.70	792	-0.04	0.05	0.38	-0.10
Feeding 6-8m frequency: Correct Answer	0.25	803	0.30	792	0.05	0.04	0.18	0.12
Feeding 6-8m amount: Correct Answer	0.42	803	0.44	792	0.02	0.05	0.67	0.04
Feeding 9-11m frequency: Correct Answer	0.56	803	0.51	792	-0.05	0.05	0.29	-0.11
Feeding 9-11m amount: Correct Answer	0.56	803	0.57	792	0.01	0.05	0.83	0.02
Feeding dairy 12-23m frequency: Correct Answer	0.08	803	0.08	792	-0.00	0.02	0.95	-0.01
Feeding dairy 12-23m frequency: Correct Answer	0.16	803	0.27	792	0.12	0.04	0.00	0.28

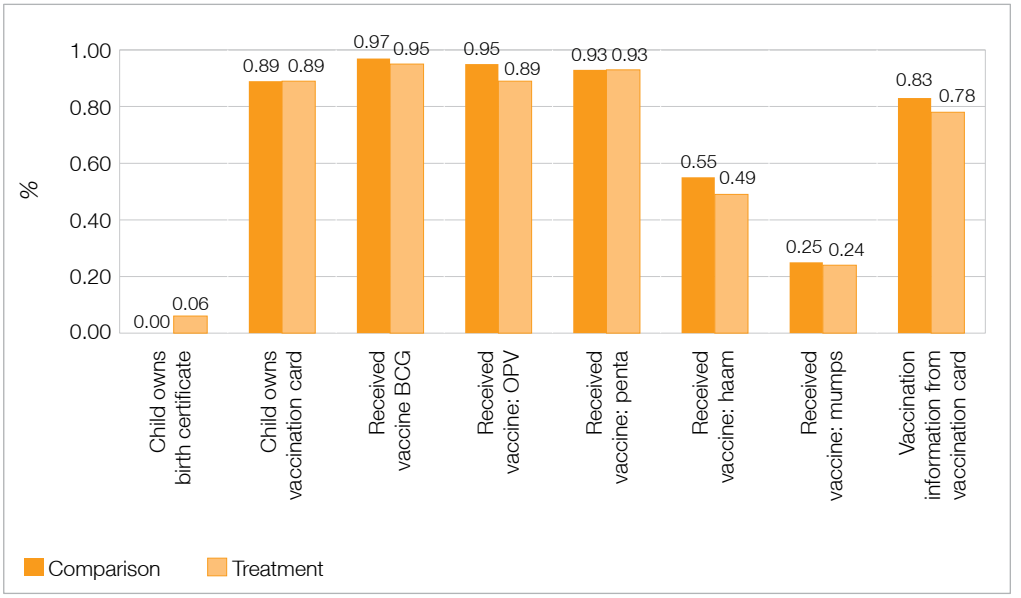
Notes: Diff is the average difference between Treatment and Comparison, and SE is the standard error of this difference clustered at the *Mouza* level.

Vaccination

The large majority of the households in our sample received most of the recommended vaccinations. For example, more than 90 per cent of the households in our sample received a hepatitis B or Penta vaccination. However, only a bit more than 50 per cent of the households in our sample received a measles and rubella vaccination and approximately a quarter of our sample received a mumps vaccination. Interestingly, the comparison households are more likely to own a vaccination card, but beneficiary households are more likely to own a birth certificate. In general, we, however, do not find large differences in vaccination status between beneficiary and comparison households. Figure 11 summarises the descriptive statistics on vaccination for both beneficiary and comparison households.

Fig 11.

Child vaccination status aged up to 24 months



Breastfeeding practices

Breast milk provides all the energy and nutrients that the infant needs for the first five months. For this reason, the WHO recommends exclusive breastfeeding for children of six months and younger. Thereafter, the WHO recommends to provide complementary feeding of nutritious foods. However, we find evidence that less than 40 per cent of our sample complies with the WHO recommendation of exclusive breastfeeding in the first six months. Nonetheless, almost all primary caregivers in our sample report to put the baby to the breast within 24 hours, which is in line with WHO recommendations. Furthermore, more than 95 per cent of the children in our sample is currently breastfed. This evidence indicates that BRAC may need to put more emphasis on exclusive breastfeeding in the training of community health workers, but that primary caregivers comply with most of the other WHO recommendations on exclusive breastfeeding.

We do not find major differences in breastfeeding practices between beneficiary and comparison households. Beneficiary households do not appear to comply with WHO recommendations on breastfeeding to a larger extent than comparison households. In fact, we find some evidence for stronger compliance with WHO recommendations among the comparison households than among the beneficiary households. Specifically, beneficiary mothers report to provide complementary feeding sources to infants sooner (after on average 3.26 months) than comparison households (after on average 2.42 months).

We have to be careful in the interpretation of this finding though because we have not yet accounted for other factors in the analyses of these differences. Furthermore, we only find evidence for one statistically significant difference in breastfeeding practices between beneficiary and comparison households. We do not find evidence for statistically significant differences between beneficiary and comparison households in the likelihood of exclusive breastfeeding in the first six months. We will analyse the difference in breastfeeding practices between beneficiary and comparison households in more detail in our propensity score matching analysis. Table 10 summarises the differences in breastfeeding practices between beneficiary and comparison households.

Table 10.

Breastfeeding practices

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Standardised Mean Difference
	Mean	N1	Mean	N2				
The child has been breastfed	0.99	800	0.99	788	-0.00	0.01	0.79	-0.02
The child is currently being breastfed	0.96	800	0.97	788	0.01	0.01	0.36	0.05
Time until child first breastfed (days)	16.15	795	15.70	782	-0.45	1.04	0.67	-0.03
Times the child was breastfed in last 24 hours	14.69	800	15.67	788	0.98	0.63	0.13	0.12
Age (months) until child given water or other fluids	3.26	672	2.42	723	-0.84	0.32	0.01	-0.31
Baby to Breast within 24 hours	0.95	803	0.95	792	-0.00	0.01	0.89	-0.01
Child exclusively breastfed for 6 months	0.37	803	0.29	792	-0.08	0.05	0.08	-0.17

Notes: Diff is the average difference between Treatment and Comparison, and SE is the standard error of this difference clustered at the *Mouza* level.

Infant and young child feeding practices

Appropriate IYCF practices are one of the most important factors in predicting anthropometric outcomes in low-income countries. Table 11 presents IYCF-related variables for children older than six months among beneficiary and comparison households. We relied on a dietary diversity scale recommended by the FAO that is based on questions about different foods taken in the 24 hours before the interview (FAO 2010). We find that less than 40 per cent of the households receives food from 4 or more food groups. This finding indicates that the majority of the children in our sample suffer from a relatively low dietary diversity.

Our findings also indicate that children in beneficiary households receive a more dietary diverse diet than children among comparison households. Of the children in the treatment group approximately 40 per cent receives food from a minimum of four food groups, while only 29 per cent of the children in the comparison group receives food from four or more food groups. The difference is statistically significant and appears to be mostly driven by differences in the intake of fruits and vegetables. These differences are a first indication for positive impacts of the programme on dietary diversity. We will explore this hypothesis in more detail in our propensity score matching analysis.

Table 11.

Infant and young child feeding practices for children >6 months

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Children who receive food from 4 or more food groups (dietary diversity)	0.29	238	0.40	336	0.11	0.06	0.05	0.24
Children who receive protein rich foods	0.93	567	0.93	591	-0.01	0.02	0.70	-0.02
Consumed last day: Water	0.84	799	0.88	787	0.04	0.02	0.04	0.12
Consumed last day: Sugar water	0.18	799	0.26	787	0.09	0.05	0.05	0.21
Consumed last day: Baby formula	0.09	800	0.11	787	0.03	0.02	0.18	0.09
Consumed last day: Fresh milk	0.42	800	0.31	786	-0.11	0.03	0.00	-0.23
Consumed last day: Any other liquids	0.01	800	0.04	784	0.02	0.01	0.02	0.15
Consumed last day: Powder milk	0.02	799	0.06	787	0.04	0.01	0.01	0.18
Consumed last day: Rice/Porridge/Wheat	0.71	799	0.73	787	0.02	0.02	0.45	0.04
Consumed last day: Roots/Tubers	0.43	799	0.52	787	0.09	0.03	0.01	0.18
Consumed last day: Oils, fats, butter	0.54	799	0.65	787	0.11	0.03	0.00	0.23
Consumed last day: Yellow/Orange Fruits	0.14	800	0.32	785	0.18	0.03	0.00	0.42
Consumed last day: Green leafy vegetables	0.23	800	0.35	787	0.12	0.03	0.00	0.27
Consumed last day: Yellow/orange vegetables	0.04	798	0.16	786	0.12	0.02	0.00	0.39
Consumed last day: Other fruits	0.14	800	0.16	787	0.02	0.03	0.54	0.05
Consumed last day: Eggs	0.23	800	0.28	786	0.05	0.03	0.13	0.11
Consumed last day: Fish	0.33	800	0.40	787	0.08	0.03	0.01	0.16

[Table 11. contd...]

[...Table 11. contd]

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Consumed last day: Poultry	0.04	800	0.11	787	0.07	0.02	0.00	0.25
Consumed last day: Meat	0.06	800	0.09	787	0.03	0.02	0.22	0.11
Consumed last day: lentils/nuts	0.25	800	0.39	787	0.14	0.03	0.00	0.31
Consumed last day: Spices	0.54	800	0.65	786	0.10	0.03	0.00	0.21
Consumed last day: Chips/cookies/candy	0.39	799	0.35	787	-0.03	0.04	0.36	-0.07
Consumed last day: Other	0.04	799	0.02	787	-0.02	0.01	0.07	-0.12

Notes: Diff is the average difference between Treatment and Comparison, and SE is the standard error of this difference clustered at the *Mouja* level.

Antenatal and postnatal care

The existing literature suggests a strong and positive statistically significant relationship between mother's access to antenatal and postnatal care and reductions in stunting in low-and middle-income countries (Mariachiara and Ricardo 2013). Antenatal care contributes to the early screening and treatment of diseases for the mother and the fetus. The WHO recommends a minimum of four antenatal care practices. Unfortunately, however, much less than 50 per cent of the mothers in our sample complies with the WHO recommendation of at least four antenatal care visits. Furthermore, less than 50 per cent of the mothers in our sample received postnatal care.

Interestingly, however, our results indicate that beneficiary mothers are more likely to comply with WHO recommendations on antenatal and postnatal care than comparison households. We find evidence that approximately 50 per cent of the beneficiary households conducted four antenatal care visits during their pregnancy. Furthermore, approximately 56 per cent of the households conducted a postnatal care visit. These findings show that beneficiary mothers are almost two times as likely as comparison households to comply with WHO recommendations about antenatal and postnatal care. Furthermore, beneficiary mothers are also more likely to have received at least 1 or 3 antenatal care visits and wait less long before their first antenatal care visit. In addition, beneficiary mothers are also more likely to have received iron, iron folate, or vitamins from BRAC during their pregnancies. Although it is too early to derive conclusions about the impact of the mainstreaming of nutrition under BRAC's MNCH programme, this finding indicates that the nutrition component of BRAC's MNCH programme may have been successful in stimulating antenatal and postnatal care visits. Table 12 summarises the descriptive statistics on antenatal and postnatal care.

Table 12.

Antenatal and postnatal care

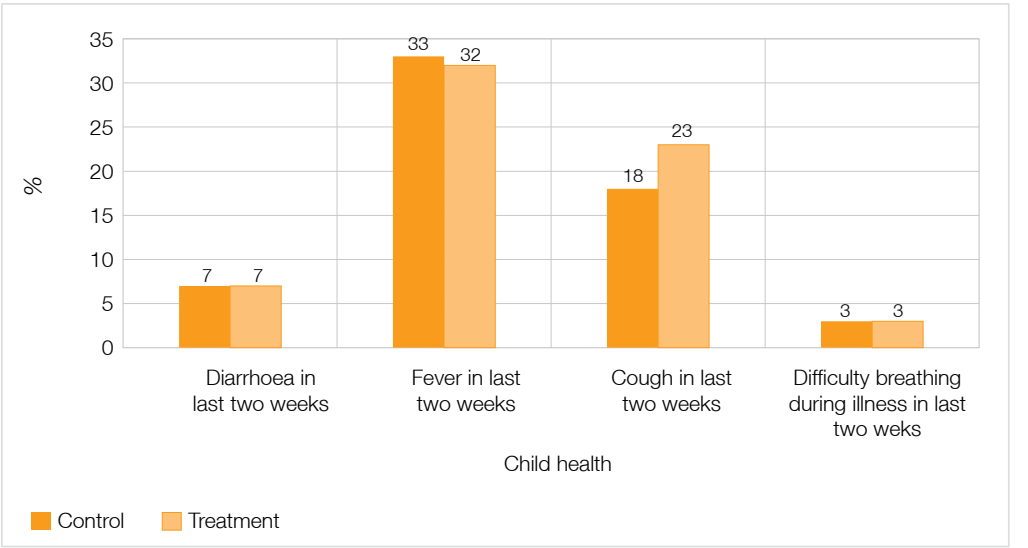
Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Mother received antenatal care	0.73	801	0.90	786	0.18	0.04	0.00	0.45
Number of antenatal care visits	2.33	801	3.64	786	1.31	0.31	0.00	0.56
Received at least 3 antenatal care visits	0.41	801	0.66	786	0.24	0.06	0.00	0.49
Received at least 4 antenatal care visits	0.26	801	0.50	786	0.24	0.06	0.00	0.50
Number of antenatal care visits from BRAC employees	1.09	801	2.57	785	1.47	0.29	0.00	0.70
Months pregnant when first received antenatal care	4.46	583	4.00	710	-0.46	0.17	0.01	-0.27
Mother took deworming tablets during pregnancy	0.04	801	0.03	785	-0.01	0.01	0.33	-0.08
Received deworming tablets from BRAC during any antenatal care	0.01	801	0.02	786	0.01	0.01	0.24	0.11
Mother took iron/iron folate during pregnancy	0.54	799	0.58	786	0.04	0.05	0.43	0.08
Received iron/iron folate from BRAC during any antenatal care	0.13	801	0.23	786	0.10	0.04	0.02	0.26
Mother took vitamins during pregnancy	0.43	800	0.45	786	0.02	0.04	0.65	0.04
Received vitamins from BRAC during any antenatal care	0.07	801	0.17	786	0.10	0.03	0.00	0.31
Scale of birthweight of child (estimated)	3.10	783	3.11	780	0.00	0.04	0.91	0.01
Received postnatal care	0.31	800	0.56	786	0.24	0.05	0.00	0.49

Notes: Diff is the average difference between Treatment and Comparison, and SE is the standard error of this difference clustered at the *Mouja* level.

Child health

We also present results on self-reported child health outcomes for beneficiary and comparison households. These outcomes include indicators with a focus on diarrhoea, fever, and cough. Our results suggest that only a small percentage of children was sick in the two weeks before the interview. Fever appears to be the most prevalent. Of the respondents approximately 33 per cent reports that the child had fever in the last two weeks. There were much fewer households that reported diarrhoea or cough incidence in the last two weeks. We did not find evidence for differences between treatment and comparison households in self-reported child health outcomes.

Fig 12.
State of child health



Anthropometric outcomes

We measured the weight and height of all of the youngest children less than two years old in a household in our study. We find that less than 30 per cent of the children in our sample is stunted, while the percentage of wasted children is less than 20 per cent. We only find evidence for differences between beneficiary and comparison children in the incidence of stunting. It appears that beneficiary children are less likely to be stunted than children in the comparison group. This may be an indication for a contribution of the mainstreaming of nutrition under BRAC's MNCH programme to reductions in stunting. However, it appears that there are no statistically significant differences between beneficiary and comparison households in the incidence of wasting. We will explore the impact of the mainstreaming of nutrition under BRAC's MNCH programme on the incidence of stunting and wasting in more detail in our section on the results of the propensity score matching analysis. Table 13 presents the descriptive statistics for the anthropometric outcomes for beneficiaries and non-beneficiaries.

Table 13.

Nutrition of child (age up to 2 years)

Variables	Comparison		Treatment		T-C Diff	Diff SE	p-value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Age of youngest child (months)	11.46	795	11.62	787	0.16	0.39	0.68	0.03
Gender of youngest child: female	0.51	803	0.51	792	-0.01	0.03	0.83	-0.01
Child weight (kg)	7.84	795	7.90	781	0.06	0.13	0.66	0.02
Child height (cm)	69.06	797	69.68	783	0.62	0.50	0.22	0.08
Converted length/height for deriving z score (in cms)	69.68	797	70.33	783	0.65	0.49	0.19	0.08
Calculated BMI of mothers	16.09	793	15.96	780	-0.13	0.26	0.62	-0.02
Weight for age (z-score) WHO 2011	-1.12	785	-1.09	773	0.03	0.09	0.74	0.02
Height for age (z-score) WHO 2011	-1.21	782	-1.03	774	0.18	0.10	0.09	0.11
Weight for height (z-score) WHO 2011	-0.50	766	-0.65	757	-0.15	0.10	0.14	-0.10
BMI-for-age z-score	-0.38	757	-0.56	756	-0.18	0.10	0.08	-0.12
Stunted (%)WHO 2011	0.32	782	0.24	774	-0.07	0.03	0.01	-0.17
Wasted (%) WHO 2011	0.15	766	0.16	757	0.00	0.03	0.86	0.01
Underweight (%) WHO 2011	0.23	785	0.24	773	0.00	0.03	0.89	0.01
Severely Stunted (%) WHO 2011	0.11	782	0.09	774	-0.02	0.02	0.31	-0.07
Severely Wasted (%) WHO 2011	0.06	766	0.05	757	-0.01	0.02	0.64	-0.03
Severely Underweight (%) WHO 2011	0.08	785	0.08	773	-0.00	0.02	0.89	-0.01

Notes: Diff is the average difference between Treatment and Comparison, and SE is the standard error of this difference clustered at the *mouza* level.

Children's cognitive and motor skills

In order to evaluate the ECD component of the programme, the study used the Ages and Stages Questionnaire (ASQ) (Bricker *et al.* 2012). The ASQ is a specialised tool that measures the cognitive development of children using age appropriate questions that measure a child's fine motor skills, gross motor skills and problem solving skills. The questions were broken down into two categories, observation questions and response questions. The 'observe' questions involved testing the children to see if they could carry out age appropriate actions. The 'response' questions involved asking the child's mother/primary caregiver questions about the child's behaviour. Table 14 below shows the breakdown of the results of the ASQ between the treatment and comparison areas. On a scale of 0-180, the average score on the ASQ for children 0-24 months of age, was 129.25 in the treatment areas, and 133.03 in the comparison areas. The difference is not statistically significant. The three sections of the ASQ, fine motor skills, gross motor skills and problem solving skills, are all scored on a scale of 0-60. As indicated in the table below, The average score for 'fine motor skills' was 45.01 in treatment versus 47.55 in control, and this represents a significant difference. For 'gross motor skills', the average

Table 14.
Ages and stages questionnaire

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Fine motor score (0-60)	47.55	803	45.01	792	-2.55	1.17	0.03	-0.19
Gross motor score (0-60)	44.75	803	43.82	792	-0.93	1.19	0.43	-0.06
Problem solving score (0-60)	40.73	803	40.42	792	-0.31	1.45	0.83	-0.02
Cumulative score (0-180)	133.03	803	129.25	792	-3.78	3.12	0.23	-0.10
Fine motor score (observation questions only) (0-30)	23.95	803	22.63	792	-1.33	0.60	0.03	-0.17
Gross motor score (observation questions only) (0-30)	21.87	803	21.12	792	-0.76	0.67	0.26	-0.08
Problem solving score (observation questions only) (0-30)	19.57	803	19.66	792	0.09	0.82	0.91	0.01
Fine motor score (response questions only) (0-30)	23.60	803	22.38	792	-1.22	0.64	0.06	-0.16
Gross motor score (response questions only) (0-30)	22.88	803	22.70	792	-0.17	0.61	0.78	-0.02
Problem solving score (response questions only) (0-30)	21.16	803	20.76	792	-0.39	0.70	0.58	-0.04

Notes: Diff is the average difference between Treatment and Comparison, and SE is the standard error of this difference clustered at the *mouja* level.

score in the treatment areas was 43.82, while the average score for the control areas was 44.75. For 'problem solving skills', the average treatment and comparison scores were 40.42 and 40.73 respectively. None of the differences between treatment and comparison groups are significant for these two categories of the ASQ. For the 'observation' questions, only the 'fine motor skills' section displayed a significant difference between treatment (22.63) and comparison (23.95). For the 'response' questions, none of the three sections, showed significant differences between the treatment and comparison areas. These findings indicate that although there are some statistically significant differences it is unclear whether the mainstreaming of nutrition under BRAC's MNCH programme contributed to these differences. We will explore this in more detail in our section on the propensity score matching analysis.

Knowledge about good parenting practices

The study also aimed to examine maternal knowledge of child development in the targeted areas. For this purpose we collected data on the knowledge of primary caregivers about parenting practices that are conducive for improving child development outcomes. We present both an index and descriptive statistics associated with responses to individual questions. The descriptive statistics show that parents have some knowledge about parenting practices that are conducive to child development. For example, more than 90 per cent of the respondents correctly reports that playing with children supports child development and close to 90 per cent of the sample reports that talking to children contributes to children's development. However, at the same time there are also several gaps in the knowledge of mothers about appropriate parenting practices. For example, approximately two-third of the sample reports that infants only understand words they can say.

Table 15.
Stimulation knowledge of the respondents

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Stimulation knowledge index	-0.06	803	-0.03	792	0.03	0.10	0.77	0.03
Per cent of correct responses to stimulation knowledge questions	0.70	803	0.73	792	0.03	0.02	0.21	0.14
Stimulation knowledge-cry: Correct answer	0.65	803	0.69	792	0.05	0.06	0.42	0.10
Stimulation knowledge-trouble: correct answer	0.71	803	0.70	792	-0.02	0.05	0.72	-0.04
Stimulation knowledge - Words: Correct Answer	0.33	803	0.40	792	0.08	0.05	0.14	0.16
Stimulation knowledge - Father: Correct Answer	0.65	803	0.69	792	0.04	0.04	0.39	0.08

[Table 15. contd...]

[...Table 15. contd]

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Stimulation knowledge - Month: Correct Answer	0.63	803	0.76	792	0.13	0.05	0.01	0.29
Stimulation knowledge - Song: Correct Answer	0.68	803	0.77	792	0.09	0.05	0.06	0.21
Stimulation knowledge - Talk: Correct Answer	0.86	803	0.79	792	-0.08	0.04	0.03	-0.20
Stimulation knowledge - Color: Correct Answer	0.87	803	0.83	792	-0.03	0.03	0.31	-0.09
Stimulation knowledge - Play: Correct Answer	0.92	803	0.91	792	-0.01	0.02	0.53	-0.04

Notes: Diff is the average difference between Treatment and Comparison, and SE is the standard error of this difference clustered at the *mouja* level.

Parenting practices

The family environment is considered the most important potential contributors to children's development. It is established that the more mental stimulation a child gets around the age of four, the more developed the parts of their brains dedicated to language and cognition will be in the decades ahead. Daily book reading, age-appropriate toys and books can promote children's learning and language. For example, playing with children has an important role in the optimal growth, learning, and development of children from infancy through adolescence. Reading books help to boost children's learning potential.

Our results indicate that the mother's adoption of appropriate parenting practices in our sample is relatively high, but there are some exceptions. For example, almost all of the primary caregivers report that a household member play with toys with the child. Furthermore, approximately 70 per cent of the mothers in our sample reports that they sing with the child. However, only 43 per cent of the primary caregivers reports that they read books to the child, while only 30 per cent of the mothers reports that they name, count, or draw things with the child. These findings indicate that although mothers have adopted some behaviour that is conducive to children's development, there is still a lot of scope for improvements in the adoption of appropriate parenting practices. We present the descriptive statistics regarding the adoption of appropriate parenting practices in Table 16.

We rely on the family care indicator (FCI) to measure the quality of children's home environment or the adoption of appropriate parenting practices. This measure can be included in a household survey to capture information about the home environment. It is a less complex adaptation of the Home Observations for the Measurement of the Environment Instrument. It contains relative few but very clear questions, and it is easy to

administer by trained enumerators. The instrument allows for collecting information about the variety of play materials, play and learning activities, and availability of books, among others. The FCI was used and validated in in a survey with 801 rural Bangladeshi mothers (Hamadani *et al.* 2010) . The FCI indicators include items related to the variety of play materials, play and learning activities, and the availability of household books, magazines, and newspapers.

We do not find major differences between beneficiary and comparison households in the adoption of appropriate parenting practices. Our index of good parenting behaviour does not demonstrate statistically significant differences between beneficiary and comparison households. Beneficiary households are only statistically significantly more likely to report that they play with toys with the child. However, the percentage of parents that reports this is close to 90 per cent in the comparison group as well and the difference is only 0.13 standard deviations. Hence, there are only minor differences between beneficiary and comparison households in the adoption of parenting practices that are conducive to child development.

Table 16.

Knowledge of appropriate parenting practices

Variables	Comparison		Treatment		T-C Diff	Diff SE	p value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Parenting good practices index	0.04	799	-0.01	786	-0.06	0.10	0.58	-0.06
Percent of Good Parenting Practices conducted	0.60	803	0.57	792	-0.02	0.03	0.51	-0.07
A household member reads books to the child	0.43	801	0.43	786	-0.00	0.05	0.92	-0.01
A household member tells stories to the child	0.60	800	0.62	786	0.01	0.05	0.76	0.03
A household member sings to the child	0.73	801	0.65	786	-0.08	0.05	0.12	-0.18
A household member plays with toys with the child	0.92	800	0.88	786	-0.04	0.02	0.04	-0.13
A household member names, counts, or draws things with the child	0.30	801	0.32	786	0.02	0.05	0.72	0.04

Notes: Diff is the average difference between Treatment and Comparison, and SE is the standard error of this difference clustered at the *mouja* level.

DESCRIPTIVE STATISTICS FOR THE ECD PROGRAMME

This section presents the baseline descriptive statistics for the evaluation of the ECD programme. In our analyses we will mostly focus on the analysis of key outcome measures for the impact evaluation. These outcome measures include the results of the ASQ test, and the knowledge about and adoption of appropriate parenting practices by primary caregivers. However, we will not discuss all of the data we collected during our baseline survey because most of these data were already discussed in the description of the descriptive statistics for the impact evaluation of the nutrition component of BRAC's MNCH programme.

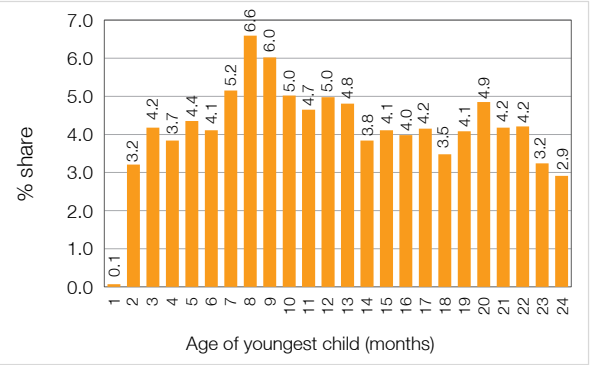
Another reason for not discussing the data at great length is in general we find strong evidence that our randomisation was successful in creating equivalence in observable characteristics across the treatment and the control group. We only find a few cases of small but statistically significant differences in observable characteristics between treatment and control households. Almost all of these differences are smaller than 0.30 standard deviations. Hence, the findings of our baseline survey indicate that the RCT design will enable us to make causal claims about the impact of BRAC's ECD programme during the follow-up survey. We present all descriptive statistics on the differences between treatment and control households in Annex A.

We also make some comparisons between the survey data in our sample data and the survey data reported in another large-scale RCT of an early childhood development programme in Bangladesh. This evaluation focused on Save the Children's early childhood stimulation programme in the *upazilas* of Muladi, Satkania, and Kalaura. The evaluation focuses on the cognitive and language development and anthropometric outcomes of children between 3 and 42 months of age. Eight community clinics participated in the Save the Children study, with half receiving the intervention (the treatment group) and half not receiving it (the control group). Thirty-three households with children between 3 and 18 months of age residing in the catchment area of each community clinic at the time of baseline data collection were randomly sampled, resulting in a total sample size of 2,574 households, half treatment and half control (Chinen *et al.* 2014). A comparison of our data with the data collected in that cluster-RCT will provide some useful descriptive evidence on how our sample compares to a different representative sample in a different region in Bangladesh.

Children's age

We start with a description of the age of the children in the ECD sample. It is important to describe the age distribution because the outcomes of interest are sensitive to the child's age. The average age of the children in the sample was 11.6 months. Overall, the distribution of children in each age category was homogeneous, with slightly fewer children at the tail ends of the age distribution. Figure 13 presents the distribution of age for the ECD sample.

Fig 13.
Children's age distribution



Ages and stages questionnaire to measure children's cognitive and motor skills

We relied on the ASQ test to measure child development outcomes. The ASQ test is a brief screening assessment used to identify with some degree of certainty children who are at risk of having developmental problems in the cognitive development and motor skills domain. The questionnaires are divided into two- to three month age intervals for use with children from 4-60 months of age. The test can be used to examine how the treatment group of children performs on the test relatively to other groups by using a series of 12 developmental questionnaires designed to be completed by parents and caregivers of young children. Previous research analysed over 7,000 ASQ questionnaires, and discovered a high test-retest reliability, interrater reliability, and internal consistency. Furthermore, the test was also validated using standardised measures—resulting in an overall agreement of 85%, with a range of 76–91% (Squires, Bricker and Potter 1997). Recently, the tool was also validated in Bangladesh (Hamadani *et al.* unpublished observation; Frongillo *et al.* 2014). The use of the ASQ is cost-effective because of its parent-centred approach and its flexibility in administration procedures. These arguments indicate that the ASQ test can be considered a reliable and valid tool for measuring child development outcomes in Bangladesh.

We used three different ASQ tests to measure fine and gross motor as well as problem solving skills of the children in our sample. Each primary caregiver responded to questions about the youngest child in the household that were determined on the basis of the age of the child. The questions in the ASQ test were divided in two months intervals starting at one month.[3] Thus, a child of three months and three days old received questions associated with the age category that ranges from three months to four months and 30 days. Since the sample included children from 0-23 months, we used 12 different age categories. The answer categories for each question were either "Yes", "Sometimes", or "No".

We used both observations and self-reported answers to questions to measure child development outcomes. Of the included questions we measured 50 per cent of the responses by observation. Specifically, the mothers were given tools (balls, blocks, etc.) by the enumerators to give to their children to perform a task.

[3]No questions were available for children of 0-1 months old

We calculated the score for each subtest by relying on a scale that ranges from 0-60 points. Each child received 10 points for an answer of Yes, 5 points for an answer of Sometimes, and 0 points for an answer of No. Figure 14 summarises the cumulative distribution of scores for each of the sub-tests in one figure. The figure shows that some parents and enumerators may have been too optimistic in their responses. A relatively large percentage of the children received a maximum score of 180. We will take this possible optimism bias into consideration in the interpretation of our results. Furthermore, Figure 14-17 display the distribution of scores for fine motor skills, gross motor skills, and problem solving skills respectively.

Fig 14.
Cumulative ASQ score

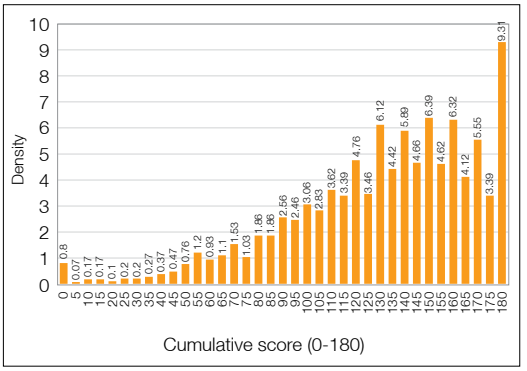


Fig 15.
Cumulative fine motor skills score

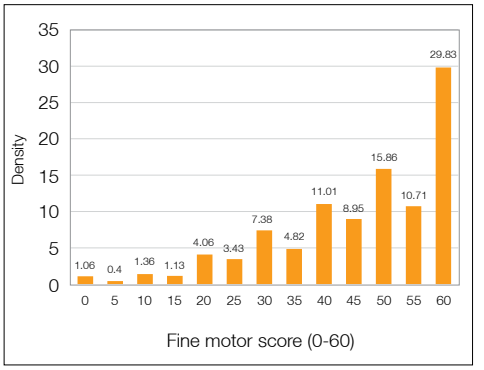


Fig 16.
Cumulative gross motor skills score

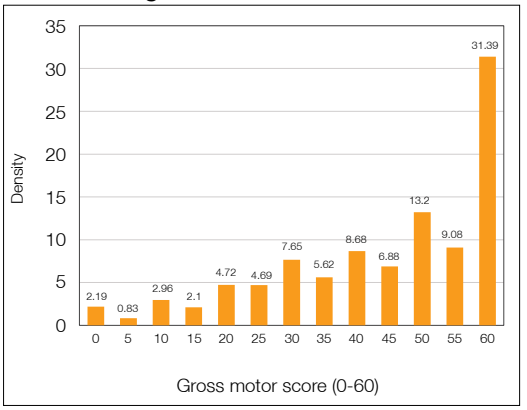


Fig 17.
Cumulative problem solving skills score

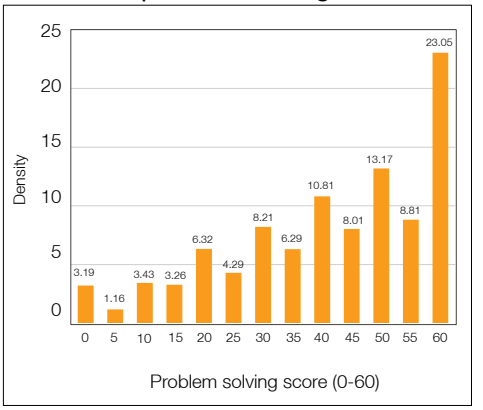


Table 17 presents the results for the outcome measures collected from each child as measured by ASQ. The descriptive statistics of the ASQ results demonstrate that the starting points for the problem solving and fine as well as gross motor skills domains were equivalent in the treatment and control conditions. The mean (standard deviation) of the Ages and Stages composite scores was 131 (SD=37). The observation and response questions also appear to show similar scores. The subtest scores for both response and observation are almost the same for both fine and gross motor skills and slightly lower (2 points) for the problem solving observation score.

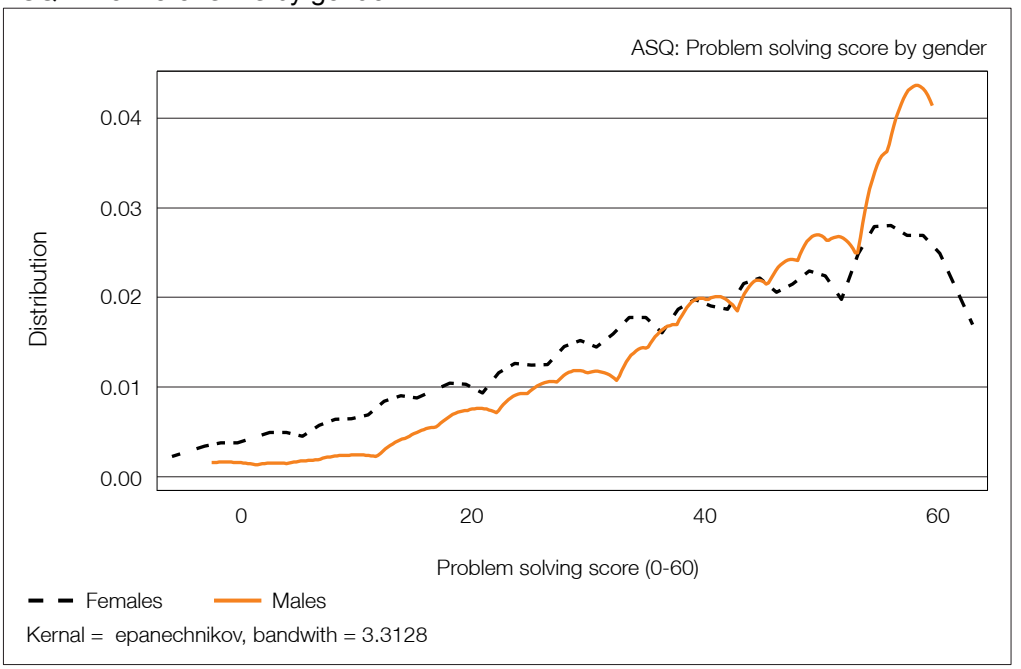
Table 17.

Child development outcomes: Ages and stages results by treatment condition

Variables	Control		Treatment		T-C Diff	Diff SE	Diff p-value	Standardised Mean Difference
	Mean	N1	Mean	N2				
Cumulative fine motor score (0-60)	45.27	1,514	46.83	1,493	1.56	1.04	0.14	0.11
Cumulative gross motor score (0-60)	43.88	1,514	44.18	1,493	0.30	0.90	0.74	0.02
Cumulative problem solving score (0-60)	40.78	1,514	41.39	1,493	0.61	1.18	0.60	0.04
Cumulative ASQ score (0-180)	129.93	1,514	132.40	1,493	2.47	2.79	0.38	0.07
Fine motor score (observation questions only) (0-30)	22.80	1,514	23.58	1,493	0.78	0.52	0.13	0.10
Gross motor score (observation questions only) (0-30)	21.16	1,514	21.25	1,493	0.09	0.50	0.86	0.01
Problem solving score (observation questions only) (0-30)	19.73	1,514	19.93	1,493	0.20	0.64	0.75	0.02
Fine motor score (response questions only) (0-30)	22.47	1,514	23.25	1,493	0.78	0.56	0.16	0.10
Gross motor score (response questions only) (0-30)	22.72	1,514	22.94	1,493	0.21	0.46	0.65	0.02
Problem solving score (response questions only) (0-30)	21.05	1,514	21.46	1,493	0.41	0.59	0.49	0.05

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the *mouja* level.

Fig 18.
ASQ: Fine motor skills by gender



Knowledge about and adoption of appropriate parenting practices

We rely on the family care indicator (FCI) to measure the quality of children's home environment. This measure can be included in a household survey to capture information about the home environment. It is a less complex adaptation of the Home Observations for the Measurement of the Environment Instrument. It contains relative few but very clear questions, and it is easy to administer by trained enumerators. The instrument allows for collecting information about the variety of play materials, play and learning activities, and availability of books, among others. Hamadani *et al.* (2010) piloted and validated the use of the FCI in a survey with 801 rural Bangladeshi mothers. The FCI indicators include items related to the variety of play materials, play and learning activities, and the availability of household books, magazines, and newspapers.

Our descriptive statistics in Table 18 suggest that parents in our sample have adopted more practices that are conducive to children's development than in the sample for the impact evaluation of Save the Children's early childhood stimulation programme. For example, 87% of the parents in the BRAC sample reported playing with toys with their child, whereas, this was only 56% in the ECSP study. Similarly, 69% of respondents

reported that a household member sings to their child in the BRAC sample whereas, only 32% reported this in the ECSP study; 42% of parents in the BRAC study reported reading a book to their child and in the ECSP study this was 15%; 61% of mothers reported telling storing to their children in the BRAC study whereas, only 38% of the ECSP study household reported this occurring; and 30% of mothers in the BRAC study reported household members counting or drawing things with the child and this was only 18% in the ECSP study. Overall, in the BRAC study 22% of parents reported participating in all five of the activities. At the end of Table 19, we present a stimulation knowledge index that we developed on the basis of the individual questions. The index is a composite of the statements listed in the table. The index ranges from -1.90 to 1.3. The index can be considered reliable because the Cronbach's alpha is 0.7452.

Table 18.

Parenting practices

Variables	Control		Treatment		T-C Diff	Diff SE	Diff p-value	Mean Difference
	Mean	N1	Mean	N2				
A household member reads books to the child	0.42	1,503	0.41	1,474	-0.01	0.03	0.87	-0.01
A household member tells stories to the child	0.61	1,503	0.61	1,472	-0.00	0.03	0.93	-0.01
A household member sings to the child	0.68	1,504	0.70	1,475	0.02	0.04	0.58	0.04
A household member plays with toys with the child	0.88	1,505	0.90	1,475	0.01	0.02	0.37	0.04
A household member names, counts, or draws things with the child	0.32	1,505	0.28	1,475	-0.04	0.03	0.25	-0.08
Parenting good practices index	-0.01	1,501	-0.01	1,471	-0.01	0.08	0.91	-0.01

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the *mouja* level.

We also examined the knowledge of parents about appropriate parenting practices. We display the results in Table 19. This Table shows the percentage of primary caregivers who disagreed with the various statements about stimulation practices presented to them. These questions capture knowledge of stimulation practices in order to learn what mothers believed to be appropriate caretaking practices before receiving programme messages. In general, the results in this table show that mothers appeared to have a good understanding of the basic principles of stimulation. For example, about 64% disagreed with the statement that "a baby should not be held when he (she) is crying"; 68% disagreed with the statement that "babies do some things just to make trouble for their parents"; and around 82% agreed with the statement that "talking to a child about things

he (she) is doing helps its mental development." One area where there is clearly room for improvement, however, concerns communication between parents and their children. Approximately 59 per cent of the respondents agreed with the statement that "Infants understand only words they can say. At the end of the table we include a Stimulation Knowledge scale. To create the stimulation knowledge scale, we reverse coded these questions, which were negative responses, and then we added the total number to get a scale from 0-9. The index can be considered a reliable estimate of knowledge about appropriate parenting practices because the Cronbach's alpha is 0.746.

Table 19.

Stimulation knowledge: Percentage of mothers correctly agreeing or disagreeing with the following statements

Variables	Control		Treatment		T-C Diff	Diff SE	Diff p-value	Mean Difference
	Mean	N1	Mean	N2				
A baby should not be held when he (she) is crying	0.68	1,514	0.60	1,493	-0.08	0.04	0.09	-0.16
Babies do some things just to make trouble for their parents, like crying a long time or pooping	0.70	1,514	0.66	1,493	-0.04	0.04	0.31	-0.08
Infants understand only words they can say	0.41	1,514	0.41	1,493	-0.00	0.04	0.97	-0.00
Fathers are naturally clumsy when it comes to taking care of babies	0.68	1,514	0.69	1,493	0.01	0.03	0.63	0.03
A baby should not be fed for the first time in an odd month, such as February, April, June, August, October, or December	0.78	1,514	0.68	1,493	-0.10	0.04	0.01	-0.23
It is important to talk and sing to your baby	0.75	1,514	0.80	1,493	0.05	0.03	0.13	0.11
Talking to a child about things he (she) is doing helps its mental development	0.80	1,514	0.84	1,493	0.04	0.02	0.06	0.12
It is important to teach the baby names of simple objects and colors	0.85	1,514	0.89	1,493	0.04	0.02	0.04	0.13
It is important to play games with the baby	0.91	1,514	0.93	1,493	0.02	0.02	0.13	0.08
Stimulation knowledge (0-9)	6.56	1,514	6.52	1,493	-0.04	0.14	0.75	-0.02

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the *mouja* level.

The complete set of balance tables for all data collected in Annex A show that there are only very few statistically significant differences between treatment and control households in the BRAC study sample. We find that there is balance in observable characteristics for beneficiary and non-beneficiary households. This finding indicates that the cluster-randomised controlled trial will allow for determining unbiased impact estimates of the intervention on child development and nutrition.

PROPENSITY SCORE MATCHING RESULTS

We used three different propensity score matching methods to estimate the impact of mainstreaming nutrition under BRAC's MNCH programme. For the first propensity score matching method we relied on nearest neighbour matching without replacement. This method compares beneficiary households to comparison households that are closest to them in terms of the propensity score with a maximum distance of 0.12 standard deviations of the propensity score. We did not use replacement households to ensure that comparison households do not receive an excessive weight in the analysis. The use of replacement households is useful in a sample where beneficiary and comparison households are not very similar to each other, but our descriptive statistics demonstrated that comparison households are close to statistically identical to the beneficiary households. Therefore, we decided to not use comparison households more than once as the nearest neighbour for beneficiary households. Second, we used kernel matching. Kernel matching uses a weighted average of all households in the comparison group where weights are kernel distributed and based on how close the propensity score of the comparison household lies to the propensity score of the beneficiary household. Third, we use inverse-probability of treatment weighting using the propensity score. The inverse-probability weighting method reweights the comparison group data to account for the effect that untreated units with low propensity scores are over-represented in the comparison group and under-represented in the treatment group. We only control for *mouza* level characteristics in the estimation of impacts on the basis of nearest neighbour and kernel matching. For these estimations we rely on a propensity score that we estimated before the start of the data collection. We re-estimate the propensity score for the inverse probability of treatment weighting using both *mouza*-level and plausibly exogenous household-level characteristics. The inverse-probability weighting methodology thus serves as a robustness check to examine the validity of the impact estimates from the nearest neighbour and kernel matching estimates to the inclusion of household-level control variables. Below we present each of the impact estimates of the three different methods.

We estimate impacts along the causal chain of the theory of change underlying the nutrition component of the MNCH programme in a backward manner. In other words, we start with the estimation of impacts on anthropometric and child development outcomes followed by estimates of the impact of the nutrition component of the MNCH programme on child health. Next, we will present impacts of mainstreaming nutrition under BRAC's MNCH programme on IYCF, breastfeeding, antenatal and postnatal care visits, and parenting practices followed by impact estimates on the knowledge of primary caregivers about IYCF, breastfeeding and parenting practices that are conducive to improvements in nutrition and child development outcomes.

IMPACTS ON ANTHROPOMETRIC OUTCOMES

We find evidence for statistically significant contributions of the nutrition component of the MNCH programme to reductions in stunting, but we do not find evidence for statistically significant effects of the programme on the likelihood of wasting or being underweight. Our propensity score matching estimates indicate that the mainstreaming of nutrition under BRAC's MNCH programme reduces the likelihood of stunting with approximately 0.15 standard deviations. The impact estimates are robust to the choice of the propensity score matching method. In fact, we find evidence for larger point estimates when we apply inverse probability weighting. Thus, we conclude that the mainstreaming of nutrition contributes to reductions in stunting, but not to reductions in wasting and underweight. We display the results in Table 20.

Table 20.

Impact on anthropometric outcomes

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
Stunting N.N.	0.32	782	0.24	770	-0.07	0.05
Stunting Kernel	0.32	782	0.24	774	-0.08	0.02
Stunting IPW	0.32	782	0.24	774	-0.15	0.05
Wasting N.N.	0.14	766	0.16	757	0.02	0.04
Wasting Kernel	0.15	766	0.16	757	0.00	0.02
Wasting IPW	0.15	766	0.16	757	0.00	0.02
Underweight N.N.	0.24	785	0.24	772	0.00	0.02
Underweight Kernel	0.22	786	0.24	772	0.02	0.04
Underweight IPW	0.22	786	0.24	772	0.00	0.02

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

IMPACTS ON CHILDREN'S COGNITIVE AND MOTOR SKILLS

We do not find evidence for positive statistically significant effects of the nutrition component of BRAC's MNCH programme on either fine motor, gross motor, or problem solving skills. Propensity score matching analyses indicate that there are no statistically significant differences in gross motor or problem solving skills between beneficiary and non-beneficiary households regardless of the methodology. However, we find some evidence that beneficiary households score worse than comparison households in fine motor skills after controlling for various community-characteristics using propensity score matching. Although this may be a statistical anomaly, this result may also be a reason for concern and shows the importance of designing effective ECD programmes for stimulating child development outcomes. We do not find differential treatment effects when we distinguish between self-reported behaviour and observations by the enumerator. The results are robust to the choice of the propensity score matching method. We present the results in Table 21.

Table 21.

Impact on child development outcomes

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
Fine Motor N.N.	47.64	803	45.01	792	-2.63	0.68
Fine Motor Kernel	47.43	803	45.01	792	-2.42	0.68
Fine Motor IPW	47.43	803	45.01	792	-2.55	0.68
Gross Motor N.N.	44.89	803	43.82	792	-1.07	0.81
Gross Motor Kernel	44.63	803	43.82	792	-1.00	0.81
Gross Motor IPW	44.63	803	43.82	792	-0.93	0.81
Problem Solving N.N.	40.73	803	40.42	792	-0.30	0.85
Problem Solving Kernel	40.57	803	40.42	792	-0.15	0.86
Problem Solving IPW	40.57	803	40.42	792	-0.31	0.85

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

IMPACT ON FOOD SECURITY AND DIETARY DIVERSITY

We find strong positive and statistically significant effects of the mainstreaming of nutrition under BRAC's MNCH programme on dietary diversity for children of six months and older and food security. Dietary diversity is a proxy for receiving foods with an adequate micronutrient-density. We relied on a dietary diversity scale recommended by the FAO that is based on questions about different foods taken by the child in the 24 hours before

the interview (FAO 2010). We consider children who have received food from a minimum of four food groups in the 24 hours before the interview as children with a sufficient dietary diversity. We use seven foods groups for the measurement of dietary diversity:

- Grains, roots and tubers
- Legumes and nuts
- Dairy products (including breast milk)
- Meats/Poultry/Fish
- Eggs
- Vitamin-A rich fruits and vegetables
- Other fruits and vegetables

We measure food security by relying on survey questions that were developed by the FAO. For this purpose we ask questions that measure how many meals households usually have, whether households had a smaller meal or had to skip meals because there was not enough food, and whether households had to go to sleep hungry because there was not enough food.

Our results demonstrate that the nutrition component of BRAC's MNCH programme has strong and positive statistically significant effects on dietary diversity and food security. We present these results in Table 22. The results demonstrate that the results are robust to the use of different propensity score matching methods. We find that the programme had strong positive effects on dietary diversity and the number of meals per day and reduced the likelihood of a household having to eat a smaller meal because there was not enough food. We do not find evidence for impacts on the likelihood that households had to skip a meal, however. Again, the results are robust to the use of different propensity score matching methods.

Table 22.

Impact on food security and dietary diversity

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
Dietary Diversity N.N.	0.29	238	0.41	237	0.13	0.04
Dietary Diversity Kernel	0.28	238	0.40	237	0.12	0.04
Dietary Diversity IPW	0.28	238	0.40	237	0.11	0.04
Number of Meals per Day N.N.	3.05	801	3.18	784	0.13	0.02
Number of Meals per Day Kernel	3.06	801	3.18	784	0.12	0.02
Number of Meals per Day IPW	3.06	801	3.18	784	0.13	0.02
Had to Eat Smaller Meal N.N.	0.18	801	0.13	784	-0.06	0.02
Had to Eat Smaller Meal Kernel	0.19	801	0.13	784	-0.06	0.02
Had to Eat Smaller Meal IPW	0.19	801	0.13	784	-0.06	0.02
Had to Skip Meal N.N.	0.06	801	0.06	784	0.00	0.01
Had to Skip Meal Kernel	0.06	801	0.06	784	0.00	0.01
Had to Skip Meal IPW	0.06	801	0.06	784	0.00	0.01

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

IMPACT ON BREASTFEEDING PRACTICES

We find hardly any evidence for positive effects of mainstreaming nutrition under BRAC's MNCH programme on breastfeeding practices. In fact, we find some evidence that comparison households with children younger than six months old are more likely to exclusively breastfeed than beneficiary households. However, beneficiary households do breastfeed their children of six months and older more often than comparison households. Hence, it appears that the nutrition component of BRAC's MNCH programme needs to focus more strongly on the breastfeeding practices of beneficiary households with children younger than six months. The programme appears to have positive effects on the breastfeeding practices of households with children of six months and older. At the same time, however, comparison households are statistically significantly more likely to exclusively breastfeed children of six months and younger than beneficiary households. We need to remain careful in the interpretation of the latter result because the sample size decreases significantly when we focus on households with children younger than six months. Nonetheless, the results are robust to the use of different propensity score matching methods. We present the results of the analyses in Table 23.

Table 23.

Impact on breastfeeding practices

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
Exclusive Breastfeeding children <6 months N.N.	0.43	209	0.27	194	-0.16	0.05
Exclusive Breastfeeding children <6 months Kernel	0.45	209	0.26	194	-0.18	0.05
Exclusive Breastfeeding children <6 months IPW	0.45	209	0.26	194	-0.18	0.05
Frequency breastfeeding children >6 months between sunrise and sunset N.N.	8.30	585	8.76	564	0.45	0.26
Frequency breastfeeding children >6 months between sunrise and sunset Kernel	8.31	585	8.75	564	0.43	0.25
Frequency breastfeeding children >6 months between sunrise and sunset IPW	8.31	585	8.75	564	0.50	0.25
Frequency breastfeeding children >6 months between sunset and sunrise N.N.	4.60	585	5.23	564	0.63	0.18
Frequency breastfeeding children >6 months between sunset and sunrise Kernel	4.62	585	5.19	564	0.57	0.17
Frequency breastfeeding children >6 months between sunset and sunrise IPW	4.62	585	5.19	564	0.62	0.17

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

IMPACT ON ANTENATAL AND POSTNATAL CARE SEEKING BEHAVIOUR

We find strong positive and statistically significant effects of the nutrition component of BRAC's MNCH programme on the likelihood that mothers comply with WHO recommendations regarding antenatal and postnatal care that. Beneficiary mothers are almost two times as likely as comparison mothers to conduct four antenatal care visits. Furthermore, beneficiary mothers are statistically significantly more likely to conduct postnatal care visits. The effect sizes are large, which suggests that BRAC is very successful in stimulating antenatal and postnatal care. The results are also robust to the use of different propensity score matching methods.

Interestingly, we find positive effects both for primary caregivers with and without primary education, but the mechanism driving the effects is different. We find very large and positive effects of the nutrition component of BRAC's MNCH programme on the likelihood that primary caregivers without primary education have at least one antenatal care visit. We also find positive effects on the likelihood of at least one antenatal care visit for households with primary caregivers with at least primary education. However, the positive effects on having at least one antenatal care visit are primarily driven by households with primary caregivers who have not finished primary education. We summarise the results in Tables 24-26.

Table 24.

Impact on antenatal and postnatal care

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
At least one antenatal care visit N.N.	0.73	801	0.90	786	0.18	0.02
At least one antenatal care visit Kernel	0.72	801	0.90	786	0.18	0.02
At least one antenatal care visit IPW	0.72	801	0.90	786	0.18	0.02
At least three antenatal care visits N.N.	0.41	801	0.66	786	0.25	0.02
At least three antenatal care visits Kernel	0.41	801	0.66	786	0.25	0.02
At least three antenatal care visits IPW	0.41	801	0.66	786	0.24	0.02
At least four antenatal care visits N.N.	0.26	801	0.50	786	0.24	0.02
At least four antenatal care visits Kernel	0.26	801	0.50	786	0.24	0.02
At least four antenatal care visits IPW	0.26	801	0.50	786	0.26	0.02
At least one postnatal care visit N.N.	0.31	801	0.56	786	0.24	0.02
At least one postnatal care visit Kernel	0.31	801	0.56	786	0.25	0.02
At least one postnatal care visit IPW	0.31	801	0.56	786	0.24	0.02

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

Table 25.

Impact on antenatal and postnatal care for mothers without primary education

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
At least one antenatal care visit N.N.	0.59	236	0.86	219	0.25	0.04
At least one antenatal care visit Kernel	0.60	236	0.85	219	0.25	0.04
At least one antenatal care visit IPW	0.60	236	0.85	219	0.25	0.04
At least three antenatal care visits N.N.	0.30	236	0.58	219	0.28	0.05
At least three antenatal care visits Kernel	0.29	236	0.57	219	0.27	0.04
At least three antenatal care visits IPW	0.29	236	0.57	219	0.26	0.04
At least four antenatal care visits N.N.	0.20	236	0.43	219	0.23	0.04
At least four antenatal care visits Kernel	0.20	236	0.42	219	0.22	0.04
At least four antenatal care visits IPW	0.20	236	0.42	219	0.22	0.04
At least one postnatal care visit N.N.	0.18	235	0.49	218	0.31	0.04
At least one postnatal care visit Kernel	0.20	235	0.51	218	0.31	0.04
At least one postnatal care visit IPW	0.20	235	0.51	218	0.32	0.04

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

Table 26.

Impact on antenatal and postnatal care for mothers with primary education

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
At least one antenatal care visit N.N.	0.78	565	0.93	509	0.15	0.02
At least one antenatal care visit Kernel	0.76	565	0.93	509	0.16	0.02
At least one antenatal care visit IPW	0.76	565	0.93	509	0.15	0.02
At least three antenatal care visits N.N.	0.46	565	0.69	509	0.23	0.03
At least three antenatal care visits Kernel	0.44	565	0.70	509	0.25	0.03
At least three antenatal care visits IPW	0.44	565	0.70	509	0.24	0.03
At least four antenatal care visits N.N.	0.30	565	0.53	509	0.23	0.03
At least four antenatal care visits Kernel	0.28	565	0.54	509	0.26	0.03
At least four antenatal care visits IPW	0.28	565	0.54	509	0.25	0.03
At least one postnatal care visit N.N.	0.35	565	0.57	509	0.22	0.03
At least one postnatal care visit Kernel	0.35	565	0.59	509	0.23	0.03
At least one postnatal care visit IPW	0.35	565	0.59	509	0.22	0.03

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

Although we find strong and positive effects on the compliance of households with WHO recommendations on antenatal and postnatal care, the results are entirely driven by home visits from *Shasthya shebhikas* and *Shasthya kormis*. We do not find evidence for positive effects of the programme on antenatal care from other health providers. This finding indicates that the households in our sample are strongly reliant on antenatal and postnatal care delivered by BRAC's community health workers.

IMPACT ON KNOWLEDGE ABOUT FEEDING AND BREASTFEEDING PRACTICES

We do not find evidence for positive effects of mainstreaming nutrition under BRAC's MNCH programme on knowledge about breastfeeding and IYCF. We assessed the impact of the programme on the percentage of correct answers to questions about breastfeeding and IYCF. However, we find no evidence for positive effects of the programme on the knowledge of beneficiary households. In fact, we find some evidence that comparison households have more knowledge about exclusive breastfeeding for children <6 months old. We also find that comparison households have a statistically significantly higher number of correct responses when applying inverse probability weighting. However, the statistically significant effect is not robust to the use of different propensity score matching methods. We report the differences in the knowledge between beneficiary and comparison households in Table 27.

Table 27.

Impact on knowledge about breastfeeding and IYCF

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
Knowledge of IYCF and Breastfeeding N.N.	0.54	594	0.52	575	-0.01	0.01
Knowledge of IYCF and Breastfeeding Kernel	0.54	594	0.52	575	-0.02	0.01
Knowledge of IYCF and Breastfeeding IPW	0.54	594	0.52	575	-0.02	0.01

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

MACHANISM OF IMPACTS

Since we do not find evidence for positive effects of the nutrition component of BRAC's MNCH programme on knowledge about IYCF and breastfeeding practices, it is likely that the positive effects of the programme on dietary diversity and food security are driven by a different mechanism than we identified in the original theory of change. We conducted

some exploratory analyses to identify this mechanism. Specifically, we hypothesised that the positive effects of the programme on dietary diversity and food security may be driven by positive effects of the programme on the mother's bargaining power in the household. We will explore this hypothesis in more detail in the next section.

Impacts on mother's bargaining power in the household

To identify the impact of the programme on the mother's bargaining power, we estimated the impact of the programme on the decision-making power of the mother about food preparation, expenditures, and health seeking behaviour when the child is ill. We also created an index to determine the impact of the programme on the mother's bargaining power in the household. This index consists of responses to questions about who makes decisions when the child is sick, who makes decisions about food expenditures, who makes decisions about healthcare expenditures, and who makes decisions about food preparation. We used a factor analysis to construct the index.

We estimate the impact of mainstreaming nutrition under the MNCH programme on this index as well as a dummy variable that is one when the mother contributes to decision-making about food preparation. The latter decision-making power may be predictive of positive effects of mainstreaming nutrition under BRAC's MNCH nutrition programme on food security and dietary diversity. Importantly, we need to treat this analysis as an exploratory analysis because we did not anticipate this mechanism during the registration of the study. However, we believe it is nonetheless an important mechanism to explore. In addition to the impact on the mother's bargaining power we also estimate impacts of the programme on the bargaining power of the mother-in-law. Previous research suggests that in Bangladesh the mother-in-law may have more decision-making power than the primary caregiver about factors that are closely associated with child nutrition, such as food preparation (White and Masset 2007).

The findings in Table 28 indeed suggest that the effects of the programme may run through the channel of the mother's decision-making power in the household. The findings indicate that the nutrition component of BRAC's MNCH programme contributes to the decision-making power of mothers in the household. This effect is primarily driven by positive effects on the mother's decision-making power about food preparation in the household, which may in turn contribute to improvements in dietary diversity and food security. Interestingly, the nutrition component of BRAC's MNCH programme also appears to have a negative effects on the decision-making power of mothers-in-law about food preparation. Hence, the programme appears to have led to a shift in the bargaining power about food preparation from mothers-in-law to mothers.

Table 28.

Impact on decision-making power

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
Mother's Decision-Making Power Index N.N.	-0.08		0.04	792	0.12	0.05
Mother's Decision-Making Power Index Kernel	-0.07	803	0.04	792	0.11	0.05
Mother's Decision-Making Power Index IPW	-0.07	803	0.04	792	0.12	0.05
Mother's Decision-Making Power about Food	0.33	803	0.41	792	0.08	0.02
Preparation N.N.						
Mother's Decision-Making Power about Food Preparation Kernel	0.33	803	0.41	792	0.08	0.02
Mother's Decision-Making Power about Food Preparation IPW	0.33	803	0.41	792	0.07	0.02
Mother-in-Law's Decision-Making Power about Food Preparation N.N.	0.31	803	0.26	792	-0.05	0.02
Mother-in-Law's Decision-Making Power about Food Preparation Kernel	0.31	803	0.26	792	-0.05	0.02
Mother-in-Law's Decision-Making Power about Food Preparation IPW	0.31	803	0.26	792	-0.05	0.02

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

Heterogeneous effects for households that include the mother-in-law

We implement one additional robustness check to examine whether the effects of the programme on the mother's decision-making power about food preparation indeed result in reductions in stunting. For this purpose we examine heterogeneous effects of the programme on stunting for households with and without mothers-in-law of the primary caregiver. We would expect a larger positive effect of the nutrition component of the MNCH programme on stunting in households that include the mother-in-law of the primary caregiver if the programme indeed result in a shift in the decision-making power about food preparation from mothers-in-law to mothers. Tables 29 and 30 shows that the contributions of mainstreaming nutrition under the MNCH programme to reductions in stunting are indeed primarily driven by households that include the mother-in-law. This finding provides additional evidence for the hypothesis that the shift in decision-making power about food preparation from mothers-in-law to mothers is the mechanism through which the nutrition component of BRAC's MNCH programme contributes to reductions in stunting. The results suggest that mainstreaming nutrition is at least three times as effective in reducing stunting among households that include the mother-in-law of the primary caregiver as in households that do not include the mother-in-law of the primary caregiver. In fact, we do not find evidence for statistically significant contributions of the

mainstreaming of nutrition under BRAC's MNCH programme to reductions in stunting in households that do not include the mother-in-law of the primary caregiver. We need to remain cautious in interpreting this result because we did not anticipate the mechanism during the registration of the study. Nonetheless, the result provide important exploratory evidence on how the nutrition component of BRAC's MNCH programme contributes to reductions in stunting in Mymensingh, Bangladesh.

Table 29.

Impact on stunting in households that include the mother's mother-in-law

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
Stunting N.N.	0.35	286	0.16	228	-0.19	0.04
Stunting Kernel	0.32	286	0.16	233	-0.16	0.04
Stunting IPW	0.32	286	0.16	233	-0.15	0.04

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

Table 30.

Impact on stunting in households that do not include the mother's mother-in-law

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
Stunting N.N.	0.32	496	0.27	495	-0.05	0.03
Stunting Kernel	0.32	496	0.28	495	-0.04	0.03
Stunting IPW	0.32	496	0.28	495	-0.04	0.03

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

Heterogeneous effects by education level of primary caregiver

We also assessed heterogeneous effects of the nutrition component of BRAC's MNCH programme on stunting, wasting, food security, and dietary diversity to determine whether the education level of the primary caregiver is associated with the differential impact of the programme on stunting and wasting. We find that the incidence of wasting is strongly and statistically significantly higher among households where the primary caregiver has not finished primary school. By contrast we do not find statistically significant differences in stunting between households where the primary caregiver has not finished primary school

and households where the primary caregiver has finished primary school. This difference may help explain why mainstreaming nutrition contributes to reductions in stunting but does not appear to contribute to reductions in wasting. Specifically, we hypothesised that the nutrition component of BRAC's MNCH programme may be more effective for primary caregivers with a minimum level of education.

Our results indeed show that the positive contributions of the nutrition component of BRAC's MNCH programme to reductions in stunting, dietary diversity, and food security appear to be fully driven by households where the primary caregiver has at least finished primary school. In fact, we do not find evidence for positive contributions of the programme to reductions in stunting in households where the primary caregiver has not finished primary school. We also only find less evidence for positive effects of the programme on food security and dietary diversity in households where the primary caregiver has finished primary school. These results suggest that the nutrition component of BRAC's MNCH programme may be more effective for primary caregivers with a minimum level of education. Hence, the programme possibly does not contribute to reductions in wasting because of the high incidence of wasting among households where the primary caregiver has not finished primary school. We summarise the heterogeneous effects for households where the primary caregiver has or has not finished primary school in Table 31 and 32. The results are robust to different the use of different propensity score matching methods.

Table 31.

Impact on stunting, wasting, food security and dietary diversity in households where the primary caregiver has finished primary school

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
Stunting N.N.	0.32	551	0.21	500	-0.11	0.03
Stunting Kernel	0.32	551	0.21	500	-0.11	0.03
Stunting IPW	0.32	551	0.21	500	-0.11	0.03
Wasting N.N.	0.13	541	0.14	515	0.01	0.02
Wasting Kernel	0.13	541	0.14	515	0.01	0.02
Wasting IPW	0.13	541	0.14	515	0.01	0.02
Dietary Diversity N.N.	0.29	180	0.45	170	0.17	0.05
Dietary Diversity Kernel	0.27	180	0.45	170	0.18	0.05
Dietary Diversity IPW	0.27	180	0.45	170	0.17	0.05
Number of Meals per Day N.N.	3.07	565	3.22	510	0.15	0.02
Number of Meals per Day Kernel	3.07	565	3.21	510	0.14	0.02
Number of Meals per Day IPW	3.07	565	3.21	510	0.15	0.02

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

Table 32.

Impact on stunting, wasting, food security and dietary diversity in households where the primary caregiver has not finished primary school

Variables	Comparison		Treatment		T-C Diff	Diff SE
	Mean	N1	Mean	N2		
Stunting N.N.	0.33	231	0.31	214	-0.01	0.05
Stunting Kernel	0.32	231	0.32	214	-0.00	0.04
Stunting IPW	0.32	231	0.32	214	-0.00	0.04
Wasting N.N.	0.18	225	0.18	242	-0.00	0.04
Wasting Kernel	0.19	225	0.19	242	-0.00	0.04
Wasting IPW	0.19	225	0.19	242	-0.01	0.04
Dietary Diversity N.N.	0.33	58	0.31	58	-0.02	0.09
Dietary Diversity Kernel	0.34	58	0.32	58	-0.02	0.08
Dietary Diversity IPW	0.34	58	0.32	58	-0.03	0.08
Number of Meals per Day N.N.	3.02	236	3.09	251	0.07	0.03
Number of Meals per Day Kernel	3.02	236	3.11	251	0.09	0.03
Number of Meals per Day IPW	3.02	236	3.11	251	0.09	0.03

Notes: Diff is the average treatment effect on the treated, and SE is the standard error adjusted for the estimation of the propensity score

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CONCLUSION

IMPACT EVALUATION OF MAINSTREAMING NUTRITION UNDER BRAC'S MATERNAL, NEWBORN AND CHILD HEALTH PROGRAMME

This report presents evidence that the nutrition component of BRAC's MNCH programme contributes to reductions in stunting in Mymensingh, Bangladesh, by stimulating IYCF that are conducive to improvements in nutrition outcomes and encouraging compliance with WHO recommendations regarding antenatal and postnatal care practices. The results of the evaluation demonstrate that the programme has strong and statistically significant effects on the likelihood that households comply with WHO recommendations about antenatal and postnatal care. In addition, we find evidence that the programme improves compliance with recommended IYCF practices, which in turn contributes to dietary diversity and food security among households in Mymensingh. The evidence indicates that these improvements in food security then contribute to reductions in stunting. We find evidence for positive and statistically significant effects of mainstreaming nutrition under the MNCH programme on reductions in stunting that are equal to approximately 0.15 standard deviations. This result demonstrates that mainstreaming nutrition can contribute significantly to improvements in nutrition outcomes in Bangladesh. These results are robust to a wide range of specifications, which suggests that the effect can be considered causal. Since it is challenging to achieve positive effects on nutrition outcomes, the reduction in stunting can be considered an important achievement in the fight against malnutrition in Bangladesh. The contribution of the nutrition component of the MNCH programme to reductions in stunting demonstrates the strong potential of mainstreaming nutrition under the MNCH programme to contribute to reductions in stunting in Bangladesh when the programme would be implemented at scale. However, we do not find evidence that the programme contributes to reductions in wasting.

We present evidence that the lack of positive programme effects on wasting is associated with the higher incidence of wasting among children of primary caregivers that did not

finish primary school. Our results suggest that the positive effects of mainstreaming nutrition on stunting are almost exclusively driven by households with primary caregivers who have finished primary education at a minimum. The incidence of wasting among these households is lower than among households with primary caregivers who have not finished primary school. We do not find evidence for positive effects of the nutrition component of BRAC's MNCH programme on either stunting or wasting for households with primary caregivers who have not finished primary school.

In addition, we find hardly any evidence for improvements in breastfeeding practices that result from the mainstreaming of nutrition under BRAC's MNCH programme. The results of our impact evaluation do not demonstrate evidence for statistically significant differences in wasting between beneficiaries and non-beneficiaries of the programme Furthermore, although there is some evidence that the programme results in an increase in the likelihood of continued breastfeeding for children >6 months old, we also find some surprising evidence that beneficiaries of the nutrition component of the MNCH programme are more likely to provide complementary feeding to children<6 months old than the comparison group because of limited knowledge about exclusive breastfeeding. The latter finding indicates that the beneficiaries of BRAC's MNCH programme are less likely to comply with WHO recommendations about exclusive breastfeeding for children<6 months old than the comparison group. By contrast, there appear to be positive effects of the programme on the number of times that children older than six months are breastfed. These findings indicate that the nutrition component of BRAC's MNCH programme may be more effective in stimulating appropriate breastfeeding practices for children older than six months than for children younger than six months old.

The reductions in stunting appear to be associated with positive effects of the mainstreaming of nutrition on complementary feeding practices for children of six months and older and food security. We find evidence for large positive and statistically significant effects of the programme on dietary diversity or the likelihood that children of six months and older receive food from a minimum of four food groups. Furthermore, we find evidence for positive effects of the programme on the likelihood of complementary feeding for children older than six months. In addition, we find evidence for positive effects of the programme on food security. The mainstreaming of nutrition appears to result in reductions in the likelihood that a household member ate a smaller meal than needed in the four weeks before the survey. Finally, the nutrition component of BRAC's MNCH programme has a positive effect on the number of meals per day among the beneficiaries.

We also find evidence that the nutrition component of the MNCH programme has large positive and statistically significant effects on the likelihood of the adoption of antenatal and postnatal care practices that are recommend by the WHO. The results indicate that access to the programme increases the likelihood of four antenatal care visits from approximately 25 per cent to 50 per cent. Our findings also show evidence for positive effects of the programme on the likelihood of at least one antenatal care visit. The latter results are primarily driven by households where the primary caregiver has not

finished primary education. In addition, we find strong evidence for positive effects of the programme on the likelihood of postnatal care visits.

Our findings also indicate that the positive impacts of mainstreaming nutrition are not associated with improvements in knowledge of primary caregivers. We do not find evidence for positive impacts of the programme on the knowledge of primary caregivers about infant and young child feeding and breastfeeding practices. In fact, our results suggest that in some topic areas, such as exclusive breastfeeding, beneficiary primary caregivers have less knowledge about certain behaviours that are conducive to improving nutrition outcomes than the mothers in the comparison group even after controlling for a wide range of control variables using propensity score matching.

Exploratory analyses instead suggest that the positive impacts of the nutrition component of the MNCH programme on dietary diversity, food security, and nutrition outcomes may be associated with positive effects of the programme on the bargaining power of primary caregivers. Our findings indicate that the programme has strong and positive effects that primary caregivers have decision-making power about the food prepared in the household. In addition, we find evidence that the programme contributes significantly to reductions in the mother-in-law's decision-making power about the food prepared in the household. We need to remain careful in interpreting these results because we did not anticipate them during the registration of the study. Nonetheless, the results provide some important exploratory evidence on how the nutrition component of the MNCH programme influences nutrition outcomes.

Our findings also indicate that the contributions of mainstreaming nutrition to reductions in stunting are primarily driven by households that include the mother-in-law of the primary caregivers. The contribution of the programme to reductions in stunting appears to be two times as high in households that include the mother-in-law of the primary caregiver. This finding indicates that the primary caregivers' bargaining power concerned with food preparation may be one of the key binding constraints toward improvements in nutrition outcomes in the context of Bangladesh. Again, however, we need to remain careful in the interpretation of this result because we did not hypothesise this mechanism during the registration of the study. Our evaluation nonetheless provides some important exploratory evidence on how BRAC's MNCH programme achieves positive effects through the mechanism of increasing the bargaining power of the primary caregiver in the household. The findings of our impact evaluation also illustrate the importance of focusing on child development in addition to nutrition outcomes. We do not find evidence for positive effects of mainstreaming nutrition on either parenting practices or child development outcomes. In fact, we find some evidence that beneficiary households score worse in fine motor skills than comparison households. These findings indicate that investing in nutrition programming is not sufficient for achieving improvements in child development outcomes. Hence, it will be critical to examine the effectiveness of BRAC's pilot ECD programme.

The analyses of home visits of community health workers suggests that BRAC is successful in targeting home visits to beneficiary households with the youngest children, but the number of home visits is not in line with BRAC's guidelines. Our analyses indicate that the likelihood of a visit in the month before the survey from either a *Shasthya shebhika* or a *Shasthya kormi* is statistically significantly higher for households with the youngest children in the sample. This finding shows the importance BRAC attaches to targeting the children that are most at risk of nutrition deficiencies. However, BRAC's guidelines suggest that all children of four months and younger need to be visited by a *Shastya shebhika* or *Shasthya kormi* every month. Our results suggest that home visits by community health workers are lower than anticipated.

BASELINE RESULTS FOR IMPACT EVALUATION OF BRAC'S ECD PROGRAMME

The baseline results for the evaluation of BRAC's ECD programme demonstrate that the RCT was successful in creating equivalence in observable characteristics between treatment and control households. We do not find evidence for systematic statistically significant differences. Furthermore, almost none of the statistically significant differences at baseline are larger than 0.3 standard deviations. This finding indicates that the randomisation will enable BRAC and AIR to make causal claims about the short-term effects of the ECD programme after the follow-up survey.

RECOMMENDATIONS

Our results indicate that the mainstreaming of nutrition under BRAC's MNCH programme has the potential to contribute to reductions in stunting when implemented at scale. The results suggest that the nutrition component of the MNCH programme is effective in improving compliance with WHO recommendations regarding antenatal and postnatal care, and dietary diversity and food security, as well as food security, which in turn results in significant reductions in the likelihood of stunting. These findings indicate that BRAC should consider mainstreaming nutrition at a larger scale and that donors that are interested in improving nutrition programmes should consider funding the nutrition component of BRAC's MNCH programme in Bangladesh. However, we have not examined the cost-effectiveness of the programme. Furthermore, there are several components of the mainstreaming of nutrition under BRAC's MNCH programme that need to be reconsidered.

The findings of our evaluation indicate that although home visits of community health workers focus on the youngest children, the frequency of home visits by community health workers is not in line with BRAC's guidelines. For this reason, we recommend BRAC to reconsider its incentive structure for *Shasthya shebhikas* and *Shasthya kormis*. BRAC is currently considering a move to a social enterprise model for the nutrition component of its MNCH programme. Our results suggest that such an approach may

make the programme more effective, but only if the financial incentives for community health workers focus on the right behavioural practices. It appears that the sale of micronutrients and multivitamins by community health workers is lower than anticipated, possibly because of a lack of demand for these products among primary caregivers in rural Bangladesh. Therefore, we recommend BRAC to refocus the mainstreaming of nutrition on increasing the demand for micronutrients and multivitamins. This demand creation can be combined with financial incentives for community health workers that rely on antenatal and postnatal care visits by mothers. The antenatal and postnatal care visits can then serve to create additional demand for micronutrients and multivitamins. In addition, the financial incentives could help increase the frequency of home visits by community health workers, particularly to households with children of six months and younger.

It will be important for BRAC to focus the mainstreaming of nutrition under its MNCH programme more strongly on children younger than six months old. Although knowledge may not be the key constraint toward improving dietary diversity and food security, our findings indicate that BRAC may need to reconsider its approach to improving the knowledge of primary caregivers about exclusive breastfeeding. The current knowledge of primary caregivers about breastfeeding practices does not appear to be sufficient for widespread adoption of exclusive breastfeeding among the beneficiaries. We do not find evidence for positive effects of the nutrition component of BRAC's MNCH programme on the knowledge about and adoption of exclusive breastfeeding for children younger than six months old. This finding is all the more reason to focus the programme more strongly on households with children of six months and younger.

Our results also suggest that the positive effects of the nutrition component of BRAC's MNCH programme on dietary diversity and food security run through the channel of the decision-making power of the primary caregiver as opposed to the channel of knowledge. This finding indicates that BRAC may need to focus more attention on improving mother's empowerment than on increasing the knowledge of primary caregivers about dietary diversity and food security. This emphasis on mother's empowerment may then create indirect positive effects on dietary diversity and food security by shifting the decision-making power about food preparation to primary caregivers. There may also be scope for synergies of the mainstreaming of nutrition and ECD programmes with programmes that focus on women's empowerment, such as women's self-help group programmes. A recent systematic review on women's self-help groups with a focus on South Asia indicates that these programmes can be effective in increasing women's bargaining power in the household (Brody *et al.* 2015; Brody *et al.* 2016).

Finally, our results indicate that the positive contributions of the mainstreaming of nutrition under BRAC's MNCH programme on dietary diversity, food security, and reductions in stunting are primarily driven by households with primary caregivers who have finished primary school at as minimum. We find little to no evidence for positive programme effects on wasting, which is much more prevalent among households with primary caregivers who have not finished primary school. We also only find little evidence for

positive contributions of the nutrition component of BRAC's MNCH programme on food security, dietary diversity, and stunting among households where primary caregivers have not finished primary school. These findings indicate that BRAC may have to reconsider its approach to communicating appropriate IYCF and breastfeeding practices to primary caregivers who have not finished primary school.

LIMITATIONS

We need to remain cautious in extrapolating the results of the impact evaluation to other contexts. The results of our propensity score matching analysis demonstrate that the beneficiary and comparison mouzas in our sample are statistically significantly different from other *mouzas*, both in Mymensingh and Bangladesh. The differences in observable characteristics are also quite strong. Hence, we may not be able to extrapolate the results of the impact evaluation to other settings in Bangladesh. We mitigate this concern by relying on a theory-based approach to impact evaluation. We examine the impacts of the mainstreaming of nutrition along the causal chain of the theory of change, which contributes to the external validity of the findings.

Furthermore, we were not able to implement a RCT to determine the effects of mainstreaming nutrition under BRAC's MNCH programme. Hence, there may still be lingering doubts about the ability of the propensity score matching design to make causal claims about the impact of the nutrition programme. Nonetheless, we are optimistic about the ability of our propensity score matching design to demonstrate causal effects. The use of propensity score matching before the start of the household-level data collection enabled BRAC and AIR to identify comparison households that are similar and in most cases almost statistically identical in observable characteristics to the beneficiary households. Our household-level data analysis suggests that there were only few and small (almost all differences are smaller than three standard deviations) statistically significant differences in exogenous characteristics between beneficiary and comparison households after propensity score matching.

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ANNEXES

Baseline Descriptive Statistics for Impact Evaluation of BRAC's Early Childhood Development Programme

Table A1.

Social and demographic characteristics of household

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Size of household	5.11	1,514	5.16	1,491	0.05	0.11	0.62	0.03
Male head of household	0.96	1,514	0.96	1,493	-0.01	0.01	0.61	-0.03
Mother in_law_hh	0.30	1,505	0.32	1,484	0.02	0.03	0.46	0.04
Mother of youngest child is alive	1.00	1,503	1.00	1,477	-0.00	0.00	0.77	-0.01
Mother of youngest child is part of household	1.00	1,503	1.00	1,477	-0.00	0.00	0.98	-0.00
Percent of household male	0.48	1,514	0.48	1,491	-0.01	0.01	0.12	-0.05
PCG religion: muslim	0.98	1,514	0.99	1,493	0.01	0.01	0.47	0.05
PCG ethnicity: Bengali	1.00	1,514	1.00	1,493	-0.00	0.00	0.16	-0.05
Number of siblings of youngest child	1.24	1,514	1.23	1,493	-0.01	0.05	0.88	-0.01

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the Union level.

Table A2.

Housing characteristics of household

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Piped water_source	1.00	1,504	0.99	1,477	-0.01	0.00	0.03	-0.09
Poor cooking_fuel	0.98	1,501	0.98	1,477	-0.00	0.01	0.97	-0.00
Earth floor	0.87	1,504	0.86	1,475	-0.01	0.03	0.65	-0.04
Tin roof	0.97	1,500	0.98	1,477	0.00	0.01	0.61	0.03
Family owns homestead	0.94	1,504	0.94	1,477	-0.00	0.02	0.95	-0.00
Walls of purchased/good materials	0.79	1,504	0.84	1,477	0.06	0.05	0.25	0.15
Roof of purchased/good materials	0.02	1,500	0.02	1,477	-0.00	0.01	0.73	-0.02
Floor of purchased/good materials	0.13	1,504	0.14	1,475	0.01	0.03	0.63	0.04
Drinking water on household premises	0.81	1,504	0.75	1,477	-0.06	0.04	0.19	-0.13
Household has adequate plumbing	0.71	1,502	0.69	1,477	-0.02	0.05	0.61	-0.05
Time it takes to collect drinking water outside of household	2.07	1,504	2.48	1,477	0.41	0.50	0.42	0.08

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the Union level.

Table A3.

Land ownership and use

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Household owns land other than homestead land	0.44	1,505	0.45	1,471	0.01	0.03	0.72	0.02
Area of land (in decimals)	40.83	1,505	56.98	1,471	16.14	7.96	0.05	0.07
Hours spent on production of crops in last 2 weeks	1.42	1,505	2.49	1,471	1.07	0.58	0.07	0.11
Household uses land for home gardening	0.15	1,504	0.18	1,471	0.03	0.02	0.20	0.09
Area of land used for home gardening (demicals)	2.74	1,505	2.59	1,471	-0.15	0.61	0.81	-0.01
Hours spent on home gardening in last two weeks	0.46	1,505	0.77	1,471	0.31	0.21	0.13	0.08
Land used for farming beyond home gardening	0.35	1,504	0.36	1,471	0.01	0.03	0.79	0.02
Area of land used for farming beyond home gardening (demicals)	30.47	1,505	36.76	1,471	6.29	3.99	0.12	0.07
Hours spent on farming beyond home gardening in last two weeks	0.97	1,505	1.73	1,471	0.76	0.47	0.11	0.10

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the Union level.

Table A4.

Asset ownership

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Asset / Wealth Index	0.05	1,501	-0.04	1,461	-0.09	0.08	0.28	-0.09
Owns asset: Auto Rickshaw (CNG)	0.02	1,507	0.02	1,479	-0.00	0.01	0.67	-0.02
Owns asset: Rickshaw/Cycle Cart	0.08	1,506	0.09	1,479	0.02	0.01	0.23	0.06
Owns asset: Bicycle	0.25	1,507	0.23	1,478	-0.03	0.02	0.28	-0.06
Owns asset: Motorcycle	0.05	1,506	0.06	1,479	0.00	0.01	0.63	0.02
Owns asset: Electricity	0.71	1,507	0.66	1,481	-0.06	0.06	0.33	-0.13
Owns asset: Solar Panel	0.09	1,507	0.09	1,481	0.00	0.04	0.98	0.00
Owns asset: Radio	0.01	1,507	0.01	1,480	-0.01	0.01	0.27	-0.06
Owns asset: Television	0.35	1,507	0.35	1,481	0.00	0.04	1.00	0.00
Owns asset: VCD/VCR	0.02	1,507	0.02	1,479	-0.00	0.01	0.69	-0.03
Owns asset: DVD	0.02	1,506	0.03	1,478	0.01	0.01	0.33	0.06
Owns asset: Mobile phone	0.91	1,507	0.91	1,481	-0.00	0.02	0.74	-0.02
Owns asset: Landline phone	0.01	1,506	0.01	1,479	-0.00	0.00	0.52	-0.03
Owns asset: Refrigerator	0.09	1,506	0.11	1,480	0.02	0.02	0.39	0.06
Owns asset: Wardrobe	0.50	1,506	0.41	1,481	-0.09	0.04	0.05	-0.18
Owns asset: Table	0.82	1,507	0.82	1,481	-0.01	0.02	0.74	-0.02
Owns asset: Chair	0.88	1,507	0.87	1,480	-0.01	0.02	0.76	-0.02
Owns asset: Bench	0.19	1,507	0.16	1,480	-0.04	0.03	0.32	-0.09
Owns asset: Fan	0.72	1,507	0.66	1,481	-0.06	0.05	0.21	-0.13
Owns asset: Sewing Machine	0.05	1,507	0.04	1,481	-0.01	0.01	0.22	-0.05
Owns asset: WaterPump	0.05	1,507	0.06	1,478	0.01	0.01	0.58	0.03

Table A5.

Livestock ownership

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Livestock Index	-0.01	1,504	0.12	1,476	0.14	0.07	0.05	0.14
Owns any livestock	0.82	1,504	0.84	1,477	0.02	0.02	0.33	0.06
Owns livestock: Buffalo	0.00	1,504	0.01	1,476	0.00	0.00	0.24	0.06
Owns livestock: Cow	0.41	1,504	0.47	1,477	0.05	0.03	0.09	0.11
Owns livestock: Goat	0.17	1,504	0.20	1,477	0.03	0.02	0.15	0.08
Owns livestock: Sheep	0.00	1,504	0.00	1,477	-0.00	0.00	0.66	-0.02
Owns livestock: Chicken	0.75	1,504	0.76	1,477	0.01	0.03	0.72	0.02
Owns livestock: Duck	0.40	1,504	0.47	1,477	0.07	0.05	0.13	0.14

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the Union level.

Table A6.

Community health worker visits, micronutrient, and vitamin intake

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Shasthya shebika or *Shasthya kormi* visited household in last month	0.37	1,504	0.35	1,478	-0.02	0.05	0.61	-0.05
Shasthya shebika visited household in last month	0.33	1,504	0.31	1,478	-0.02	0.05	0.68	-0.04
Number of *Shasthya shebika* visits in last month	0.60	1,504	0.48	1,478	-0.12	0.10	0.23	-0.10
Shasthya kormi visited household in last month	0.28	1,504	0.23	1,477	-0.05	0.05	0.30	-0.11
Number of *Shasthya kormi* visits in last month	0.40	1,504	0.27	1,478	-0.13	0.08	0.09	-0.20
Child took *Pustikona* sprinkles in last 2 weeks	0.03	1,504	0.03	1,476	0.00	0.01	0.74	0.01
Child took *Pustikona* sprinkles in last 24 hours	0.01	1,504	0.02	1,478	0.00	0.01	0.76	0.01
Child took Monimix sprinkles in last 2 weeks	0.00	1,501	0.01	1,477	0.00	0.00	0.82	0.01
Child took iron folate in last 2 weeks	0.02	1,503	0.01	1,477	-0.01	0.00	0.24	-0.05
Child took Vitamin A in last 2 weeks	0.04	1,503	0.03	1,476	-0.01	0.01	0.16	-0.07
Child took Vitamin C in last 2 weeks	0.03	1,504	0.02	1,478	-0.01	0.01	0.51	-0.04
Child took Multivitamin in last 2 weeks	0.05	1,501	0.03	1,478	-0.02	0.01	0.07	-0.12
Child took Zinc in last 2 weeks	0.07	1,503	0.05	1,476	-0.02	0.01	0.18	-0.08
Child took tablet for intestinal worm in last 6 months	0.14	1,504	0.17	1,476	0.03	0.02	0.21	0.08
Child had diarrhoea in last 2 weeks	0.07	1,503	0.07	1,477	-0.00	0.02	0.89	-0.01
Child had fever in last 2 weeks	0.33	1,504	0.32	1,478	-0.01	0.03	0.72	-0.03
Child had cough in last 2 weeks	0.24	1,503	0.21	1,475	-0.03	0.04	0.55	-0.06
Child had difficulty breathing during illness in last two weeks	0.03	1,503	0.03	1,477	-0.00	0.01	0.91	-0.01

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the Union level.

Table A7.

Knowledge about infant and young child feeding and breastfeeding practices

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Knowledge of feeding recommendations index	-0.07	1,514	0.03	1,493	0.11	0.10	0.27	0.11
Percent of correct responses to feeding Recommendation questions	0.53	1,514	0.54	1,493	0.01	0.01	0.50	0.06
Newborn breastfeeding: Correct answer	0.94	1,514	0.96	1,493	0.01	0.01	0.34	0.06
Feeding infant under 6 months: Correct answer	0.97	1,514	0.98	1,493	0.01	0.01	0.60	0.04
Breastfed baby needs water: Correct answer	0.52	1,514	0.62	1,493	0.10	0.05	0.07	0.20
Age to introduce food: Correct answer	0.70	1,514	0.75	1,493	0.04	0.05	0.45	0.09
Feeding 6-8m frequency: Correct answer	0.31	1,514	0.32	1,493	0.01	0.05	0.83	0.02
Feeding 6-8m amount: Correct answer	0.46	1,514	0.43	1,493	-0.03	0.05	0.62	-0.05
Feeding 9-11m frequency: Correct answer	0.53	1,514	0.52	1,493	-0.01	0.05	0.86	-0.02
Feeding 9-11m amount: Correct answer	0.56	1,514	0.54	1,493	-0.02	0.04	0.54	-0.04
Feeding dairy 12-23m frequency: Correct answer	0.08	1,514	0.09	1,493	0.01	0.02	0.79	0.02
Feeding dairy 12-23m frequency: Correct answer	0.25	1,514	0.22	1,493	-0.03	0.04	0.46	-0.07

Notes: Diff is the average difference between treatment and control, and SE is the standard error of this difference clustered at the union level.

Table A8.
Vaccination

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Child owns birth certificate	0.06	1,505	0.07	1,484	0.01	0.04	0.86	0.03
Child owns vaccination card	0.89	1,503	0.91	1,484	0.02	0.02	0.24	0.07
Received vaccine: BCG	0.94	1,505	0.96	1,484	0.01	0.01	0.29	0.05
Received vaccine: OPV	0.87	1,505	0.91	1,484	0.04	0.03	0.26	0.13
Received vaccine: Penta	0.92	1,505	0.93	1,483	0.01	0.01	0.58	0.02
Received vaccine: Haam	0.50	1,505	0.50	1,484	0.01	0.02	0.77	0.01
Received vaccine: Mumps	0.23	1,505	0.24	1,483	0.01	0.02	0.67	0.02
Vaccination information from vaccination card	0.80	1,501	0.82	1,483	0.02	0.03	0.39	0.06

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the Union level.

Table A9.
Poverty and food security

Variables	Control		Treatment		T-C Diff	Diff SE	p-value	Effect Size
	Mean	N1	Mean	N2				
Considers their household to be non-poor	0.43	1,502	0.31	1,483	-0.12	0.05	0.01	-0.24
Considers their household to be very poor	0.09	1,502	0.09	1,483	-0.00	0.02	0.89	-0.01
A HH member ate a smaller meal than needed in past 4 weeks	0.13	1,502	0.13	1,483	0.00	0.03	0.85	0.01
A HH member skipped a meal in past 4 weeks	0.06	1,501	0.07	1,483	0.01	0.02	0.70	0.03
A HH member went a whole day without eating in past 4 weeks	0.03	1,502	0.05	1,482	0.02	0.02	0.26	0.11
Youngest child is wearing footwear	0.01	1,503	0.01	1,477	0.00	0.00	0.96	0.00

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the Union level.

Table A10.

Decision-making power

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
PCG is one of the hh members that makes decisions what to do when child is seriously ill	0.18	1,514	0.18	1,493	0.01	0.02	0.71	0.02
PCG is one of the hh members that decides how their earnings will be spent	0.17	1,514	0.17	1,493	0.00	0.02	0.98	0.00
PCG is one of the hh members that makes decisions about buying important things	0.17	1,514	0.17	1,493	0.00	0.02	0.95	0.00
PCG is one of the hh members that makes decisions about what food is prepared e	0.11	1,514	0.09	1,493	-0.02	0.02	0.20	-0.07
PCG is one of the hh members that makes decisions about how much money the hous	0.16	1,514	0.17	1,493	0.01	0.02	0.75	0.02
PCG makes decisions what to do when child is seriously ill	0.04	1,514	0.03	1,493	-0.01	0.01	0.47	-0.04
PCG decides how their earnings will be spent	0.07	1,514	0.08	1,493	0.00	0.01	0.79	0.01
PCG makes decisions about buying important things for the family	0.06	1,514	0.06	1,493	-0.00	0.01	0.93	-0.00
PCG makes decisions about what food is prepared every day	0.03	1,514	0.02	1,493	-0.01	0.01	0.41	-0.04
PCG makes decisions about how much money the household spends on food	0.06	1,514	0.07	1,493	0.01	0.01	0.31	0.05
Mother in law makes decisions about how their earnings will be spent	0.16	1,514	0.16	1,493	-0.00	0.02	0.89	-0.01
Mother in law makes makes decisions about how much money the household spends o	0.18	1,514	0.17	1,493	-0.01	0.02	0.57	-0.04
Mother in law makes decisions about buying important things for the family	0.17	1,514	0.17	1,493	-0.00	0.02	0.99	-0.00
Mother in law makes decisions about what food is prepared every day	0.26	1,514	0.27	1,493	0.01	0.02	0.68	0.02
Mother in law makes decisions what to do when child is seriously ill	0.21	1,514	0.21	1,493	0.00	0.03	0.99	0.00

Table A11.

Breastfeeding practices

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
The child has been breastfed	0.99	1,504	1.00	1,483	0.01	0.00	0.04	0.08
The child is currently being breastfed	0.97	1,504	0.98	1,483	0.01	0.01	0.20	0.06
Time until child first breastfed (days)	14.75	1,493	13.58	1,481	-1.17	1.13	0.30	-0.08
Times the child was breastfed in last 24 hours	15.72	1,503	14.89	1,483	-0.83	0.62	0.18	-0.11
Age (months) until child given water or other fluids	2.42	1,380	2.79	1,351	0.37	0.37	0.32	0.14
Baby to Breast within 24 hours	0.95	1,514	0.96	1,493	0.01	0.01	0.48	0.04
Exclusive breastfeeding for 6 months child under 6 months	0.07	1,514	0.06	1,493	-0.01	0.01	0.46	-0.03
Exclusive breastfeeding for 6 months	0.21	1,514	0.26	1,493	0.05	0.04	0.18	0.12

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the Union level.

Table A12.

Antenatal and postnatal care

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Mother received antenatal care	0.88	1,504	0.89	1,485	0.01	0.03	0.81	0.02
Number of antenatal care visits	3.60	1,505	4.19	1,484	0.59	0.38	0.12	0.22
Recieved at least 3 antenatal care visits	0.64	1,505	0.70	1,484	0.06	0.05	0.25	0.13
Recieved at least 4 antenatal care visits	0.49	1,505	0.56	1,484	0.07	0.05	0.21	0.14
Number of antenatal care visits from BRAC employees	2.56	1,504	3.06	1,485	0.50	0.31	0.12	0.21
Months pregnant when first received antenatal care	4.04	1,330	3.94	1,323	-0.09	0.17	0.58	-0.06
Mother took deworming tablets during pregnancy	0.02	1,504	0.02	1,485	0.00	0.01	0.90	0.01
Received deworming tablets from BRAC during any antenatal care	0.01	1,505	0.01	1,485	-0.00	0.01	0.46	-0.04
Mother took iron/iron folate during pregnancy	0.57	1,505	0.59	1,485	0.02	0.05	0.68	0.04
Received iron/iron folate from BRAC during any antenatal care	0.21	1,504	0.27	1,485	0.06	0.04	0.21	0.13
Mother took vitamins during pregnancy	0.44	1,505	0.45	1,485	0.01	0.04	0.86	0.02
Received vitamins from BRAC during any antenatal care	0.15	1,505	0.18	1,485	0.03	0.04	0.45	0.08
Scale of birthweight of child (estimated)	3.10	1,498	3.10	1,479	-0.00	0.03	0.98	-0.00
Received postnatal care	0.54	1,505	0.46	1,485	-0.09	0.05	0.11	-0.17

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the Union level.

Table A13.

Anthropometric outcomes

Variables	Control		Treatment		T-C Diff	Diff SE	p value	Effect Size
	Mean	N1	Mean	N2				
Age of youngest child (months)	11.69	1,506	11.48	1,485	-0.21	0.27	0.44	-0.03
Gender of youngest child: female	0.49	1,512	0.49	1,491	0.00	0.02	0.99	0.00
Child weight (kg)	7.86	1,490	8.37	1,476	0.51	0.28	0.07	0.12
Child height (cm)	69.80	1,493	69.78	1,476	-0.02	0.37	0.95	-0.00
Converted length/height for deriving z score (in cms)	70.47	1,493	70.44	1,476	-0.03	0.37	0.93	-0.00
Calculated bmi=weight / squared(_clenhei)	15.77	1,488	16.57	1,473	0.80	0.50	0.11	0.12
Weight for age (z-score) WHO 2011	-1.14	1,472	-1.08	1,436	0.06	0.06	0.37	0.04
Height for age (z-score) WHO 2011	-1.05	1,475	-0.97	1,459	0.08	0.09	0.35	0.05
Weight for height (z-score) WHO 2011	-0.73	1,447	-0.73	1,414	-0.00	0.08	0.96	-0.00
BMI-for-age z-score	-0.64	1,445	-0.66	1,411	-0.02	0.08	0.84	-0.01
Stunted (%)WHO 2011	0.25	1,475	0.22	1,459	-0.03	0.02	0.20	-0.07
Wasted (%) WHO 2011	0.17	1,447	0.17	1,414	-0.00	0.02	0.96	-0.00
Underweight (%) WHO 2011	0.26	1,472	0.22	1,436	-0.04	0.02	0.06	-0.09
Severely stunted (%) WHO 2011	0.09	1,475	0.06	1,459	-0.03	0.01	0.04	-0.11
Severely wasted (%) WHO 2011	0.05	1,447	0.06	1,414	0.01	0.02	0.53	0.04
Severely underweight (%) WHO 2011	0.09	1,472	0.06	1,436	-0.02	0.01	0.06	-0.09

Notes: Diff is the average difference between Treatment and Control, and SE is the standard error of this difference clustered at the Union level.

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