FANTA III

FOOD AND NUTRITION TECHNICAL ASSISTANCE

USAID

FROM THE AMERICAN PEOPLE

Process Evaluation of the Rang-Din Nutrition Study: Final Report

Susana L Matias
Kassandra L Harding
Md Munir Muniruzzaman
Malay K Mridha
Md Barkat Ullah
Stephen A Vosti
Kathryn G Dewey

September 2017

FANTA
FHI 360
1825 Connecticut Ave., NW
Washington, DC 20009-5721
Tel: 202-884-8000 Fax: 202-884-8432
fantamail@fhi360.org www.fantaproject.org

fhi 360

THE SCIENCE OF IMPROVING LIVES

This report is made possible by the generous support of the American people through the support of the Office of Health, Infectious Diseases, and Nutrition, Bureau for Global Health, U.S. Agency for International Development (USAID) under terms of Cooperative Agreement No. AID-OAA-A-12-00005, through the Food and Nutrition Technical Assistance III Project (FANTA), managed by FHI 360.

The contents are the responsibility of FHI 360 and do not necessarily reflect the views of USAID or the United States Government.

September 2017

Recommended Citation

Matias, Susana L.; Harding, Kassandra L.; Muniruzzaman, Md Munir; Mridha, Malay K.; Ullah, Md Barkat; Vosti, Stephen A.; Dewey, Kathryn G. 2017. *Process Evaluation of the Rang-Din Nutrition Study: Final Report.* Washington, DC: FHI 360/Food and Nutrition Technical Assistance III Project (FANTA).

Contact Information

Food and Nutrition Technical Assistance III Project (FANTA)
FHI 360
1825 Connecticut Avenue, NW
Washington, DC 20009-5721
T 202-884-8000
F 202-884-8432
fantamail@fhi360.org
www.fantaproject.org

Acknowledgments

The authors would like to thank Zeina Maalouf-Manasseh, Camila Chaparro, and Megan Deitchler from the Food and Nutrition Technical Assistance Project (FANTA); Rebecca Young and Charles Arnold from the University of California, Davis (UCD); Md. Shamsul Huda, Md. Monjurul Alom, Md. Zahangir Alam, Md. Faisal Ahamed, Tamanna-E-Jnnat, Kaniz Fatema, Rumana Parvin, Aungha Bushion Chakraborty, Faisal Ahmed, Golzer Ruma, Rahena Parvin, and Kamal Chandra Sil from icddr,b; and Louise Tina Day, Stacy L Saha, Swapan Pahan, Altaf Hossain, Shafiul Alam, Pronoy Ganguly, Mahtab Liton, and Steve Withington from LAMB for their support during the implementation of this process evaluation.

Contents

Abbreviations and Acronyms

A&T	Alive & Thrive
ANC	antenatal care
ANOVA	analysis of variance
BBS	Bangladesh Bureau of Statistics
BCC	behavior change communication
BMI	body mass index
BRAC	Bangladesh Rural Advancement Committee
CF	community facilitator
CHDP	Community Health and Development Program
CHW	community health worker
CMW	community midwife
FANTA	Food and Nutrition Technical Assistance Project
FC	field coordinator
g	gram(s)
IFA	iron and folic acid
IQR	interquartile range
IRB	Institutional Review Board
KAP	knowledge, attitudes and practices
kcal	kilocalorie(s)
LNS	lipid-based nutrient supplement(s)
LNS-C	lipid-based nutrient supplement(s) for children
LNS-PLW	lipid-based nutrient supplement(s) for pregnant and lactating women
µg	microgram(s)
mg	milligram(s)
MNP	micronutrient powder(s)
NGO	nongovernmental organization
PE	process evaluation
PEPA	Process Evaluation of Participant Adherence
PEPA-C	Process Evaluation of Participant Adherence among Children
PEPA-PLW	Process Evaluation of Participant Adherence among Pregnant and Lactating Women
PI	Principal Investigator
PLW	pregnant and lactating women
PNC	postnatal care

RDNS	Rang-Din Nutrition Study
RI	research investigator
SACMO	sub-assistant community medical officer
SBA-CP	skilled birth attendants cum paramedic
SD	standard deviation
SDMR	Supplement Distribution and Monitoring Register
SDU	safe delivery unit
UCD	University of California, Davis
UNHCR	United Nations High Commissioner for Refugees
USAID	U.S. Agency for International Development
VHV	village health volunteer
WHO	World Health Organization

Executive Summary

This report presents results from a process evaluation (PE) conducted in the context of the Rang-Din Nutrition Study (RDNS), a cluster-randomized effectiveness study that evaluated the use of lipid-based nutrient supplements (LNS) for the prevention of malnutrition in children and the improvement of the nutritional status of pregnant and lactating women (PLW) in Bangladesh. The RDNS intervention consisted of different combinations of nutritional supplements delivered to PLW and/or their children using an existing programmatic platform for supplement distribution as well as supplement use messages: the Community Health and Development Program (CHDP) implemented by LAMB, a local nongovernmental organization (NGO).

The main objectives of the RDNS PE were to document and evaluate the human and physical resources and processes needed for implementation of the interventions in the context of the CHDP and to use the findings to explain and interpret program effectiveness results and identify important facilitators and barriers to the success of the nutrition intervention. A cost-effectiveness analysis of the RDNS intervention was also conducted; results from that analysis are in the FANTA report "The Rang-Din Nutrition Study in Rural Bangladesh: The Costs and Cost-Effectiveness of Programmatic Interventions to Improve Linear Growth at Birth and 18 Months, and the Costs of These Interventions at 24 Months." (Humber et al. 2017)

For the RDNS PE, we collected various types of data from different populations, including longitudinal assessments of program staff; information from RDNS participants; and data from program registers, including all program beneficiaries (even those not enrolled in the RDNS but receiving supplements). Likewise, several types of data collection tools were used: questionnaires, PE (e.g., storage) forms, program registers, and observations (i.e., time and motion assessments). The following sections summarize the main RDNS PE findings, organized according to the steps in the program implementation pathway (i.e., from inputs to outcomes).

Inputs

CHDP Resources

LAMB's commitment, a critical input for this intervention to be carried out successfully, was already in place. LAMB has been implementing multisectoral development programs for the local population, including the CHDP, for more than 40 years, and the NGO has a good reputation in the study area. The CHDP has a clear organizational structure and staff that had already been trained on basic maternal and child health topics. In addition, new frontline staff were hired in anticipation of the increase in workload expected for supplement distribution, and one LAMB staff member assumed the role of liaison between the CHDP and the RDNS.

Other inputs identified at the outset as needed for program implementation included available health staff with basic literacy and math skills (to keep a register and beneficiary cards and to count supplements); storage space in the local health clinics (called safe delivery units [SDUs]); and bicycles and motorbikes, which were available from the beginning of program implementation.

To carry out new activities, CHDP staff needed to be trained on aspects of the new component (i.e., supplement distribution). RDNS trainings were conducted by RDNS staff and included an initial orientation (for all CHDP staff) and a refresher training session (only for Community Health Workers [CHWs], Community Facilitators [CFs], and Field Coordinators [FCs]). Trainings were received by most

of the CHDP staff interviewed and, based on responses among those who completed the post-training evaluation, CHWs, CFs, and FCs appeared to have assimilated the information reinforced in the RDNS refresher training (91% of CHWs and 5 of 7 CFs and FCs passed the post-training evaluation quiz). In general, the CHDP staff believed that they were well trained to perform their assigned tasks, and most of them (>90%) attended monthly CHDP refresher trainings throughout program implementation.

Answers to questions regarding job motivation among CHDP staff point to a potential barrier related to the perception of lacking sufficient job-specific training. In addition, most staff found it difficult to manage their workloads and reported being under a lot of pressure at baseline (90% of community health workers [CHWs] and 9 of 11 community facilitators [CFs] and field coordinators [FCs]). This perceived pressure seemed to decrease as the program moved from the start-up phase to completion (only 43% of CHWs and 5 of 11 CFs and FCs felt that same pressure at the end).

Supplement availability was sustained throughout program implementation, as a result of RDNS staff efforts and continuous communication with LAMB staff. However, LNS orders had to be placed several months in advance given that the product was not nationally produced. Also, iron and folic acid (IFA) supplements with the desired dosage were not available in Bangladesh, and specific arrangements were made for them to be produced for the RDNS. Micronutrient powder (MNP) supplements were already in the market in Bangladesh. Overall, PE data on supplement availability at the central and SDU storage sites indicate that the expected type (either maternal or child) and amount of supplements, and the materials needed for supplement distribution, were available throughout program implementation.

CHDP Context

In general, CHDP staff turnover was low throughout program implementation (6%–11% for CHWs), with the exception that, around the midpoint of the implementation period, several (four of seven) supervisors (i.e., CFs and FCs) were new to their role (i.e., they had spent less than 1 year in the position).

Supervision of CHDP staff seemed to decrease during program implementation. In particular, after the start-up phase of the program, CHWs reported fewer meetings with village health volunteers (VHVs)[1] to discuss their work and less-frequent supervision received from the CFs and FCs. CFs and FCs also reported meeting less frequently with their LAMB supervisors during the final period of program implementation.

Processes

Reach

In response to a CHDP staff survey (described in Section 3.2.1), CHWs and VHVs reported identification of pregnant women as the most frequently conducted activity during program implementation. This activity was already a key component of the CHDP and served as a trigger for the provision of other maternal and child health services, that is, services other than supplement distribution. Identifying pregnant women was the main recruitment activity for the RDNS intervention, and it triggered the beginning of maternal supplementation among eligible beneficiaries. Thus, incorporating a maternal nutrition intervention into a program in which pregnancy identification is a regular activity proved to be a successful strategy for reaching potential beneficiaries.

[1] CHWs were the key frontline workers for program implementation. They were younger and better educated than VHVs, who were mostly illiterate; CHWs were supervised by CFs or FCs, who had higher education levels.

Monitoring rates of beneficiaries' participation (i.e., those receiving supplements though not necessarily enrolled in the RDNS) was purposively not done for this PE. However, data available from the program records suggested that among infants who started receiving supplements at 6 months of age, about 97% were still in the records for receiving a supplement when they were 14–15 months of age and about 79% of them were still receiving supplements at 22–23 months of age. Because these indicators were calculated using program data, they need to be interpreted cautiously.

Dose Delivered and Fidelity

The LNS products required specific storage conditions. At the central storage site, supplement storage recommendations were met most of the time. However, during the summer season, the temperature at the central site frequently (11–26 days in July) surpassed the maximum recommended for LNS. Environmental conditions were not monitored in the SDUs, but this may have also occurred at these locations as they did not have a fun running, as the central storage did.

Overall, implementation of the supplement distribution component appeared to have occurred as planned. The main supplement distribution mechanism was the delivery by CHWs at beneficiaries' homes. Consistently, most CHWs (83%–94%) reported conducting home visits during the previous month throughout program implementation; this was confirmed by RDNS participants, though at somewhat lower rates (75%–76%). Along with the supplements, messages on supplement use were given to most beneficiaries, as reported in the Process Evaluation of Participant Adherence (PEPA) assessments.

According to protocol, CHWs were supposed to check supplement stocks in households and retrieve excess supplements if the stock was more than a 7-day supply. Most CHWs' (75%–88%) reported checking whether supplements had been consumed, but fewer (56%–61%) reported checking supplement stocks at the households.

Outputs

Dose Received and Fidelity

Program records, which were kept by CHWs, indicated that once the program was established, most supplement distributions (≥95% of distributions to beneficiaries) occurred in a timely fashion (i.e., within 35 days of the previous delivery date). However, during the start-up phase, about 12% of maternal supplement distributions were delayed. Because these program records were maintained by CHWs (who were responsible for delivering supplements in a timely manner), these indicators need to be considered cautiously. For instance, RDNS participants reported running out of supplements more frequently (15% for maternal supplements and 9% for child supplements) than what would be expected based on program records.

All women reported receiving supplement use messages when they received the first maternal and/or child supplement. When asked about their most recent supplement distribution, the percentage of women who reported receiving maternal supplement use messages was higher among those receiving IFA than among those receiving LNS, but this difference was no longer observed when postpartum women were excluded, probably because the dosage message for IFA was different during the postpartum period than during pregnancy. With regard to child supplements, most caregivers (>90%) reported receiving child supplement use messages, with no differences by supplement type (i.e., LNS or MNP). Nonstandard messages on supplement use were provided occasionally. However, these deviations from protocol were isolated.

Outcomes

For the supplements to be properly consumed, beneficiaries needed not only to receive the supplement use messages but also to recall and follow these messages. Findings from the PEPA assessments suggested that most women (≥80%) recalled the correct supplement use messages.

Self-reported supplement consumption during pregnancy in the PEPA subsample was similar between women given LNS and those given IFA (p=0.086), although a significantly higher percentage of the former reported not consuming any supplements during the previous week (22% vs. 6%, respectively; p=0.039). Adherence to LNS was not significantly different across pre/postpartum time periods (pregnancy, early postpartum, and late postpartum; p=0.39), suggesting sustained adherence through 6 months postpartum. For IFA, the percentage reporting not consuming any supplements during the previous week was higher during postpartum than during pregnancy.

Reported adherence to consumption recommendations for children for LNS and MNP was relatively high in the PEPA subsample (median adherence >85%) after 12 months of usage (at approximately 18 months of age). Caregivers reported that forgetfulness, illness, a child's perceived acceptance of the supplements, and travel were the most common reasons for low adherence. Sharing of supplements and loss or destruction of sachets were reported more often among LNS recipients than among MNP recipients. Greater sharing of LNS could be related to the palatability and novelty of LNS, while greater loss or destruction may be related to children's attempts to open the LNS sachets for self-feeding.

Analysis of data from the entire RDNS cohort shows statistical differences in adherence to maternal supplementation recommendations between the types of supplements consumed during the previous 6 months. During pregnancy, 92% of mothers consumed the IFA supplement every day or almost every day, while only 64% of mothers consumed LNS every day or almost every day (p<0.0001). In the early postpartum, 75% of mothers consumed IFA every other day or almost every other day, compared to 63% of mothers who consumed LNS every day or almost every day (p<0.0001). Analysis of data from only the previous week during the early postpartum period shows that high adherence (defined as four or more supplements for LNS, two or more supplements for IFA) also differed by type of supplement (55% for LNS and 77% for IFA; p<0.0001).

With regard to child supplementation, the vast majority of RDNS caregivers reported high adherence, whether defined as consuming eight or more sachets of LNS or four or more sachets of MNP within the past week (77%–80% at 12 months, 83%–86% at 18 months, and 90%–92% at 24 months of age) or as "almost every day" or "regularly, every day" during the past 6 months (94%–97% at 12 months, 95%–97% at 18 months, and 97%–99% at 24 months of age).

Other Process Evaluation Results

The context in which the program was implemented was an impoverished rural area with a shortage of formally trained health care providers. During program implementation, the political situation in Bangladesh posed extra challenges for implementation, in addition to the already difficult conditions presented by weak infrastructure and extreme climate. LAMB's strong presence, the continuous communication between LAMB and the RDNS staff, motivated staff, and access to adequate supplies and equipment were crucial elements in overcoming these challenges.

An initial concern was the possibility that adding a new component to an existing program would affect other CHDP activities. Based on CHWs' reports, the only CHDP activity that occurred less frequently than the new component during RDNS implementation was the supervision of VHVs. Time and motion

assessments indicated that, once supplement distribution was well established, the RDNS activities took on average less than 10% of the CHWs' and VHVs' time, with most of that time spent counseling women and completing or checking registers.

RDNS participants receiving supplements (intervention groups) were more likely than those not receiving supplements (control group) to report home visitation by a CHW (93%–94% in the intervention groups vs. 19%–20% in the control group, depending on time point) and attendance at behavior change communication group sessions (18%–32% in the intervention groups vs. 8%–9% in the control group, depending on time point). This suggests that adding a nutrient supplement component to an existing community health program may increase the frequency of contact with CHWs. Increased access to frontline health workers and to those based in the SDUs could have other positive health outcomes, beyond those associated with access to nutritional supplementation.

In summary, implementation of RDNS activities, inserted into the CHDP, appeared to have occurred mostly as planned, indicating a good level of fidelity. A key factor facilitating the implementation of this new component was the strong presence and good reputation of a local NGO providing the programmatic platform. The close work and continuous communication between the implementing partners also contributed to success. Adding a nutritional supplementation intervention that started during pregnancy into a program in which identification of new pregnancies was already a regular activity facilitated reaching potential beneficiaries. This experience also indicates that CHWs can implement this type of intervention, resulting in good levels of uptake by the beneficiary population. Still, thorough training and frequent supervision are important for frontline staff. Barriers to successful implementation included an unstable political situation, a weak infrastructure, and an extreme climate. However, these challenges can be overcome when strong collaborations, motivation, and access to adequate inputs are in place.

Introduction

The U.S. Agency for International Development (USAID)-funded Food and Nutrition Technical Assistance Project (FANTA), in collaboration with the University of California, Davis (UCD), initiated the Rang-Din Nutrition Study (RDNS), a cluster-randomized controlled effectiveness study to evaluate the use of lipid-based nutrient supplements (LNS) for the prevention of chronic malnutrition in children and for the improvement of the nutritional status of pregnant and lactating women (PLW) in Bangladesh.

The RDNS was implemented in partnership with icddr,b (formerly known as the International Centre for Diarrhoeal Disease Research, Bangladesh) and LAMB (a local nongovernmental organization [NGO] formerly known as Lutheran Aid to Medicine in Bangladesh). UCD designed the RDNS and provided overall technical oversight of its implementation; icddr,b hired and supervised the RDNS field staff and provided administrative support (e.g., procurement of domestically produced supplements). LAMB provided an ideal programmatic context in which to test these interventions, as it has been implementing multisectoral development programs in the study area for more than 40 years, and it is well regarded by the local population. LAMB's Community Health and Development Program (CHDP) was used as the product and information delivery platform for the RDNS, which was modeled after the health, nutrition, and population program of the Bangladesh Rural Advancement Committee (BRAC), the largest NGO in Bangladesh. The CHDP was a particularly convenient programming platform on which to base the RDNS, as CHDP staff were already trained on basic maternal and child health topics.

1.1 Process Evaluation

A process evaluation (PE) involves the use of indicators to reflect how well interventions are delivered by implementing agents and how well they are received by targeted beneficiary groups. Thus, a PE documents and analyzes the implementation of the intervention program, assessing whether activities were implemented as planned and whether expected outputs were produced. Such information can be useful in determining the key components of an intervention that are effective, the beneficiary groups for whom it is effective, and under what conditions it is effective (Linnan and Steckler 2002). Usually, a PE assesses the following components:

- **Resources:** These are the human, physical, and financial resources available to, or characteristics of, the organizations, implementers, or targeted beneficiaries necessary to attain project goals.
- **Reach:** This component refers to the degree of participation by the target beneficiary group, as well as the identification of subgroups that may be more willing than others to participate, participate more intensively, or remain in the intervention program for longer periods of time.
- **Dose Delivered:** This component involves the measurement of the number or amounts of the intended intervention (in the RDNS context, nutrient supplements and use messages) that are delivered to beneficiaries or their caregivers.
- **Dose Received:** This refers to the extent to which program beneficiaries are receptive to and use the intervention.
- **Fidelity:** This component assesses the extent to which the intervention is carried out as planned by the project developers, vis-à-vis the stated guidelines and protocols.
- **Context:** This provides a snapshot of the larger physical, social, and political environment that may directly or indirectly influence the implementation of the program; the elements in this environment can be facilitating factors or impediments (barriers) to optimal delivery and uptake of the intervention.

1.2 The RDNS Region

There are 64 districts in Bangladesh. The RDNS was implemented in the northwest area of Bangladesh, in six unions[2] in the Chirirbandar sub-district of the Dinajpur district and in five unions in the Badarganj sub-district of the Rangpur district. A union consists of multiple villages with a total of about 30,000 people.

The RDNS sub-districts are located in one of the poorest areas of Bangladesh, with at least 48% of their residents living below the poverty line (Bangladesh Bureau of Statistics [BBS] 2012). In 2011, the total population of all 11 RDNS unions was 279,614. In the RDNS sub-districts, average household size was four, 52% of the population over 7 years of age was illiterate, 31% of households had electricity, 98% had access to safe drinking water, and 75% had sanitary or non-sanitary toilets (BBS 2012). The major economic activities in the area include farming, transportation, construction, and petty trading, and it is common for inhabitants to move to large cities for work, especially during the lean seasons. The climate is typically tropical. There are six seasons in Bangladesh: summer, rainy, autumn, fall, winter, and spring. Due to the monsoon, it can rain a lot during the rainy season (middle of June to the middle of August), and transportation and travel become difficult, as roads are muddy and some areas get flooded. The cold weather during winter also poses extra challenges, reducing visibility on the roads due to fog, particularly in the northern area.

Health services in the area are provided by both the public and the private sectors. In each union, there are three to four public health facilities that provide primarily maternal and child health services. A number of NGOs, including LAMB and BRAC, also provide community-based health services for women and children. Community-based health services from both the public and private sectors are free of charge, but the NGOs charge user fees when service is provided from a static health center or a satellite clinic. Other NGOs working in partnership with LAMB in the RDNS area during its implementation included UNICEF (Maternal, Neonatal, and Child Survival Project) and PLAN Bangladesh (Women and Their Children's Health Project) in the Chirirbandar sub-district and the Tear Fund (Disaster Risk Reduction Project) in the Badarganj sub-district.

Access to adequate health care was likely a challenge in the RDNS area. We observed a shortage of formally trained health care providers; in fact, at the time of data collection, there was no single trained doctor (i.e., MBBS [Bachelor of Medicine, Bachelor of Surgery]) in any of the RDNS Unions. On the other hand, there were a number of community health care providers in each of the 11 RDNS unions, in particular village doctors (informal health care providers practicing allopathic medicine). A total of 292 village doctors were identified in the RDNS area. Other types of community health care providers available in the unions include *fakirs*, who are religious, mystic, and native healers who use magical methods, and *kabirajs*, who apply traditional medicine based on the use of herbs, minerals, and diet restrictions. There were 144 fakirs or kabirajs in the RDNS area, as well as 11 health care providers with some level of formal training (e.g., medical assistant, sub-assistant community medical officer [SACMO], paramedic). We also identified more than 300 medicine shops in the 11 RDNS unions, all of which sold some kind of vitamin or mineral supplement. However, it was not possible to determine how many of them sold maternal or child supplements.

During program implementation, Bangladesh underwent political turmoil, and the RDNS area was not immune from the violence that resulted from the unrest. There were strikes, road blocks, and conflicts between law enforcement agencies and political activists. For example, in the first quarter of 2015, strikes and road blocks continued for 92 consecutive days. Though CHDP and RDNS activities continued during

[2] A union is the lowest administrative unit in rural Bangladesh.

the period of political turmoil, there were huge challenges for transportation and delivery of supplements, home visits by CHWs, and any other activities involving mobilization of staff or beneficiaries. Four-wheel-drive vehicles were stopped and only rickshaws or walking transportation was allowed during road blocks.

1.3 The Programmatic Platform

The CHDP provides a host of services to the community, including maternity services at the home and at safe delivery units (SDUs), health education through behavior change communication (BCC) sessions on a wide variety of health topics, postpartum care, and neonatal and child health services. The CHDP is staffed with community facilitators (CFs) and field coordinators (FCs), skilled birth attendants cum paramedics (SBA-CPs), community health workers (CHWs), and village health volunteers (VHVs), as well as program officers and program managers. VHVs are responsible for pregnancy surveillance, identification of newly wed couples, health promotion activities, and assistance to CHWs during health education sessions. CHWs supervise VHVs, conduct health education sessions, provide antenatal and postnatal primary care, and keep records of PLW and children under 5 years of age. It is important to mention that CHWs, SBA-CPs, nurses, community midwives (CMWs), CFs, and FCs were paid positions, while VHVs were volunteers from the communities. However, VHVs received a monthly honorarium and performance incentives from LAMB as compensation for transportation costs when they attended events outside their villages (e.g., trainings).

1.4 The RDNS Design and Intervention

The RDNS was a longitudinal, cluster-randomized effectiveness trial, in which "clusters" (by definition, the work areas of the CHWs and the population served within those work areas), rather than individual women, were randomly assigned to one of four study arms. The study was implemented in 64 clusters in the 11 study unions; each study arm included 16 clusters. The women were enrolled during the first or second trimester of pregnancy (≤20 weeks gestation) and followed through pregnancy to 6 months postpartum, and their children were followed from birth to 2 years, with health/growth assessments being conducted at several time points.

The RDNS involved four treatment arms:

1. **Comprehensive LNS:** LNS for women during pregnancy and the first 6 months postpartum (LNS-PLW), plus LNS for their children (LNS-C) starting at 6 months of age and continuing to 24 months
2. **Child LNS:** Iron and folic acid (IFA) every day for women during pregnancy and every other day during the first 3 months postpartum, and whose children received LNS-C starting at 6 months of age and continuing to 24 months
3. **Child MNP:** IFA every day for women during pregnancy and every other day during the first 3 months postpartum, and whose children received micronutrient powder (MNP) starting at 6 months and continuing to 24 months
4. **Control:** IFA every day for women during pregnancy and every other day during the first 3 months postpartum, and whose children received no additional supplement

1.4.1 Supplement Distribution

Within the CHDP, CHWs were identified as the key field-level CHDP staff members who could implement the RDNS interventions. The illiteracy rate among VHVs was a barrier to choosing them as

the main supplement distributors in the villages. The intervention activities, including training of the CHWs and VHVs, storage and distribution of supplements, nutrition education and counseling, record keeping, and reporting, were incorporated into the existing CHDP activities of LAMB. According to LAMB CHDP protocol, women picked up their first 1-month supply of supplements at the LAMB SDU. Subsequent monthly supplies were usually delivered by the CHW (or VHV) to the woman's home and, in some cases, during the monthly educational sessions given by CHWs at the villages. At the first supplement distribution, each woman received a registration card (to record receipt of future supplies) with key messages about the supplements that were read aloud to the woman. CHWs recorded the supplement delivery dates on the card during subsequent supplement distributions.

Depending on the cluster, the CHWs were also asked to counsel the pregnant woman to consume either one IFA tablet with water each day after eating a large meal or one sachet of LNS-PLW mixed with any food of her choice each day as part of a large meal. CHWs were instructed to advise women not to consume more than one tablet or sachet per day, even if they did not take the supplement the previous day. Further supplement-specific and dietary messages given to women (which were also printed on the registration card and on the maternal supplement container labels) are listed in Appendix 4. The CHWs were expected to repeat all these messages at the monthly follow-up visits to the woman's home, to advise women not to take any IFA supplements (other than the IFA tablets provided to women in those arms), and to tell women to contact them immediately if they experienced any side effects during the treatment.

LNS-PLW distribution was interrupted from August 8 to October 20, 2012 to comply with a new quality control criterion that required ready-to-use supplementary foods to be free of *Cronobacter sakazakii* (i.e., no samples testing positive at any level). *C. Sakazakii* is present in many foods and considered an opportunistic pathogen. *C. sakazakii* can cause sepsis and meningitis in young infants (< 2 months of age), but potential risk to older infants, children, and adults are considered to be much lower (CDC 2015). During the interruption, women in all arms received IFA.

When children turned 6 months of age, they started receiving either LNS-C or MNP or they received no supplement, depending on the cluster. As with maternal supplements, CHWs were the key staff for distribution of child supplements within the CHDP, and they continued record keeping for these supply distributions. CHWs were trained to instruct the women to feed their children either two sachets of LNS-C or one sachet of MNP per day, and to emphasize that breastfeeding should continue along with complementary feeding. Further supplement-specific and infant feeding messages given to caregivers receiving child supplements (which were also printed on the registration card and on the child supplement container labels) are listed in Appendix 4. As with maternal supplementation, the CHWs were expected to repeat all these standard messages at the monthly follow-up home visits. If needed, a new registration card was given to the caregivers when they started receiving supplements for their children.

1.4.2 Maternal Supplements

LNS-PLW was packed in 20 g sachets and contained 118 kcal per day. Because production of LNS in Bangladesh had not yet been established, LNS-PLW was produced by Nutriset SA in Malaunay, France. For the purpose of the RDNS intervention, the LNS-PLW was given a local name, "Jononi," which means "mother" in Bengali. The composition of the LNS-PLW used in this study can be found in Appendix 2.

The standard of care in Bangladesh calls for women to consume IFA tablets containing 60 mg of iron and 400 µg of folic acid daily during pregnancy and for the first 3 months postpartum. Thus, women not receiving LNS-PLW, were provided IFA tablets (known as "Alic"). In the current study, postpartum women were advised to consume IFA tablets containing 60 mg of iron and 400 µg of folic acid every

other day because the recommended dietary allowance for iron for lactating women is only 9 mg per day, compared to 27 mg during pregnancy.

1.4.3 Child Supplements

LNS-C was a novel product that was distributed only by LAMB in the study unions during the RDNS study period, and, for the RDNS intervention, it was given a local name, "Sonamoni," which means "sweetheart." The LNS-C product was a 10 g sachet of fortified paste to be consumed twice daily. On the other hand, 1 g MNP packets were readily available in the Dinajpur and Rangpur markets prior to this study, as they were produced by a local company (Renata Ltd). The commercial name for the MNP was "Pushtikona," and it contained 15 micronutrients: 5 minerals and 10 vitamins. The composition of the LNS-C and MNP products used in this study can be found in Appendix 3.

1.5 The RDNS Process Evaluation

To better understand the operational aspects of delivering LNS and MNP through community-based programs, UCD and icddr,b conducted a comprehensive PE. In the context of the RDNS implementation, we defined two primary objectives for the PE:

- Document and evaluate the resources (human, capital, and informational) and processes needed for implementation of interventions that provide a nutrient supplement, such as LNS or MNP, in the context of the CHDP.
- Use the PE findings to explain and interpret program effectiveness results and identify important facilitators and barriers to the success of the nutrition intervention, which can then be used to improve the performance of current (CHDP) and future programs in the scaling up of LNS or MNP distribution.

There were two categories of participants in the PE: CHDP staff in the 11 RDNS unions (i.e., VHVs, CHWs, CFs, and FCs) and RDNS participants, either the entire cohort or subsamples, depending on the indicator being measured.

As part of the RDNS PE, we also analyzed data from the program registers. Data analyzed from those registers included information on program activities conducted with all program beneficiaries, involving some who were not RDNS participants but who received CHDP services (including nutritional supplements). Thus, CHDP beneficiaries whose data were part of the registers were considered passive participants in the PE.

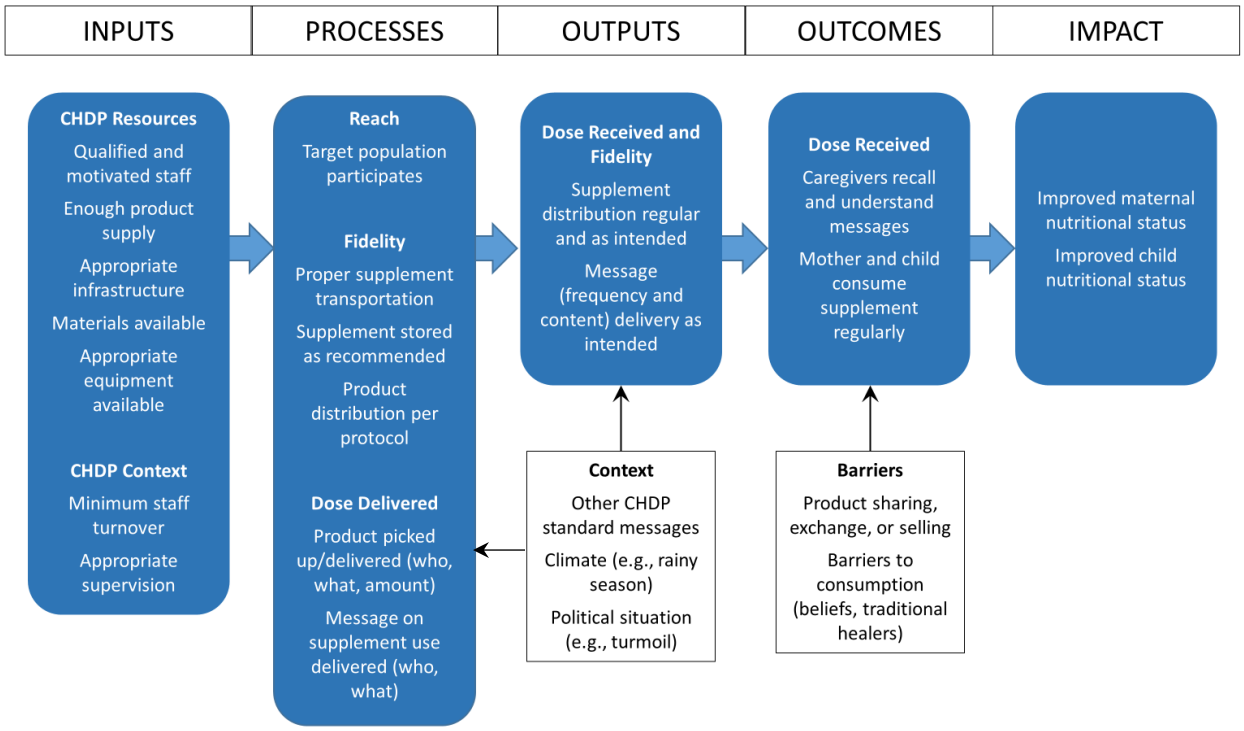
Further exploration of the financial resources needed for implementing the RDNS, and how they compared to the observed benefits of the intervention**,** were also addressed as part of a cost-effectiveness analysis; results from that analysis are reported are in the FANTA report "The Rang-Din Nutrition Study in Rural Bangladesh: The Costs and Cost-Effectiveness of Programmatic Interventions to Improve Linear Growth at Birth and 18 Months." (Humber et al. 2017)

2 Methods

2.1 The RDNS Process Evaluation Model and Design

The proposed logic implementation model for the impact of LNS or MNP on mothers' and children's biological outcomes is described in **Figure 1**. This figure shows the different components assessed as part of the RDNS PE (resources, reach, dose delivered, dose received, and fidelity), within the implementation pathway (from inputs to impact). Thus, the hypothesized (and ideal) pathway begins with the required resources necessary for delivery of the intervention (LNS or MNP), continues with the sequence of processes that need to be adopted and practiced by program implementers (in this case, CHDP staff), followed by the outputs that need to be attained by the program, which would then generate the expected outcomes in terms of caregivers' consumption and child feeding practices. Completion of this pathway would allow the final desired impact on maternal and child nutrition and health and child development.

Figure 1. RDNS process evaluation model



Overall, the RDNS PE consisted of a combination of research designs, including cross-sectional, longitudinal, and continuous assessments or measurements. Similarly, different types of data were collected and categorized into three main types: CHDP staff data, RDNS participant data, and program data. With regard to time, PE activities occurred concurrently with the RDNS implementation, starting with a baseline assessment of the CHDP staff in August 2011, and concluding with the last round of program register data collection in April 2015.

2.2 Process Evaluation Indicators, Data Collection Tools, and Sampling

Appendix 1 includes a table with the PE indicators that were analyzed, the data collection method used, the indicator-specific targeted sample sizes, and the data collection rounds (if more than one) analyzed.

Mostly quantitative methods were employed for the evaluation of PE indicators. These included facility assessments (e.g., of the condition of the central storage site and SDU storage areas), review of program records (e.g., for assessment of coverage), interviews with beneficiaries (e.g., for determination of supplement exposure and practices), and interviews and observations of utilization of time (i.e., time and motion assessments) of frontline program staff (i.e., VHVs, CHWs, CFs, and FCs). Different populations or samples were used depending on the PE indicator to be assessed. Sample sizes for each assessment were determined based on logistics and resources available for data collection activities.

In an attempt to improve efficiency, PE data collection tools were designed to cover several PE indicators, sometimes even from different PE components. For instance, the program registers were designed so that the implementers could record data not only on how well the program implementers reached the target population (i.e., reach) but also on whether supplement distribution activities occurred according to the protocol (i.e., fidelity). This illustrates the complexity of the RDNS PE assessment, in which PE data collection was not always the responsibility of trained research assistants, but was instead sometimes conducted by CHDP staff as part of their routine record keeping program activities.

2.2.1 The CHDP Staff Questionnaire

The PE baseline assessment of CHDP staff was undertaken using a survey conducted in August 2011, around the time the implementation of the new component of the program (i.e., distribution of supplements) began. At that time, identification of potential beneficiaries targeted for enrollment in the intervention (i.e., women who reported a new pregnancy) was slowly starting; the distribution of nutritional supplements and the development of supporting infrastructure and messaging were also just beginning.

The CHDP staff survey was an interviewer-administered questionnaire with three versions, one per each type of staff interviewed: CHW, VHV, CF, and FC. **Table 1** presents the domains included in the baseline surveys (one per each staff type), along with the rationale for their inclusion and information about how they were used.

Table 1. Description of domains included in the CHDP staff questionnaire

Domain	Rationale for Inclusion	Use
Socio-demographic characteristics	Factors such as age and education can influence worker performance and effectiveness, especially the ability to take on new tasks of greater complexity. In addition, since VHVs are voluntary positions, information on their sources of income and non-LAMB employment may help elucidate employee incentives and potential time constraints.	• Establish a baseline. • Document changes over time. • Identify potential barriers to the use of community volunteers. • Potential use in analysis of overall intervention results.
Activities and time use	It is important to understand the pre-study workload and time allocation demands, as well as how employees and volunteers manage their time. This information will also be helpful for the cost-effectiveness analysis.	• Establish baseline. • Document changes in CHDP activities after introducing supplement distribution.
Experience and training	Experience and training can affect productivity and effectiveness. Training is found to be a motivating factor for frontline workers.	• Establish a baseline. • Potential use in analysis of overall intervention results.

Domain	Rationale for Inclusion	Use
Job motivation	Motivation can be strongly related to job performance; capturing perceptions related to employees' and volunteers' job motivation may help identify potential barriers to or facilitators of project success.	• Establish a baseline. • Document possible changes. • Potential use in analysis of overall intervention results.
Self-efficacy	Personal assessments of efficacy can influence motivation and therefore affect job performance.	• Establish a baseline. • Potential use in analysis of overall intervention results.
Job satisfaction	Job satisfaction can be also an important predictor of job performance.	• Establish a baseline. • Document possible changes. • Potential use in analysis of overall intervention results.
Supervision	Effective supervision can be critical in frontline workers' performance, motivation, and training.	• Establish a baseline. • Potential use in analysis of overall intervention results.
Supplement distribution resources (e.g., cell phones, motorbikes) and perceptions	Availability of resources to conduct the new activities may affect staff motivation and effectiveness. Also, employees' perceptions of the challenges and opportunities associated with the new program component may shed light on perceived barriers, motivators, and expectations, which in turn may influence project implementation and effects.	• Establish a baseline. • Identify perceived barriers and facilitators.

Job motivation, self-efficacy, and supervision were measured using Likert-type scales. Most of these questions included a series of statements that were read to each interviewee who then was asked to state the extent to which s/he was in agreement with the statement, with scores ranging from 1 ("strongly disagree") to 5 ("strongly agree"). However, the scoring on a single-item scale to assess job satisfaction went from 1 ("highly dissatisfied") to 5 ("highly satisfied"), and items for one of the two supervision scales administered to CHWs, CFs, and FCs (but not to VHVs) asked about the frequency of specific supervisor's behaviors, with scores ranging from 1 ("never") to 5 ("always"). These scales were adapted from those developed by the Alive & Thrive (A&T) team, which conducted a survey with frontline public health care workers with similar characteristics in Bangladesh (Saha et al. 2011). Two main adaptations to the A&T survey instruments were incorporated: instead of using the numbered scale with corresponding verbal statements in the A&T tools, we decided to use only the colored scale, including different shades of colors from black to white to provide answers on level of agreement; and, for the VHV questionnaire, all the statements in these Likert-type scales were reworded to make them simpler and easier to understand and the number of answer options was reduced from 5 to 3 (e.g. "disagree", "neither agree nor disagree" and "agree"), but still presented in a colored scale.

To collect the information listed above, three different versions of the questionnaire, one for each type of staff, were developed in English and then translated to Bengali by bilingual staff. Pilot testing of the questionnaires occurred during July 2011, by interviewing CHDP staff using the three different draft versions of the questionnaire.

To identify CHDP staff from the SDUs, CHDP headquarters staff provided a list of all CHDP staff at the 11 unions where the RDNS is implemented. This list was also used to allocate identification numbers to the CFs, the FCs, the CHWs, and the VHVs, and to draw random samples for the PE assessments.

In addition to the baseline CHDP staff assessment, we conducted two follow-up surveys, one in February–April 2013 and one in September–November 2014. The objective of these follow-up assessments was to monitor potential changes in the CHWs' profiles and activities during program implementation. The follow-up questionnaires were similar to the ones used for the baseline, with minor modifications based on how well some of the questions performed in the baseline survey.

The target samples for the baseline CHDP staff assessment included all CFs and FCs (n=11, 5 CFs and 6 FCs, corresponding to the 11 RDNS unions) and CHWs (n=64), and a randomly selected subsample of VHVs (n=59, approximately 20% of the total number). Given the small sample size, results from the CF and FC questionnaire are presented as medians and interquartile range (IQR), or as frequencies (percentages are not presented).

2.2.2 Post-Training Evaluation

A self-administered post-training evaluation quiz was developed and translated into Bengali to be completed by CHDP staff immediately after the RDNS refresher training conducted in July 2011. The quiz included 30 statements about eligibility for receiving the supplements, pregnancy testing, supplement distribution, supplement dosage and use, monitoring, and coordination with RDNS staff. Respondents were asked to designate if a statement was true or false by circling either a "T" or an "F" (or the corresponding characters in Bengali) next to each statement. Due to several changes implemented around the time of the start-up of the program (supplement distribution), five of the statements were considered no longer applicable and were dropped from the analysis; therefore, with one point for each correct answer, total scores on the quiz ranged from 0 to 25.

The targeted population for the post-training evaluation was all CHWs in the 11 RDNS unions; however, some other training attendees (e.g., CFs and FCs) also completed the quiz. VHVs did not complete the quiz as they did not participate in the RDNS refresher training (although they attended the main orientation RDNS training) and because many of them were illiterate.

2.2.3 The Process Evaluation of Participant Adherence Questionnaires

We conducted two rounds of participant adherence assessment, one focused on adherence to the supplementation regime for PLW (Process Evaluation of Participant Adherence among Pregnant and Lactating Women [PEPA-PLW]) (Harding et al. 2014) and a second one focused on adherence to the supplementation regime for children (PEPA-C) (Harding et al. 2016).

The PEPA-PLW assessment was a cross-sectional survey of a random sample of RDNS participants between 28 weeks gestation and 6 months postpartum, conducted during December 2012 and January 2013. The PEPA-PLW questionnaire assessed the product delivery channel, the extent to which the messages on supplement use were provided and recalled, and the level of adherence to the consumption recommendations for each type of maternal supplement (LNS-PLW and IFA). The questionnaire also included questions about the mode of consumption, as well as sharing, loss or destruction, or commercialization (via sale or trade) of the supplement within or beyond the household. Adherence was assessed through a self-report of supplement consumption during the previous week. The target population for the PEPA-PLW assessment included randomly selected RDNS participants who were pregnant (>28 weeks gestation) or within the first 6 months postpartum. We excluded from the PEPA-PLW women who had also been randomly selected for participation in other RDNS sub-studies, to

minimize participant burden. The target sample size for the PEPA-PLW was n=360 (n=72 women in each of the following pregnancy and postpartum groups: pregnant LNS recipients, pregnant IFA recipients, LNS recipients in the early postpartum, IFA recipients in the early postpartum and LNS recipients in the later postpartum). Further details on the PEPA-PLW assessment can be found in Harding et al. (2014).

The PEPA-C assessment was also a cross-sectional survey of a random sample of RDNS participants to assess adherence to child supplementation recommendations after the child had been receiving the supplements for a year, i.e., at 18 months of age. Women were interviewed in their homes regarding the child's intake of the supplements and their experience with receiving the supplements. The PEPA-C questionnaire was similar to the one used to assess adherence to maternal supplement consumption in the PEPA-PLW assessment, but some questions were revised based on the child supplementation regimen and others were removed due to lack of variability in the PEPA-PLW assessment. Data on shared, lost, destroyed, and sold supplements since the last supplement distribution were also collected, based on women's reports. Women were also asked about running out of supplements (ever and in the past month), travel away from home in the past month, and other nutritional supplements for children that they acquired in the past 3 months. Data on how women received the child's first and most recent supply of supplements and reasons for consuming more or less than the recommended number of supplements in the past week based on reported consumption were also collected.

The target population for the PEPA-C assessment included women whose children were near 18 months of age and scheduled to complete their RDNS 18-month home and clinic follow-up visits between May 18 and July 31, 2014. The target sample size for the PEPA-C was n=256 (n=128 from the MNP arm and n=128 from the two LNS arms combined). See Harding et al. (2016) for further details on the PEPA-C assessment.

Besides the PEPA-PLW and PEPA-C, data on adherence to supplement intake recommendations were collected at the RDNS follow-up visits from all RDNS participants. At several RDNS follow-up visits, as part of the knowledge, attitudes, and practices (KAP) assessment, women were asked how many supplements they or their child had consumed in the past week and whether consumption during that week was representative of regular consumption. Responses were then categorized as "perfect adherence," defined as reported consumption of the complete dose of supplements recommended during the past week, or not "perfect adherence." A second indicator, "high adherence" during the postpartum period, was also measured using supplement consumption information from the past week. High adherence was defined for mothers as consuming four or more supplements in the last week for LNS mothers or two or more supplements in the last week for IFA mothers. For children, high adherence to supplement regime during the past week was defined as consuming eight or more sachets of LNS or four or more sachets of MNP.

Interviewerss also asked women to recall their (or their child's) supplement consumption, for instance, through pregnancy or since the last interview. Using these longer recollection timeframes, we assessed high adherence indicators, which we defined as follows:

- For women, "high adherence" was defined as taking the supplement "almost every day" or "regularly every day" (for LNS mothers during pregnancy and postpartum and for IFA mothers during pregnancy) or "regularly every other day" (for postpartum IFA mothers).
- For children, "high adherence" was defined as taking the supplement "almost every day" or "regularly every day."

Because women who received IFA did so through the first three months postpartum only, we did not report their answers for this indicator for the postpartum period because it was assessed at the six-month-postpartum interview.

2.2.4 Time and Motion Assessments

To better understand the impact of the RDNS on the work of LAMB's CHDP staff, we conducted time and motion assessments a few months after supplement distribution started (October–November 2011, round 1) and approximately 21 months after the implementation of the study started (April–July 2013, round 2). The time and motion assessments captured data on how CHDP staff allocated their time to perform the activities relevant to their roles during RDNS implementation. Staff from the RDNS PE team followed CHDP staff for 3 consecutive work days (CHWs, CFs, and FCs) or for 1 work day (VHVs) and recorded their activities, along with the start and end time of each activity to the closest minute. The activities were coded into one of four time and motion assessment codes:

- **Direct contact productive time:** Time spent directly with CHDP clients or the target community of LAMB CHDP services. Includes activities where CFs, FCs, CHWs, and VHVs were directly involved with CHDP clients or their relatives. Examples: conduct BCC session, discuss any health services with clients, advise or disseminate information about LAMB CHDP issues.
- **Non-contact productive time:** Time spent completing tasks as part of the LAMB CHDP work where CHDP clients are not directly involved. Examples: work plan preparation, discussion about official matters, preparation of bill vouchers, filling out different registers, preparation for going to field.
- **Inevitable non-productive time:** Time spent by LAMB CHDP staff on activities that are not productive in terms of getting their LAMB job done, but cannot be avoided. Example: using the bathroom, eating lunch, travel.
- **Avoidable non-productive time:** Time spent by LAMB CHDP staff on activities that are not productive in terms of getting their LAMB job done and can be avoided. Example: resting, conversations about personal issues, reading newspapers/books, personal errands.

Since this type of assessment is quite time consuming, we randomly selected a subsample of CHDP staff in the 11 RDNS unions, including approximately 50% of CFs and FCs (n=5), 20% of CHWs (n=13), and 10% of VHVs (n=30).

2.2.5 Storage Forms

The amounts of supplements (LNS, MNP, and IFA) available at the central storage site and at the SDUs were monitored throughout RDNS implementation.

To facilitate recording of data related to supplement storage, the PE team developed a central storage product supply form (Form PE-CS). The team completed the form every 3 months during the first year of the RDNS and every 6 months thereafter. The total inventory of each product was noted, as were the expiration dates of the products.

Similarly, the PE team developed an SDU product and materials checklist form (Form PE-SDU). The team completed this form for each of the SDUs in the same manner as that for Form PE-CS.

To assess fidelity indicators, Form PE-CS was also used to monitor the conditions in which the supplements were stored at the central storage unit.

The PE team conducted 24 rounds of data collection using these two storage forms. For the purpose of this analysis, we intentionally selected three specific rounds to represent the beginning (round 1), the intermediate (round 10), and the final (round 21) period of program implementation.

2.2.6 Program Registers

The team developed two registers for RDNS implementation: the New Pregnancy Register and the Supplement Distribution and Monitoring Register (SDMR). Although these were used mainly for program documentation, data from the registers were also used to supplement the RDNS PE to measure indicators related to RDNS program coverage.

Data from the New Pregnancy Register and the SDMR were also used to monitor indicators regarding product distribution (as part of the fidelity component). Data from these two registers were kept in paper forms at the SDUs and were entered into a laptop by the PE team every 3 months. These program records were maintained throughout program implementation, and the dataset was organized by supplement delivery event (first supplement delivery, second supplement delivery, etc.). For the purpose of this analysis, we selected data representing the beginning, the intermediate (midpoint), and the final points in the distribution processes (i.e., maternal and child supplementation). For example, a maximum of five supply distributions were expected during pregnancy and either three (IFA) or six (LNS-PLW) during the postpartum period. Thus, for maternal supplementation, we selected the first and second distributions during pregnancy, the fourth and fifth distributions also during pregnancy, and the second and third distributions during the postpartum period to measure the "timely" vs. "delayed" supplement distribution indicator (by measuring the time elapsed between these deliveries). From the 18 child supplement distributions expected, we analyzed data from the first and second distributions (when the child was 6–7 months of age), from the ninth and tenth distributions (14–15 months), and from the seventeenth and eighteenth distributions (22–23 months) to measure the same indicator.

2.3 Composition and Training of the Process Evaluation Team

The PE protocol was developed by the UCD co-investigator who led this component. The local PE team included a team leader (research investigator [RI]), who supervised field research supervisors and research assistants and who maintained the PE documentation and datasets. The local team was supervised by the RDNS local principal investigator (PI), who was based at the RDNS field site.

Usually, initial training of the RI was conducted either by RDNS UCD co-investigators (if visiting the field) or by the RDNS local PI. The RI then trained the other members of the team. Trainees received information on and discussed research procedures, standardization techniques, and informed consent and other ethical issues. PE questionnaires were discussed thoroughly and role-playing techniques were used as part of the training. PE data collectors were observed while conducting pilot interviews in the field and appropriate feedback was provided afterward.

2.4 Ethical Approvals

The RDNS protocol, which included the PE assessment, was approved by the Institutional Review Board (IRB) of UCD, the icddr,b Research Review and Ethical Committee, and LAMB. The RDNS was registered at clinicaltrials.gov [NCT01715038].

The CHDP staff assessment, which included non-RDNS participants, was approved by the UCD IRB and the icddr,b Research Review and Ethical Committee. A consent form in Bengali was read to all participants who signed the consent form before the interview. For VHVs who could not read, a witness

who was able to read was present at the time of consenting. All participants provided written informed consent before the interview.

2.5 Data Management and Analysis

All forms that were administered by the PE team were submitted to the RI at the end of the day. Quality control procedures consisted of repeating 10% of the interviews to check responses and supervisor observations of an additional 10% of interviews to ensure that they were conducted as instructed. Study forms were reviewed within 24 hours of data collection, after which they were scanned. Paper forms were stored in a locked file cabinet.

Data were entered into Microsoft Access or an SPSS template that flagged unreasonable values. All survey data collected by the PE team were double-entered. All PE data cleaning (including data recorded by CHDP staff) was done using either SAS 9.3 and/or Stata SE 12.

Data were analyzed using Excel, SAS 9.3, and Stata SE 12. Descriptive statistics used included mean ± SD, or median and IQR, for continuous variables and frequencies for categorical variables. Data from open-ended questions were manually coded according to common themes. Total scores (e.g., motivation scale, post-training quiz) were calculated by adding the item-specific scores. Statistical analyses of both the PEPA-PLW and the PEPA-C are described elsewhere (Harding et al. 2014; Harding et al. 2016). Hypothesis tests to determine statistical differences by group or arm for the adherence indicators were conducted using generalized linear models accounting for cluster and union/sub-district; testing for pair-wise differences in adherence indicators by time point (e.g. 12 vs. 18 months) was conducted using an extension of the McNemar's Test for clustered data (Lieber and Ashley, 1998).

3 Findings

3.1 Inputs

3.1.1 Characteristics of RDNS Households

Table 2 shows several baseline characteristics of the households involved in the RDNS, overall and by RDNS arm. No significant differences by arm were observed in any of these household characteristics. In general, baseline findings are consistent with broader information collected as part of the Bangladesh Population and Housing Census 2011 (BBS 2012). Regarding the presence of children under 5, 3.9% of households included two or more children under 5 years of age (data not shown).

Table 2. Selected baseline characteristics of the households involved in the RDNS[1]

Household Characteristics	Overall RDNS Cohort	Comprehensive LNS	Child LNS	Child MNP	Control
Number of household members	4.6 ± 2.2	4.5 ± 2.0	4. 7 ± 2.3	4.5 ± 2.2	4.6 ± 2.2
Household head years of education	6.1 ± 3.8	6.3 ± 3.5	5.8 ± 4.0	6.3 ± 3.9	6.1 ± 3.6
Households with children under 5 years, n (%)	1,505 (37.5)	380 (36.3)	347 (37.3)	387 (36.8)	391 (39.8)
House had finished walls, n (%)	1,124 (28.0)	295(28.2)	267 (28.7)	303 (28.8)	259 (26.4)
House had finished roof, n (%)	3,805 (94.9)	999 (95.4)	894 (96.1)	976 (92.8)	936 (95.3)
House had finished floor, n (%)	376 (9.4)	89 (8.5)	84 (9.0)	97 (9.2)	106 (10.8)
Used electricity or gas for cooking, n (%)	6 (0.2)	1 (0.1)	2 (0.2)	2 (0.2)	1 (0.1)
Access to clean drinking water, n (%)	3,999 (99.7)	1,044 (99.7)	924 (99.4)	1,050 (99.8)	981 (99.9)
Appropriate human waste disposal, n (%)	513 (12.8)	118 (11.3)	121 (13.0)	151 (14.4)	123 (12.5)
Household had electric connection, n (%)	1,453 (36.2)	402 (38.4)	291 (31.3)	363 (34.5)	397 (40.4)

[1] All values are mean ± SD or n (%).

3.1.2 Infrastructure and Equipment

Implementation of the RDNS intervention required physical space to store a large number of supplements that could be protected from rodents and that could have appropriate temperature levels maintained. To meet these requirements, a central storage site (managed by RDNS staff) was rented outside of LAMB facilities; rental space in each union was also procured.

Before the RDNS was implemented, the research team assessed several mechanisms to distribute the supplements. One distribution option was for beneficiaries to pick up supplements from VHVs' homes.

For this option to be practical, VHVs would have to have a secure place to keep the supplements. At baseline, 95.7% of VHVs reported having access to such space. Infrastructure was also needed for storing the supplements at the SDUs. At baseline, eight CFs or FCs indicated that their SDU had the required space.

As cell phone use has increased in Bangladesh, even in rural areas, the RDNS researchers thought that access to a cell phone may help CHDP staff perform their duties. At baseline, 53.6% of VHVs, 87% of CHWs, and all 11 CFs and FCs had access to a cell phone (usually personally owned) that they could use for their work. Also, the RDNS team thought bicycles would also be helpful for CHWs to do their job. LAMB successfully facilitated access to a bicycle for each CHW before implementing the RDNS, which allowed the CHWs to travel to the villages more easily. At baseline, all CHWs reported having access to a bicycle. Similarly, if CFs and FCs had access to a motorbike or bicycle, they would also be able to travel to the villages or other sites to conduct monitoring and supervision activities more easily. At baseline, 10 of 11 CFs or FCs reported having access to a bicycle or motorbike.

3.1.3 CHDP Personnel Resources

The CHDP PE assessments (baseline and follow-up rounds) involved all CFs, FCs, and CHWs and a subsample of VHVs. **Table 3** presents the numbers of CHWs and VHVs who participated in these assessments. All CHWs and VHVs were female, while all CFs and FCs were male. As per the CHDP organogram, there was either one FC or one CF per union. However, during the first follow up assessment, two FCs or CFs were interviewed in each of two unions, probably related to a transition due to staff turnover. Further characteristics of the CHDP staff who participated in the PE data collection activities are described in Section 3.1.3.

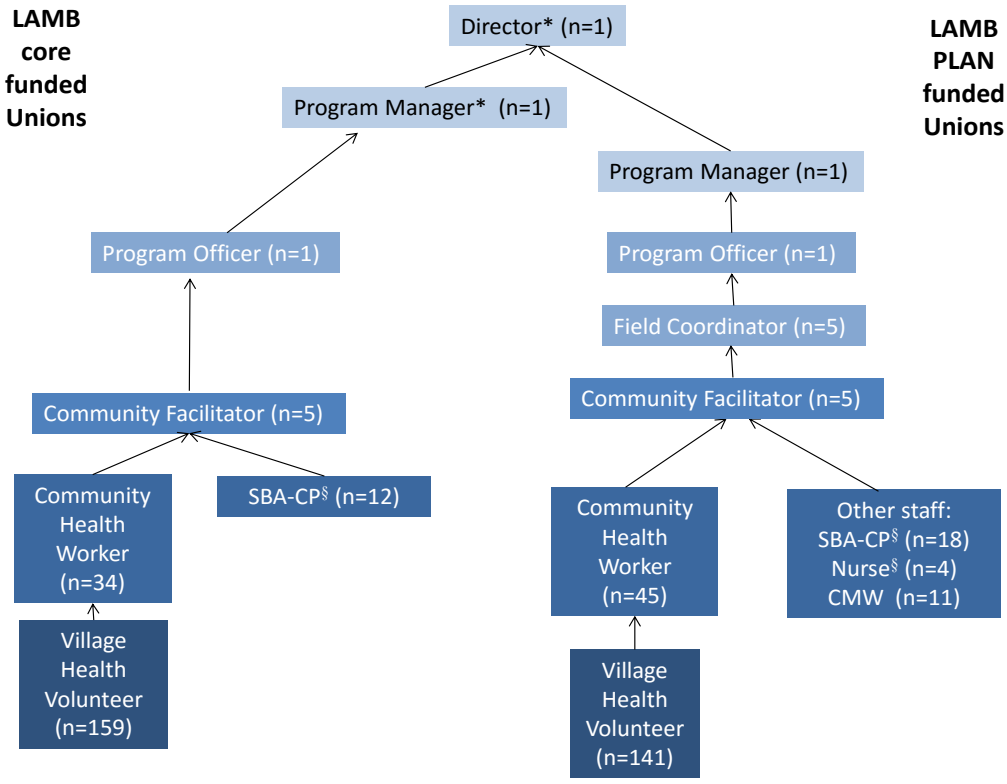
Table 3. Sample size per type of staff (CHW or VHV) who participated in the CHDP PE assessments

Baseline		Follow-Up #1		Follow-Up #2	
# of CHWs	# of VHVs	# of CHWs	# of VHVs	# of CHWs	# of VHVs
63	69	64	88	63	89

In 2012, the CHDP ran 18 SDUs and had 304 CHWs and 612 VHVs in 77 unions and 1 municipality. Each SDU had two to three SBA-CPs providing basic essential obstetrics care 24 hours a day, 7 days a week. The VHVs carried out pregnancy surveillance in 165-340 households each (covering a population of 900–1,500 people). They also identified eligible couples, conducted health promotion activities, and assisted CHWs during health education sessions. The CHWs supervised VHVs, carried out health education sessions, provided antenatal care (ANC) and postnatal care (PNC), and kept records of PLW and children under 5 years of age. Each CHW's working area covered 600–1,400 households (covering approximately 2,500–6,000 people), with the assistance of two to three VHVs.

Although the CHDP was a LAMB program, a partner NGO (PLAN International), funded and implemented the program in some unions. In those unions, the CHDP had a slightly different organizational structure. **Figure 2** shows the organizational structure of the CHDP (the left side of the diagram refers to LAMB core funded unions and the right side refers to PLAN funded unions).

Figure 2. CHDP organizational diagram in the RDNS area



* CHDP-wide responsibilities; § located at SDUs

In anticipation of new activities and an increase in workload among the CHWs related to supplement distribution, LAMB hired 11 new CHWs and allocated 1 staff person (based in LAMB's headquarters) to serve as the liaison between the RDNS and LAMB during RDNS implementation.

3.2 Characteristics of CHDP Staff at Baseline

3.2.1 Socio-Demographic Characteristics

Of 73 randomly selected VHVs, 69 consented and were interviewed for the baseline assessment, as were 63 CHWs and all 11 CFs and FCs.

Table 4 shows some of the socio-demographic characteristics of these CHDP staff. In general, CHWs were younger (26 years of age ± 5 years) and had higher education levels (12 years of formal schooling ± 1 year) than the VHVs, while CFs and FCs reported the highest education level (14 years of education).

As stated above, one supplement distribution option initially considered was that VHVs would distribute the supplements. For this option to be feasible, VHVs needed to be literate and able to count. However, only 39% of VHVs reported that they were able to read Bengali and only 36% could write it, while all CHWs, CFs, and FCs were literate. This was the primary reason for choosing the CHWs as the key personnel for supplement distribution.

Most VHVs (58%), CHWs (62%), and CFs and FCs (n=10) were married. Islam was the predominant religion among VHVs (87%) and CHWs (64%); 13% and 35% of them self-identified as Hindu, respectively. More religious variation was observed among CFs and FCs, with five self-identified Muslims, four Christians, and two Hindus (data not shown).

Being members of a microcredit organization at the time of interview was common among these CHDP staff (57% of VHVs, 41% of CHWs, and five CFs or FCs). Having a job besides their CHDP duties was more common among VHVs (28%) than CHWs (6%), which is expected given that VHVs worked for CHDP on a voluntary basis, while no CF or FC reported having a second job. Among those with a second job, 19% of VHVs said that they worked for an NGO other than LAMB, with most of them (79%) receiving compensation in cash, and all four CHWs with a second job reported receiving compensation in cash, while only one of them worked for another NGO (data not shown).

Table 4 also shows information regarding CHDP staff income. During the month previous to the interview, VHVs reported an average total income (incentives/honorarium from LAMB plus other income) that was more than double what was reported as stipends received from LAMB. As the CHWs held a paid position with LAMB, their income during the past month was higher than that of the VHVs, who received stipends for traveling expenses and a small commission for selling over-the-counter products. In contrast to what was observed among VHVs, CHWs' total income (salary from LAMB plus any other income) was not much different from their income solely from LAMB, probably because only four of them reported having a second paid job. During the month previous to the interview, median earnings of CHWs from their CHDP work equaled their total income, as none of them had another job (data not shown).

Table 4. Socio-demographic characteristics of VHVs, CHWs, CFs, and FCs

	VHV		CHW		CF/FC	
Characteristic	**Mean**	**SD**	**Mean**	**SD**	**Median**	**IQR**
Age	48	12	26	5	35	31–39
Years of education	2	3	12	1	14	14–14
Number of children	3	2	1	1	1	1–2
Hours per day worked on a second job (if any)	4	2	1.5	0.6	N/A	N/A
Total monthly incentives/honorarium from LAMB, Takas (US$[1])	168 (2.40)	83 (1.18)	3,226 (47.92)	545 (7.79)	6,470 (92.42)	3,416–9,553 (48.80–136.47)
Total monthly income, Takas (US$[1])	374 (5.34)	456 (6.51)	3,355 (47.92)	732 (10.46)	N/A	N/A

[1] US$1 = 70 Takas (at time of assessment).

3.2.2 Coverage and Work Time

On average, the reported number of households in the CHDP staff work area was 231 ± 86 (VHVs), 1,060 ± 225 (CHWs), and 6,382 (IQR: 5,206–7,423) (CFs or FCs). Ninety-seven percent of VHVs, 59% of CHWs, and four CFs or FCs were residents of their respective work areas.

With regard to the amount of time per month that they worked for LAMB, VHVs volunteered, on average, 16 days ± 9 days during the previous month, an average of 4 hours per day ± 1 hour per day, with most of them (70%) doing their VHV work during morning hours. CHWs worked 24 days ± 4 days during the last month and for an average of 7 hours per day ± 0.4 hours per day. The median number of

days CFs and FCs worked during the previous month was 26 (IQR: 20–26), for a median of 8 hours per day (IQR: 7–8), with 5 hours spent in the field (IQR: 4–6).

Visiting households was part of the VHVs' and CHWs' regular work in the CHDP. Accordingly, CHWs conducted household visits most of the days they worked (20 days ± 3 days). Fifty-seven percent of VHVs reported visiting all the households in their work area at least once during the last month, while 31% of CHWs reported doing so. One of the main activities that VHVs and CHWs conducted was pregnancy identification. At the time of the survey, VHVs reported that there were 8 ± 4 pregnant women in their work area, while CHWs reported 44 ± 12 pregnant women in theirs.

Job Activities and Use of Time

The CHDP staff conducted several types of activities as part of their role in the program. **Table 5** shows the frequency of some of these activities conducted by the VHVs and CHWs during the month prior to the interview.

Table 5. Number of activities conducted by VHVs and CHWs during the past month (mean ± SD)

Activity	VHVs	CHWs
Households visited per day (n)	9 ± 4	17 ± 8
Pregnancies identified (n)	3 ± 3	9 ± 6
Childbirths reported (n)	2 ± 1	7 ± 3
BCC sessions conducted (n)	N/A	8 ± 7
People seeking health advice at their home (n)	7 ± 9	N/A

When the CHDP staff was asked to list the different activities that they usually did as part of their CHDP duties, VHVs mentioned a total of 14 ± 3 different activities, CHWs mentioned 20 ± 6 different activities, and CFs and FCs mentioned 13 (10–16) different activities. **Table 6** and **Table 7** list the activities most frequently mentioned by each category of staff.

Table 6. Activities most frequently mentioned by VHVs and CHWs

Activity	Frequency (%) among VHVs	Frequency (%) among CHWs
Identify pregnant women	95.7	95.2
Encourage mothers to go to the SDU for ANC	94.2	–
Conduct household visits	88.4	84.1
Conduct BCC sessions	–	88.9
Provide advice on maternal nutrition	78.3	–
Provide ANC, including family planning	78.3	81.0
Provide PNC	–	77.8
Refer mother for delivery at SDU	73.9	–
General patient identification	69.6	–
Encourage vaccination of pregnant women	65.2	–
Encourage vaccination of children	63.8	–
Accompany mothers to the SDU or LAMB hospital	60.9	–

Assist with satellite clinic arrangements	–	77.8
Follow up expected date of delivery	–	74.2
Identify or follow up on disabled children	–	73.0
Complete/maintain reports	–	88.9

Table 7. Activities most frequently mentioned by CFs or FCs

Activity	Number of CFs or FCs who mentioned activity
Supervise CHWs' work at the office	11
Supervise CHWs' work in the field	11
Arrange government-NGO coordination meetings	11
Complete record keeping/information management/reporting	11
Coordinate or attend the refresher trainings	10
Fundraising	9
Supervise SBA-CPs' work	8
Do errands (e.g., going to the bank)	8
Arrange monthly meetings	7
Follow up on newborns	7
Conduct emergency meetings	6
Maintain clinic supplies	6

We also calculated the average amount of time the CHDP staff reported conducting specific activities during the past month. Results are shown in **Table 8**.

Table 8. Average self-reported amount of time (Mean ± SD) that VHVs and CHWs spent in specific activities during the past month

Time spent at each activity	VHVs	CHWs
At each home visit, minutes	15 ± 7	22 ± 9
Giving health advice at their home, minutes	21 ± 31	N/A
In monthly training, hours	5 ± 1	5 ± 1
Traveling to/from training venue, minutes	77 ± 49	49 ± 36
Conducting BCC sessions, minutes	N/A	75 ± 34
Traveling to villages, minutes	N/A	41 ± 21
Preparing reports, hours	N/A	8 ± 3

CFs and FCs were also asked about the amount of time they spent preparing reports and reported spending 12 hours (IQR: 8–15 hours) in such activity over the last month.

Experience and Training

Table 9 shows details about self-reported experience and training for each staff type. Most respondents reported receiving the required training for their role, according to a list of training topics in the CHDP survey (which was based on information provided by a CHDP Program Officer).

Table 9. CHDP staff experience and training

	VHVs	CHWs
Years of experience (mean ± SD)	9 ± 6	5 ± 4
Participated in most recent monthly refresher training	87%	89%
Received primary health care training	78%	94%
Received community group development training	74%	83%
Received training in prolonged labor and birth asphyxia	81%	
Received training in emergency obstetric care		73%
Received training in disabilities		71%
Received training in other topics (e.g., infectious diseases, BCC)	33%	49%

There was variability among CFs and FCs regarding the training sessions that they received from LAMB. All of them had received training on primary health care, nine had been trained in community group development, seven received training on microcredit, and six were trained in disabilities. Training on breastfeeding was received by five of them, and training on family planning, water and sanitation, staff management, and communication and networking was given to four of them. Three CFs or FCs were trained on annual budget preparation and two on accounting.

Almost all VHVs (91.3%) reported participating in training related to the RDNS. Similarly, almost all CHWs (94%) and CFs or FCs (n=10) reported having participated in the very first RDNS orientation training, and 98% of CHWs received the RDNS refresher training while all 11 CFs and FCs did. Eighty-six percent of CHWs completed the post-training evaluation quiz (score range: 0–25 points) right after the RDNS refresher training. Their average total score was 21 ± 2 points, which equals 85% ± 7 percentage points of correct responses. Seven CFs or FCs completed the post-training evaluation quiz, obtaining a median score of 20 points (IQR: 18–20); this corresponds to 80% of correct responses (IQR: 72%–80%). Setting a pass mark of 75% (United Nations High Commissioner for Refugees [UNHCR] 2011), 91% of CHWs and five CFs or FCs (out of seven) passed the RDNS post-training evaluation.

We also asked the CHDP staff to list topics in which they perceived they needed further training. The three topics VHVs mentioned most frequently were nutrition (in general or maternal and child nutrition specifically) (n=15), the RDNS (n=8), and delivery (n=7). The most common topics mentioned by CHWs were nutrition (general or maternal and child nutrition specifically) (n=16), PNC (n=16), counseling (n=7), and the RDNS (n=7). Among the topics CFs and FCs mentioned were management (n=6), accounting/budget (n=3), communication and networking (n=3), and organization development (n=3).

Supervision

VHVs were asked about the frequency of supervisory visits by their respective CHWs and reported meeting with their supervisor in their work area to discuss their work an average of 3 ± 2 days during the last month. CHWs were also asked about the frequency of supervisorial visits by their respective CFs or

FCs and reported being visited at their work area by their supervisor an average of 4 ± 3 days during the last month.

In terms of providing supervision, CHWs reported meeting with the VHVs in their area to discuss their work an average of 15 ± 6 days during the previous month. It is important to keep in mind that CHWs supervised several VHVs; therefore, one would expect the average number of supervision days reported by CHWs to be higher than the number of days that VHVs reported being supervised by their CHWs. With regard to CFs and FCs, they reported meeting with their supervisor to discuss their work an average of seven days (IQR: 5–15) during the last month. In terms of providing supervision, CFs and FCs reported the number of staff they supervised as 31 VHVs (IQR: 20–34), 6 CHWs (IQR: 6–7), 3 SBA-CPs/CMWs (IQR: 3–4), and 1 other staff (IQR: 0–2). The median number of days that CFs and FCs met with the CHWs at the office to discuss their work during the last month was 20 (IQR: 8–25), and the median number of days that they supervised the CHWs in the field during the last month was 14 (IQR: 10–18).

Perceptions about the supervision that CFs and FCs received were explored using a Likert-type scale. **Figure 3** presents VHVs' responses to four statements. CHWs, CFs, and FCs were assessed using a similar scale (but with five statements), plus a second scale that included six statements with response options based on frequency of occurrence ("never," "rarely," "sometimes," "often," and "always"). **Figure 4** shows the distribution of responses to the five-statement scale among CHWs, CFs, and FCs. Distribution of responses to the second set of statements (**Figure 5**) showed more variation than that for the first set of statements, which may indicate that answer options based on frequency worked better with this population.

Figure 3. VHVs' supervision assessments

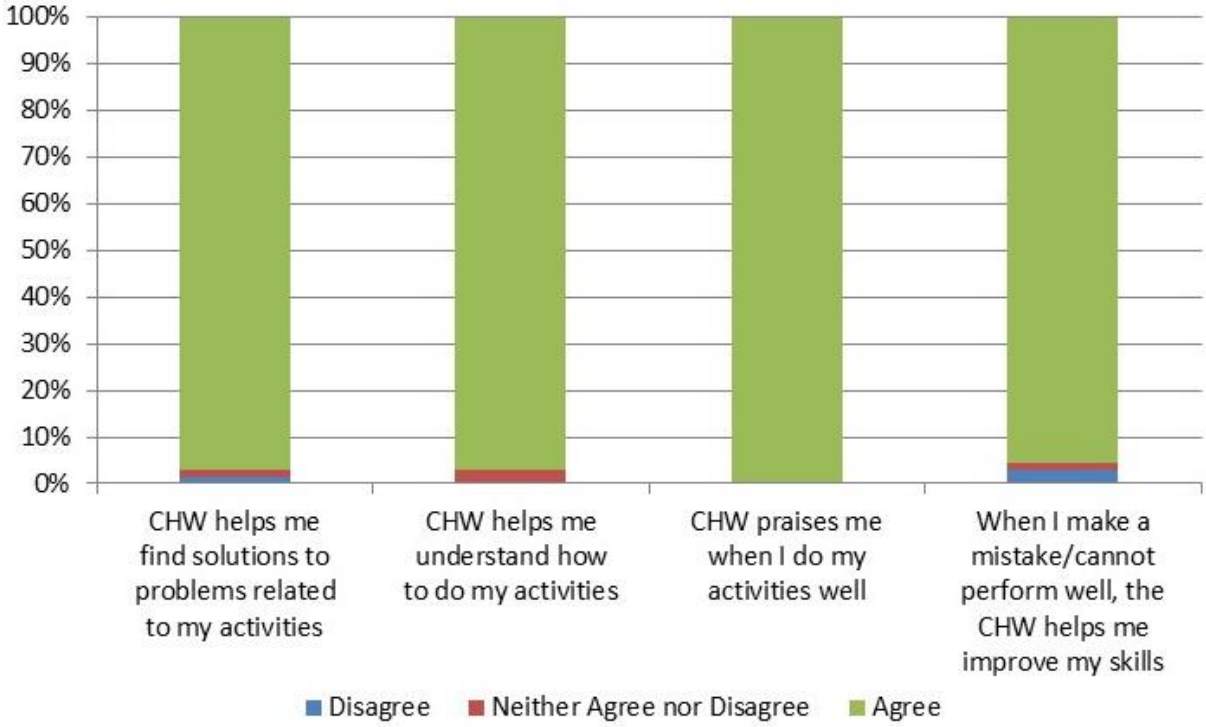


Figure 4. CHWs', CFs', and FCs' perceptions of their supervisor

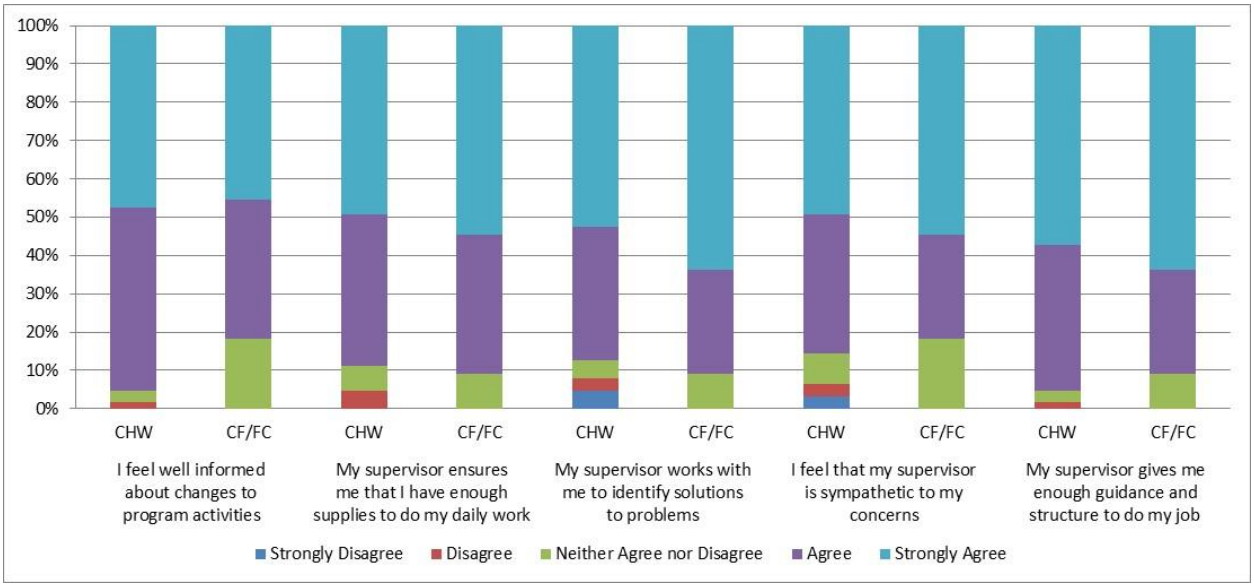
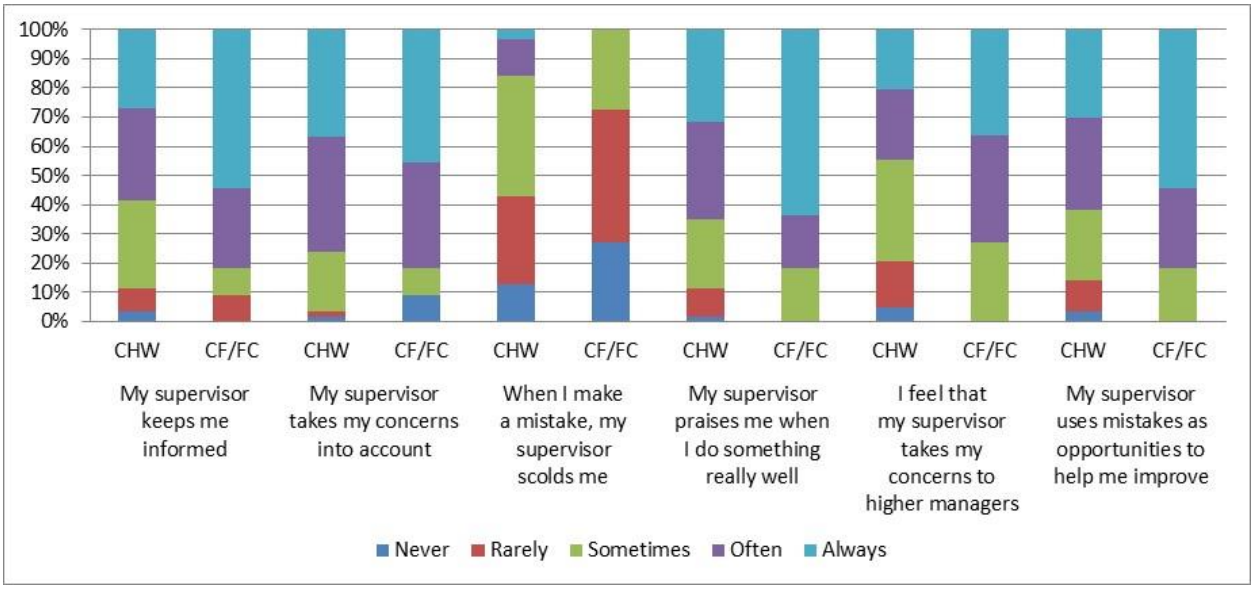


Figure 5. CHWs', CFs', and FCs' perceptions about the frequency of supervisor behaviors



Initial Perceptions about the RDNS Intervention

CHDP staff was asked to mention the three most important challenges that they foresaw in relation to the RDNS. Fourteen of 69 VHVs indicated that they did not foresee any problem with it. **Table 10** lists challenges related to the new component of supplement distribution that other VHVs perceived; most concerns were related to their having to take on additional work.

Table 10. VHVs' perceived challenges related to supplement distribution

Perceived Challenge	n
It would require them to work more time (some added that it would allow for less time with their own families)	12
It would mean an increase in their workload	11
Some mothers would refuse to/would not eat the supplement as recommended	11
Distributing the supplement to some women but not others ("old pregnancies") may create problems	7

Most of the challenges perceived by CHWs related to the acceptability and side effects of the supplements (**Table 11**).

Table 11. CHWs' perceived challenges related to supplement distribution

Perceived Challenge	n
Women would refuse to eat the supplement	21
Beneficiaries would be afraid of potential side effects[1]	20
Concerned about their workload increasing	19
It would be problematic because not everybody would receive supplements ("old pregnancies" would not receive it)	13
The issue that different supplements would be distributed in proximal areas would create a problem	10

[1] Of these 20, 12 mentioned concern about delivering a big baby.

Table 12 lists the perceived challenges related to the new component of supplement distribution that CFs and FCs mentioned. Their concerns were focused on both potential side effects of the supplement and the possibility of increased workload for the staff.

Table 12. CFs' and FCs' perceived challenges related to supplement distribution

Perceived Challenge	n
Concern about side effects[1]	4
It would mean more or harder work for the workforce	3
Reluctance from the VHVs, especially if no salary increase is given	2

[1] Of these four, two mentioned concern about delivering a big baby.

CHDP staff were also asked to mention the potential opportunities associated with the new component of the program. Most VHVs mentioned two:

1. Reduction of malnutrition in mothers and children through access to nutritious food (n=36)
2. Healthier mothers and children (n=35)

Six VHVs also mentioned that the villagers or mothers would be more likely to receive their help or advice or that their prestige in the villages would increase. Six VHVs also mentioned that the disease burden associated with malnutrition would be reduced.

CHWs mentioned the following opportunities associated with the distribution of supplements:

1. Provision of supplements would result in reduction or prevention of malnutrition or improvement of nutritional status (n=28)

2. Because of supplement distribution, there could be an increase in the use of the SDU services, including more check-up visits and safe/institutional deliveries (n=24)
3. Maternal and child health would be improved (n=22)
4. It would increase the worker (i.e., CHW) and institutional (i.e., LAMB) acceptance (n=14)
5. Giving supplements free of charge relates to higher receptivity and it would reach poor mothers (n=12)

For CFs and FCs, potential opportunities associated with the new component of supplement distribution included:

1. An increase in the use of SDU services, including increased number of institutional deliveries and check-up visits (n=10)
2. Improvement in nutritional status or reduction of malnutrition (n=6)
3. Improvement in maternal and child health (n=5)
4. Increase in the acceptability of the program and staff in the communities (n=5)

3.3 Staff-Related Changes during Program Implementation

3.3.1 Turnover Rates and Training

We assessed turnover rates among CHDP staff involved in RDNS implementation. We defined the turnover rate as the percent of staff who had less than a year on the job at the time of each follow-up round. (The first follow-up round was conducted more than a year after the baseline and each subsequent follow-up round was conducted more than a year after the previous one). In **Table 13**, we observe that there was some staff turnover for all types of CHDP personnel involved, with the highest rate (4 of 13) occurring among CFs and FCs at the first follow-up round.

Table 13. Turnover rates in CHDP staff

	Baseline			Follow-Up #1			Follow-Up #2		
CHDP Turnover	**VHV**	**CHW**	**CF/FC**	**VHV**	**CHW**	**CF/FC**	**VHV**	**CHW**	**CF/FC**
<1 year in role, n (%)	12 (17.4)	7 (11.1)	0 (0.0)	2 (2.3)	4 (6.3)	4 (44.4)	4 (4.5)	5 (7.9)	0 (0.0)

Probably related to these turnover rates, during the follow-up assessments, there were more CHDP staff who had not received the RDNS orientation and refresher trainings than what was reported at baseline. However, despite the high rate of CF/FC turnover observed at the first follow-up round, by the second round of follow-up assessments, all CFs and FCs reported receiving both types of RDNS training (**Table 14**). VHVs did not receive formal RDNS training after the very first orientation training, and were therefore not monitored on this.

Table 14. CHDP staff who reported not receiving RDNS trainings

	Follow-Up #1		Follow-Up #2	
RDNS Training	**CHW**	**CF/FC**	**CHW**	**CF/FC**
Did not receive RDNS orientation training, n (%)	7 (10.9)	5 (38.5)	17 (27.0)	0 (0.0)
Did not receive RDNS refresher training, n (%)	4 (6.3)	4 (30.8)	4 (6.4)	0 (0.0)

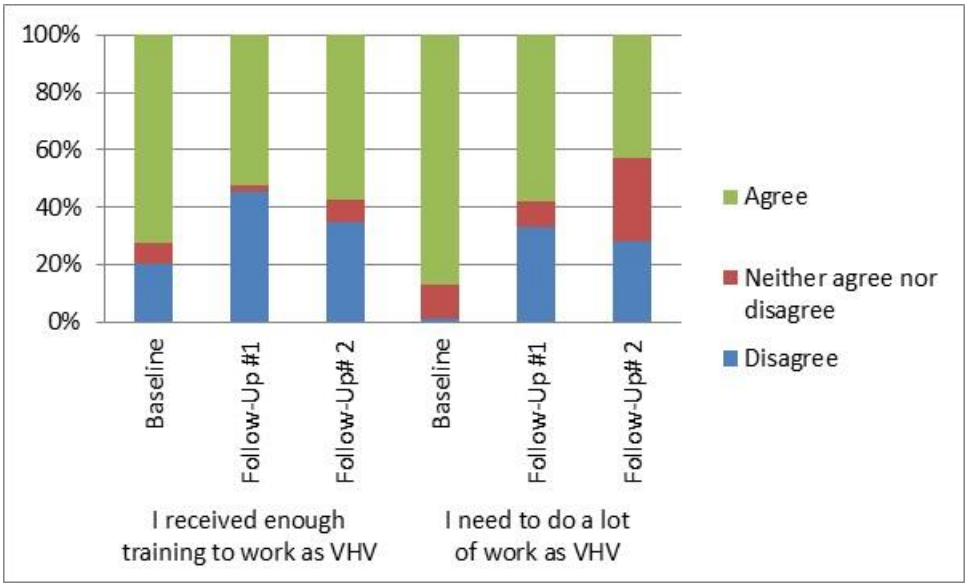
When asked about participation in the refresher trainings that are part of the regular CHDP training activities, during the follow-up assessments, most CHWs reported participating in the most recent refresher training (90.6% and 98.4% in the first and second follow-up assessments, respectively). Among VHVs, 96.6% reported participating in such trainings at both follow up assessments.

3.3.2 Job Satisfaction over Time

The distributions of responses to specific items of job satisfaction are shown in **Figures 6–8**.

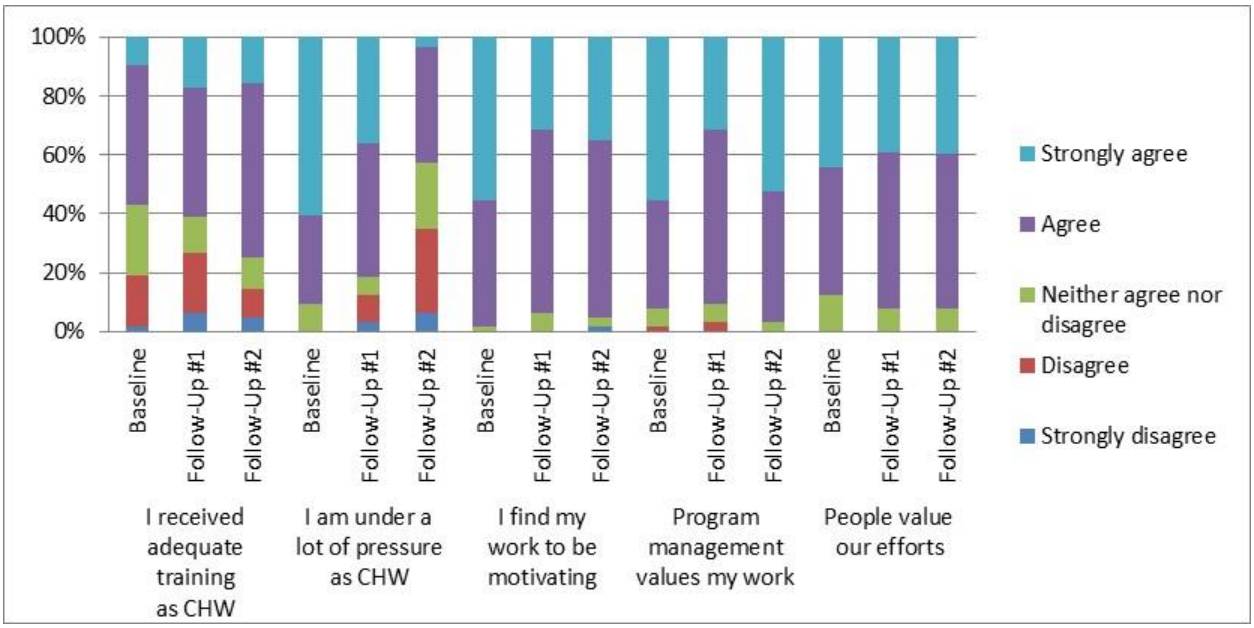
For VHVs, only two items were kept for the follow-up assessments in the job satisfaction domain because the variation in the VHVs' responses at baseline to the rest of the questions was so small. Comparison of the distribution of responses indicates that VHVs were less likely to report receiving enough training and that they were more likely to state that they "need to do a lot of work as a VHV" during the two follow-ups than they were during the baseline assessment.

Figure 6. Job satisfaction among VHVs over time



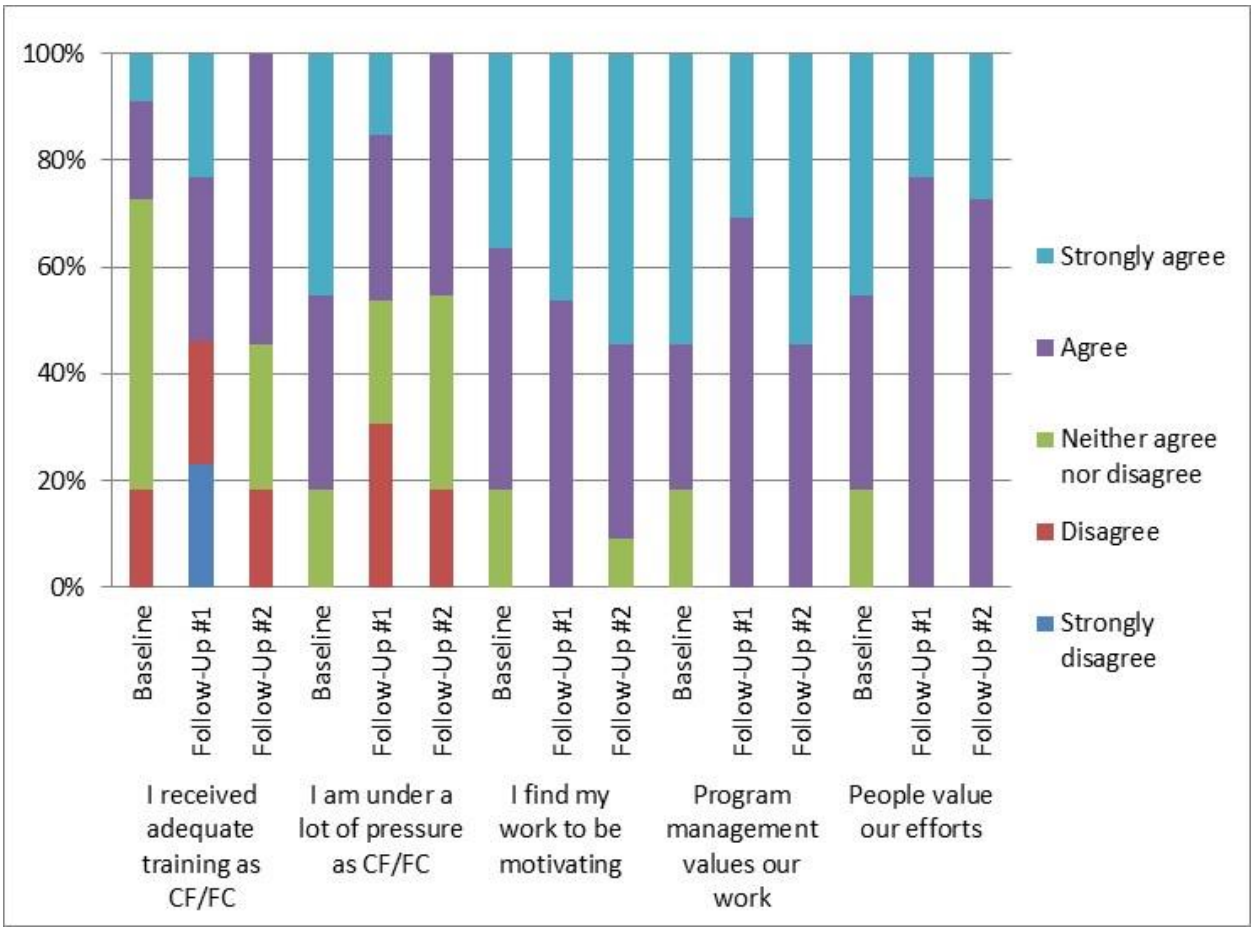
Similarly, we eliminated one item from the set of job satisfaction questions for CHWs because there was so little variation in the CHWs' responses to that item at baseline. For the remaining items (Figure 7), CHW responses did not show much change over time. However, for the items showing the most variation ("I received adequate training" and "I am under a lot of pressure as CHW"), there appeared to be greater satisfaction with training and less concern regarding the level of pressure as program implementation moved from the start-up phase to completion.

Figure 7. Job satisfaction among CHWs over time



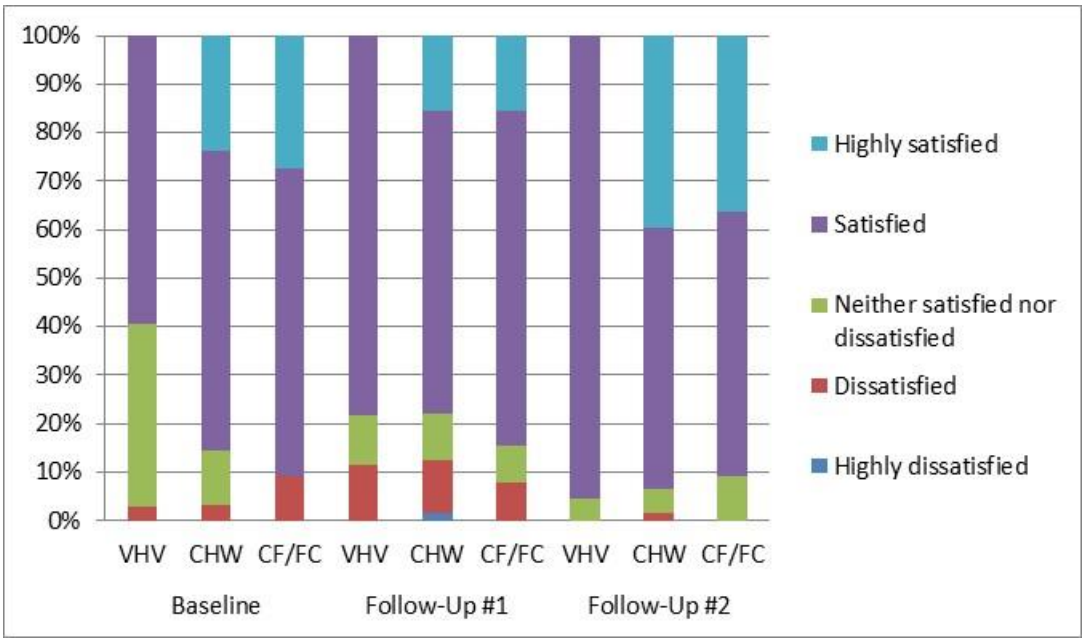
Similar patterns were observed among CFs and FCs. At the first follow-up assessment, we observed more negative perceptions regarding the amount of training that they received, which may relate to the turnover rate observed at that assessment, with some of them (4 out of 13) being fairly new in their role. By the second follow-up, responses regarding training had improved relative to baseline.

Figure 8. Job satisfaction among CFs and FCs over time



The distributions of responses to the general question about staff's level of satisfaction with their role in the CHDP are shown in **Figure 9**. For VHVs, there was an increase in the level of satisfaction as the program progressed, although the percentage reporting being "dissatisfied" was slightly higher at the first follow-up assessment than at baseline. Similar patterns were observed in the responses from CHWs. There was not much change with regard to CFs' and FCs' job satisfaction levels; however, no reports of dissatisfaction were observed in the final phase, whereas 1 of 11 was "dissatisfied" at baseline.

Figure 9. General job satisfaction among VHVs, CHWs, CFs, and FCs over time



3.3.3 Perception of Skills and Knowledge through Program Implementation

Figures 10–12 show CHDP staff perceptions of the adequacy of their knowledge and skills for the roles that they have in the CHDP. VHVs' perception of adequacy about their knowledge and skills appears to have decreased though program implementation, while the opposite trend was observed for CHWs, particularly at the second follow-up assessment. For CFs and FCs, the lower perception of adequacy at the first follow-up relative to baseline may also relate to the turnover rate observed at that follow-up round.

Figure 10. VHVs' perception of adequacy of knowledge and skills for their role

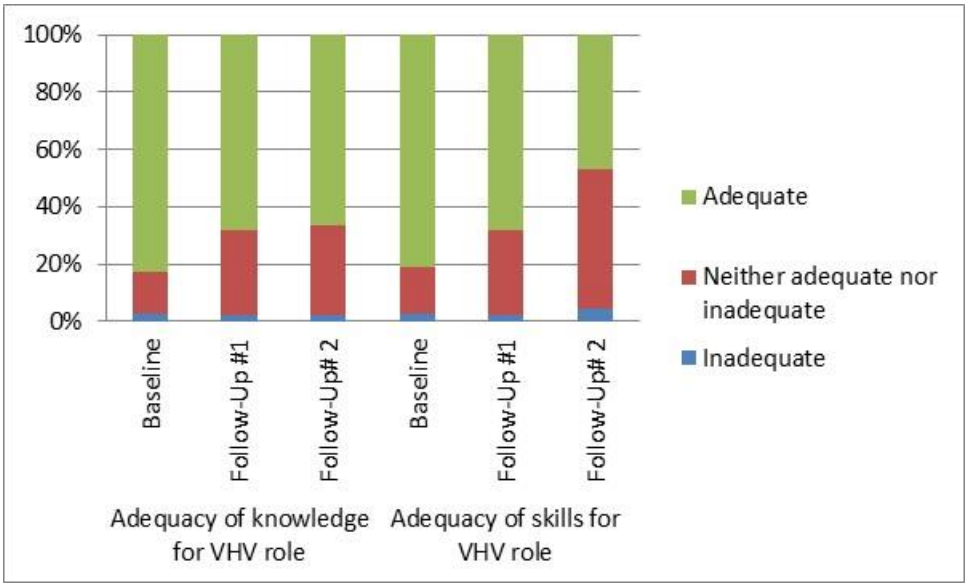


Figure 11. CHWs' perception of adequacy of knowledge and skills for their role

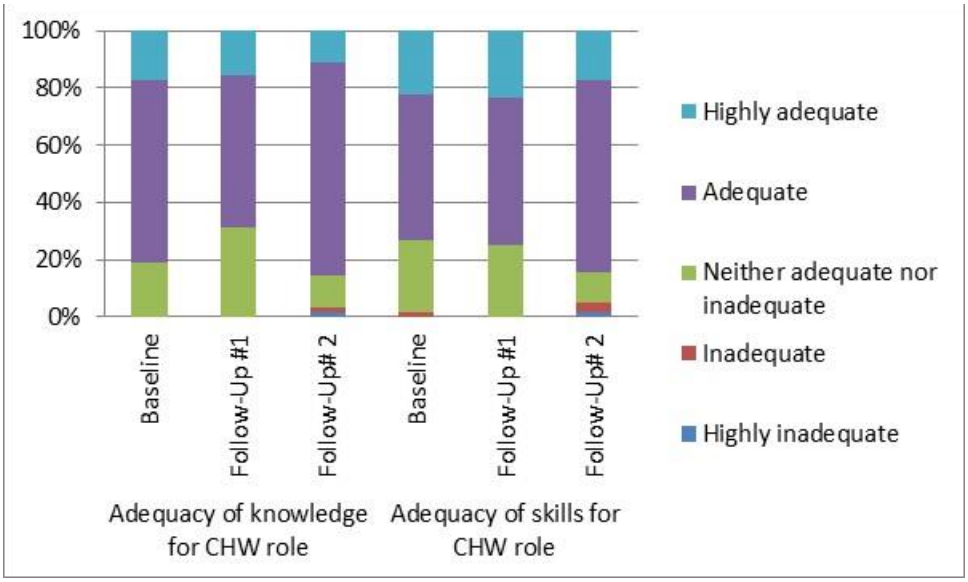
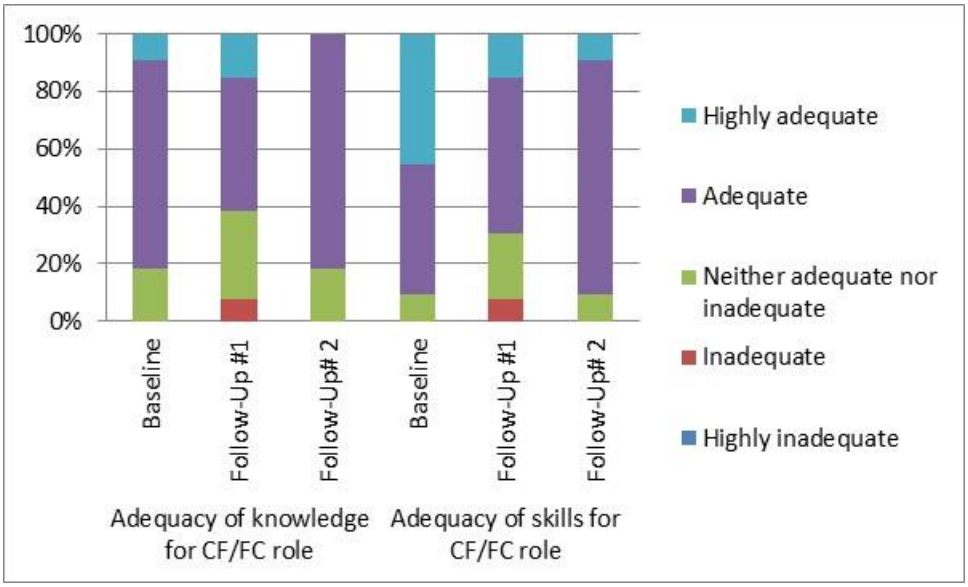


Figure 12. CFs' and FCs' perception of adequacy of knowledge and skills for their role



3.3.4 Activities and Time Allocation over Time

Findings from the PE CHDP assessments related to the CHWs' activities during RDNS implementation are presented in **Table 15**. We focused on the CHWs as they were the key CHDP personnel for RDNS implementation and therefore the ones most likely carrying the extra workload associated with the RDNS. CHWs were asked to list all the routine activities that they conducted during the past month, most of which were part of their CHDP work. However, at the follow-up assessments, several activities specifically related to RDNS implementation were also mentioned by the CHWs (Table 15). According to the program guidelines, the main supplement distribution mechanism was for CHWs to deliver supplements to the beneficiaries' homes. Consistently, most CHWs reported conducting home visits during the previous month, and such rates stayed high throughout program implementation.

We color-coded the data in Table 15: CHWs' regular activities that were reported more frequently throughout the RDNS implementation period (at least 10 percentage points higher in follow-ups #1 and #2 than at baseline) are in green and those reported less frequently (at least 10 percentage points lower in follow-ups #1 and #2 than at baseline) are in yellow. Grey shaded cells indicate activities that were not included as possible answer options at that time point assessment. There was an upward trend in the percentages of CHWs who reported providing expected delivery date follow-up, encouraging women to go to the SDU for care or referring them to the SDU for delivery, and providing complementary feeding advice during RDNS implementation. The last may include delivery of supplement consumption messages or could reflect an increased interest in complementary feeding (from either side) as a result of the RDNS intervention. There was a decrease in the percentage of CHWs reporting supervising the VHVs' work during RDNS implementation.

Table 15. Activities that CHWs reported conducting during the past month

Activities	Baseline (%)	Follow-Up #1 (%)	Follow-Up #2 (%)
Identify pregnant women	95.2	100.0	95.2
Conduct BCC sessions	88.9	62.5	92.1
Record keeping (e.g., filling in -up different registers)	88.9	85.9	88.9
Conduct household visits	84.1	82.8	93.7
Provide ANC	77.8	87.5	88.9
Provide PNC	77.8	78.1	82.5
Provide expected delivery date follow-up	73.0	85.9	87.3
Supervise the work of VHVs	71.4	48.4	41.3
Encourage/check vaccination for children	69.8	87.5	71.4
Encourage pregnant women mothers to go to the SDU for ANC	68.3	95.3	81.0
Identify young children	65.1	76.6	71.4
Encourage/check vaccination for pregnant women	65.1	85.9	68.3
Provide advice/follow- up on family planning	61.9	78.1	39.7
Provide essential neonatal care or follow-up	60.3	54.7	54.0
Encourage mothers to go to the SDU for PNC	52.4	62.5	73.0
Refer pregnant women mothers for delivery at SDU	52.4	79.7	77.8
Provide advice on maternal nutrition	46.0	78.1	47.6
Provide advice on breastfeeding	44.4	73.4	22.2
Identify newly married couples	36.5	40.6	55.6
Provide advice on complementary feeding	33.3	89.1	69.8
Identify malnourished children	30.2	32.8	22.2
Provide advice on water and sanitation practices	27.0	53.1	14.3
Reporting (e.g., monthly reports)		89.1	85.7
Distribute RDNS supplements (Jononi or Alic, Sonamoni or Pustikona)[1]		95.3	93.7
Provide information on the use of the RDNS supplements (dose, storage, etc.)[1]		90.6	74.6
Check RDNS supplement intake (Jononi or Alic, Sonamoni or Pustikona)[1]		87.5	74.6
Report childbirth to RDNS staff[1]	76.2	64.1	25.4
Check stock of RDNS supplements at the household (Jononi or Alic, Sonamoni or Pustikona)[1]		60.9	55.6

[1] New RDNS-related task.

Table 15 lists some of the new tasks required of the CHWs as part of RDNS implementation (five last rows). As expected, we observed that reporting of childbirths to RDNS staff decreased after the initial phase of the RDNS (as most children were already born by follow-up #2). Among the other new RDNS-related tasks, checking supplement stocks at the households was reported least often. Per CHDP guidelines, CHWs were supposed to check the supplement stock and retrieve any excess if more than a 7-day dose was in stock.

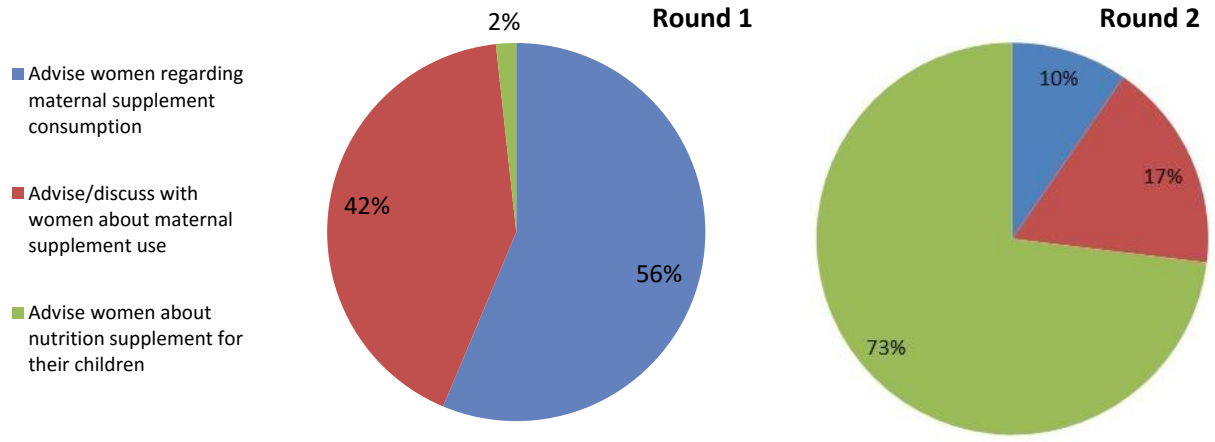
A third source of data to monitor CHDP activities and time allocation during RDNS implementation was the time and motion assessments. Results from those assessments are reported below, organized by category of CHDP staff assessed.

Village health volunteers

Thirty-six VHVs were observed during round 1 and 37 were observed during round 2 of the time and motion assessments. VHVs were volunteers and worked approximately 2.2 and 2.5 hours per day in rounds 1 and 2, respectively.

Personal activities, travel time, and ANC activities accounted for 68% of VHV time in round 1 and 61% in round 2 (Appendix 5). Time spent on RDNS-related activities (4%–5% of time) was similar during the two observation periods, all of which was related to advising women about supplement use for them and/or their children (**Figure 13**).

Figure 13. Percent of time VHVs spent on specific tasks out of the time spent on RDNS work



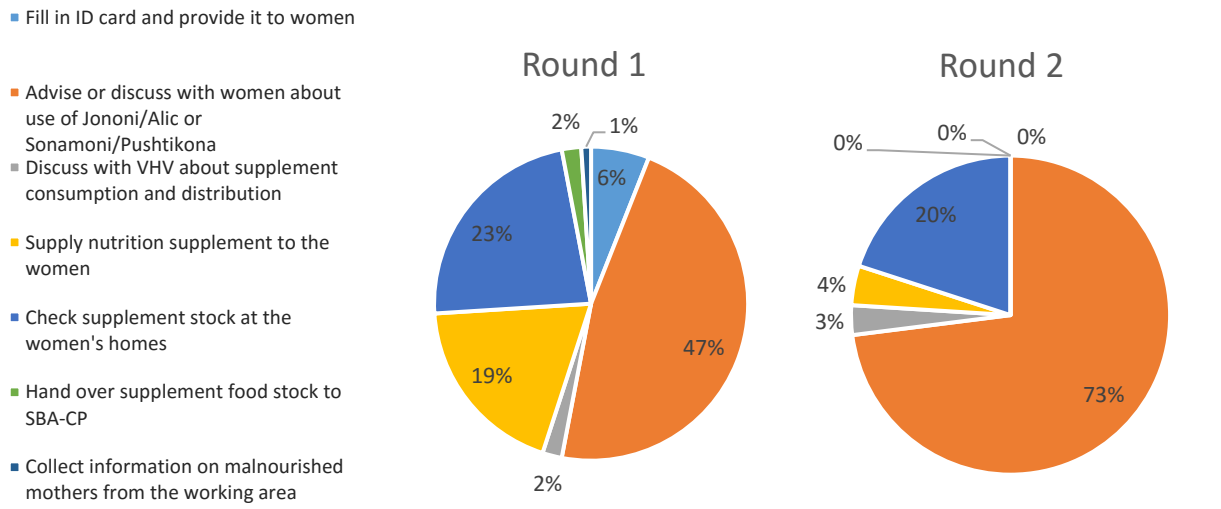
Approximately 43% of VHV time was spent on direct contact productive work, with roughly a quarter of their time spent in inevitable non-productive time and another quarter in avoidable non-productive time (Appendix 5). The majority of inevitable non-productive time was spent on travel (87% and 89% in rounds 1 and 2, respectively), and almost all of the avoidable non-productive time was spent on personal activities (80% and 95% in rounds 1 and 2, respectively).

Community health workers

A total of 13 CHWs were observed for each of the time and motion assessment rounds, and they were observed an average of 6.41 hours and 6.85 hours per day during rounds 1 and 2, respectively.

Reporting and register completion, travel, and personal activities accounted for 56% of CHW time in round 1 and 58% in round 2 (Appendix 6), and RDNS-related activities accounted for 7% of CHW time in round 2, compared with 3% in round 1, despite having less variety in the RDNS-related tasks being done (**Figure 14**).

Figure 14. Percent of time CHWs spent on specific tasks out of the time spent on RDNS work



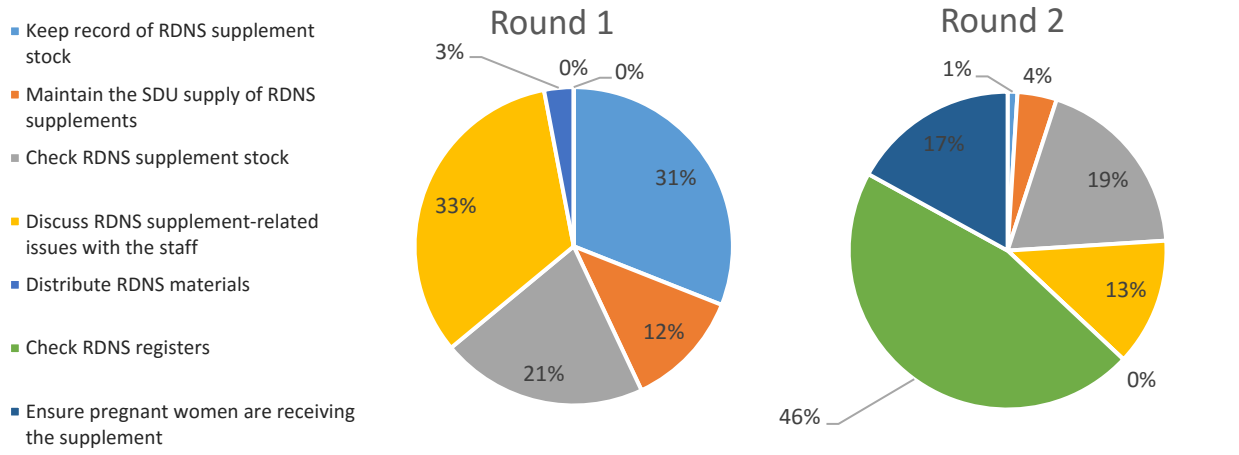
During round 1, 58% of observed CHW time was spent in direct contact or non-contact productive time, which decreased to 49% in round 2, during which more time was observed spent in inevitable non-productive time (Appendix 6). The majority of inevitable non-productive time was spent on travel (57% and 63% in rounds 1 and 2, respectively) and personal activities (37% and 28% in rounds 1 and 2, respectively), and the majority of the avoidable non-productive time was spent on personal activities (84% and 78% in rounds 1 and 2, respectively) and other official activities (16% and 22% in rounds 1 and 2, respectively).

Community Facilitators and Field Coordinators

For both the initial time and motion assessment data collection period and the follow-up, five CFs/FCs were observed for a total of 110.8 and 112.8 hours, respectively.

Official activities, reporting and registration completion, meetings and observing holidays, personal activities, and travel accounted for 84% of CF/FC time in round 1 and for 77% in round 2 (Appendix 7). The percent of observed time spent on RDNS activities increased from 3% to 10% from round 1 to round 2. During round 2, CFs and FCs spent time checking RDNS registers, while this was not something that consumed their time during the first time and motion assessment data collection (**Figure 15**).

Figure 15. Percent of time CFs/FCs spent on specific tasks out of the time spent on RDNS work



A larger proportion of direct contact productive time was observed during round 1, while more non-contact productive time and inevitable non-productive time were observed during round 2 (Appendix 7). The majority of inevitable non-productive time was spent on travel (53% and 61% in rounds 1 and 2, respectively) and personal activities (41% and 32% in rounds 1 and 2, respectively), and all of the avoidable non-productive time was spent on personal activities.

3.3.5 Supervision throughout Program Implementation

Throughout program implementation, CHDP staff were asked about the number of times they received supervision during the past month. **Table 16** shows the results by type of CHDP staff. VHVs reported that the number of times they received supervision did not change over time. On the other hand, CHWs reported that the number of supervision meetings with VHVs decreased after the program was launched (consistent with the lower proportion of CHWs reporting supervising VHVs during the follow-up assessments, presented in Table 15). The number of times CHWs reported receiving supervision from CFs and FCs at the office decreased during the final phase of program implementation, but for CHWs in the field, the answers depended on who was reporting: CHWs reported fewer supervision meetings in the field, while CFs and FCs reported maintaining the same number of supervision meetings. CFs and FCs also reported being supervised less frequently during the final phase of the program.

Table 16. Frequency of supervision during the past month, by type of CHDP staff[1]

Staff Type	Frequency of Supervision	Baseline	Follow-Up #1	Follow-Up #2
VHV	Number of days supervised by CHWs	3 ± 2	3 ± 2	3 ± 1
CHW	Number of days supervising VHVs	15 ± 6	11 ± 6	11 ± 5
	Number of days supervised by CF/FC in the field	4 ± 3	3 ± 3	2 ± 2
CF/FC	Number of days supervising CHWs at the office	20 (8–25)	20 (5–22)	8 (5–9)
	Number of days supervising CHWs in the field	14 (10–18)	15 (7–18)	15 (9–17)
	Number of days met supervisor	7 (5–15)	7 (5–12)	4 (4–6)

[1] All values are mean ± SD for VHVs and CHWs or median (IQR) for CFs/FCs.

3.4 Nutrition Supplement Availability and Distribution: Processes and Outputs

3.4.1 Availability of Supplements and Related Materials

Both LNS products were manufactured by Nutriset in Malaunay, France. Due to the amount of time needed for the supplement to reach the RDNS central storage site, including time for Nutriset to produce the order, UCD had to place supplement orders with Nutriset at least 6 months before the supplements would be needed.

IFA tablets were purchased from Hudson Pharmaceuticals Ltd in Bangladesh. Before the implementation of the RDNS, maternal supplement tablets with the World Health Organization (WHO)-recommended IFA formulation (60 mg iron and 400 µg folic acid) were not commercially available in Bangladesh. However, Hudson Pharmaceuticals agreed to manufacture the product for the RDNS (based on the recommended formulation for pregnancy). Because the shelf life of the IFA tablets was 3 years, all the IFA supply needed for the RDNS was purchased at one time by icddr,b.

The MNP used in the RDNS was already available in the market in Bangladesh. Renata Limited was the company that supplied the MNP for the RDNS. icddr,b placed supply orders for MNP three times during the implementation of the RDNS. Because the product was already commercially available, orders only needed to be placed 1 month prior to the date needed.

Once the supplement orders arrived locally, information on supplement supply (with a minimum shelf life of 3 months) available at the central storage site and at the SDUs was collected by the PE team during 21 data collection rounds that covered the program implementation period. **Table 17** and **Table 18** show the supplement supply available at the central storage site and at the SDUs in three different data collection rounds representing the start-up, the intermediate, and the final phase of program implementation. Although we cannot determine whether the specific amounts were appropriate for the amount of supplements needed at each of these rounds, we observed the expected patterns with regard to maternal and child supplements supply (i.e., no child supplements present in the initial phase, and no maternal supplements present in the final phase) at both the central storage site and the SDUs.

Table 17. Number of supplements at the central storage site (RDNS site) with a minimum shelf life of 3 months

Round	Alic	LNS-mother	LNS-child	MNP
1	658140	11700	0	0
10	15190	77400	564019	722
21	0	0	270900	60489

Table 18. Average number of supplements at the 11 RDNS unions (SDUs) with a minimum shelf life of 3 months

Round	Alic	LNS-mother	LNS-child	MNP
1	3288	877	0	0
10	12248	2436	5139	1925
21	0	0	7893	1975

Accessibility of CHDP protocols related to supplements distributed at the SDUs was also monitored throughout program implementation. Specifically, the PE team monitored the availability of written guidelines for supplement distribution and for reporting adverse events, and of supplement use education materials at the SDUs, by completing the SDU storage form during each of the 21 rounds of data collection. Findings from all rounds indicated that no SDU had a copy of these written materials at the facility at any point in time. It is possible that these written documents were carried by the CHWs, who were the ones mainly responsible for supplement distribution.

The SDU storage form was also designed to monitor the availability of materials related to supplement distribution, such as scissors to separate the LNS sachets and containers for the beneficiaries to keep the supplements in at home. **Table 19** shows data from three rounds of data collection (representing the start-up, intermediate, and final period of program implementation) regarding the availability of these materials at the SDUs. The supply of containers for LNS (which, per protocol, were given at the first supplement distribution) was lower in the final period. As expected, materials related to child supplementation were not available at the start-up of the program, as supplementation started during pregnancy. The SDMRs were kept by the CHWs; thus, the fact that only a few registers were available at the SDUs may be due to the CHWs taking the registers to the field.

Table 19. Number of materials available for distribution at the 11 RDNS unions (SDUs)

Round	Ziploc bag	Container for LNS	Scissors	Registration card – maternal	Registration card – child	SDMR
1	519	183	217	1719	0	0
10	765	405	380	1361	2183	10
21	226	93	33	1313	454	10

3.4.2 Transportation of Supplements

Nutriset sent the LNS from France by air or sea freight to Dhaka airport, Chittagong seaport, or Dhaka railway port. From each of those arrival points, the supplements were transported to the RDNS central storage site at Parbatipur, Dinajpur. There were occasions when it took a long time, sometimes more than a month, for the supplements to pass through customs.

IFA and MNP were produced in Bangladesh and the corresponding manufacturing companies delivered the supplements to the study site.

From the central storage site, supplements and other accessories were delivered to the SDUs based on monthly requisitions from the SDUs. Sometimes, the supplements and required supplies were sent to the SDUs in the van used by the SDU visit team (i.e., the RDNS team collecting evaluation data at the SDUs). However, most of the time, the supplements and supplies were sent to SDUs using rickshaw vans. On several occasions, the team had problems making the deliveries during strikes, political violence, and roadblocks. In these situations, RDNS staff talked with political leaders and let them know that these supplies were for preventing malnutrition in mothers and children. The team also used alternate routes that were less likely to be blocked during political violence. Due to regular communications with local political leaders and influential persons and the dedication of RDNS staff members, supplements and other supplies were available at the SDUs during these events.

At the SDU level, the CHW prepared the supplies for each participant in her working area and then delivered the supply during the home visits. She prepared a monthly work plan for the delivery. CHWs

used bicycles to transport the supplements from SDUs to households. Supplements were delivered to the women's homes on a monthly basis. If a woman was not home at the time the CHW visited, the CHW was instructed to leave the supplements with the husband or other family member.

3.4.3 Storage of Supplements

Storage recommendations from Nutriset were used to develop the most feasible and optimal storage conditions for the supplements used in the RDNS intervention.

The central storage site was located in Parbatipur, outside the LAMB compound. Depending on the need for storage space, we used one to two rooms (each room was approximately 15 feet x 15 feet). Initially, the rooms were not air conditioned; the main method to keep the temperature appropriately low during the summer and dry seasons was to continuously run ceiling fans. Later on, air conditioned was installed in that part of the building. A temperature log was maintained and temperature and humidity were recorded twice each workday, once in the morning and once in the afternoon. Room temperatures were rarely above 40° C; storage between 30° C and 40° C, although not optimal, does not cause major product deterioration. However, securing the room from rodents required additional measures. The ceilings and doors were sealed. Screens and nets made of steel were used to seal the windows and ventilators. Supplements were stored a few inches off the ground, on wood pallets. During the inspections and delivery of supplies to the SDUs, the doors of the central storage site were guarded or kept closed so that rodents could not enter. Mouse traps were also kept in the central storage site. A stock register was used to keep track of inflow and outflow of supplements and other supplies needed for supplement delivery (e.g., plastic containers, Ziploc bags, scissors, supplement distribution cards). These other supplies were also stored in the central location but in a different room.

Analysis of data collected at the central storage site from five different rounds indicated that, at all five observation time points, supplements were not stored in direct sunlight and that windows in the storage room had barriers to prevent pests or rain or storm debris from getting in. Central storage site conditions were monitored using Form PE-CS. **Table 20** shows the results from selected data collection rounds, including two rounds conducted during the high temperature season.

Table 20. Central storage site conditions during the previous month

	Round				
Storage Conditions	**1**	**5**	**10**	**15**	**21**
Month/year	February 2012	July 2012	December 2012	July 2013	March 2015
Highest temperature (°C)	19.1	32.5	26.5	36.5	19.0
Number of times temperature >30.0 °C	0	11	0	26	0
Highest humidity (%)	86	90	87	87	89
Lowest humidity (%)	61	70	71	54	78

At the SDUs, a steel cabinet was used to store the supplements. Though it was always suggested to store the supplements in the steel cabinet, sometimes the cabinet was full and supplements were stored on top of the cabinet. To keep the supplements free from rodents, the cartons were kept sealed when the supplements were stored outside the steel cabinet. A stock register was used to keep track of inflow and outflow of supplements and other needed supplies. No temperature or humidity measurement devices were available at the SDUs, therefore no logs of temperature and humidity were maintained.

Beneficiaries of the RDNS intervention were advised to keep the supplements in a cool and dry place at home and out of reach of children. LNS sachets were supposed to be kept in a plastic container, whereas IFA tablets and MNP sachets were supposed to be kept in Ziploc bags supplied by the project. During the PEPA-PLW assessment, the PE enumerators observed the location and storage conditions of the maternal supplements at the RDNS participants' homes (n=329). In that assessment, two women had stored supplements in direct sunlight and five had placed them in a damp area. However, most of them kept the supplements in shade (95%), out of reach of children (67%), and inside the appropriate container or Ziploc bag (60%).

3.4.4 Distribution of Supplements and Materials

Besides supplements and materials availability, beneficiary receipt of supplements and materials according to protocol was also monitored. CHDP protocol indicated that beneficiaries should receive a registration card when they started receiving the supplements and either a plastic container if receiving LNS or a Ziploc bag if receiving IFA supplements. Program records indicate that 98% of beneficiaries did receive the card (n=6,758), as well as the corresponding container or bag (n=6,754).

The RDNS researchers identified the CHWs as the CHDP key personnel for supplement distribution, and program records indicate that they predominantly assumed that role throughout program implementation. **Table 21** lists the mechanisms for supplement distribution recorded for selected supplement delivery events.

Table 21. Delivery mechanisms at selected supplement delivery events[1]

Delivery Mechanism	2nd Delivery – Pregnancy	5th Delivery – Pregnancy	3rd Delivery – Postpartum	2nd Delivery – Child (7 mo)	10th Delivery – Child (15 mo)	13th Delivery – Child (23 mo)
CHW at home	5320 (81.8)	4268 (81.0)	5676 (91.6)	4311 (96.9)	4213 (92.8)	3416 (76.2)
CHW at satellite/ BCC session	361 (5.6)	191 (3.6)	36 (0.6)	19 (0.4)	8 (0.2)	6 (0.1)
VHV at home	494 (7.6)	316 (6.0)	340 (5.5)	46 (1.0)	7 (0.2)	1 (0.0)
At VHV's home	129 (2.0)	59 (1.1)	26 (0.4)	0 (0)	0 (0)	0 (0)
At SDU	74 (1.1)	17 (0.3)	5 (0.1)	14 (0.3)	1 (0.0)	0 (0)
CF/FC at home	19 (0.3)	27 (0.5)	23 (0.4)	57 (1.3)	82 (1.8)	80 (1.8)

[1] All values are n (%).

Program data from the SDMR were also analyzed to determine the time elapsed between subsequent supplement distribution deliveries. The tables below show the percentages of beneficiaries whose supplement distribution was delayed (defined as actual delivery day more than 35 days after scheduled delivery day) for maternal supplementation during pregnancy and postpartum **(Table 22**) and for child supplementation (**Table 23**). As expected, the highest percentage of delayed distributions occurred at the very beginning of program implementation, when there was a delay in the second supply of supplements for 12% of women. However, after the start-up phase, program records suggest that at least 95% of beneficiaries received their monthly supply of supplements on time throughout program implementation.

Table 22. Percentage of delayed maternal supplement distributions to CHDP beneficiaries

Rounds	Sample size[1]	Delayed distribution[2]
1st–2nd supplement distributions – pregnancy	n=6394	776 (12.1%)
4th–5th supplement distributions – pregnancy	n=4874	159 (3.3%)
2nd–3rd supplement distributions – postpartum	n=6112	178 (2.9%)

[1] Differences in sample size are the result of enrollment at different gestational ages; some women may have already given birth by the 4th supplement distribution, and were therefore not receiving any more "pregnancy" distributions, but then resumed receiving supplements after delivery.
[2] All values are n (%).

Table 23. Percentage of delayed child supplement distributions to CHDP beneficiaries

Rounds	Sample size	Delayed distribution[1]
1st–2nd supplement distributions – 6–7 months	n=4447	230 (5.2%)
9th–10th supplement distributions – 14–15 months	n=4310	194 (4.5%)
17th–18th supplement distributions – 22–23 months	n=3520	92 (2.6%)

[1] All values are n (%).

It is important to note that the above results (in this 3.2.4 sub-section) were obtained from program records, and therefore should be interpreted cautiously.

Data from the PEPA-PLW assessment indicate that 15.0% of PLW receiving maternal supplements had run out of supplements at least once since they started receiving them (Harding et al. 2014). This prevalence was lower (9.2%) for child supplement distributions (Harding et al. 2016). These findings may suggest that delayed distributions occurred more frequently than what program records indicate. However, running out of supplements could also happen when participants consume more than the recommended dose.

The PEPA assessments also provided data on the mechanisms through which participants received their monthly supply of supplements, as well as on their supplement delivery preferences. The PEPA-PLW assessment shows that initial supplement distribution occurred mostly at the SDU (71.7%), while 17.8% of the women reported receiving the first supply of supplements from CHDP staff at their home and 7.5% reported receiving the first supply from a CHW at a satellite session (as part of CHDP services) (Harding et al. 2014). As per protocol, most women (92.2%) reported receiving their most recent supply of supplements from CHDP staff at home, mostly delivered by CHWs (76.4%), although some were delivered by VHVs (12.2%) (Harding et al. 2014). Also, 2.8% reported receiving their most recent supply from a CHW at a satellite session and 2.5% at the SDU (Harding et al. 2014). With regard to their preferred distribution method, 98.9% of women responded that receiving supplements from CHDP staff at their homes was the best distribution method (Harding et al. 2014). Specifically, 80.7% of the women preferred to receive supplements from CHWs at home, while 12.0% preferred VHVs to deliver them at home (Harding et al. 2014).

Results from the PEPA-C regarding distribution of supplements indicate that most women reported picking up the initial supply of the child's supplements from the LAMB SDU (92.8%), as indicated in the CHDP protocol (Harding et al. 2016). This visit to the SDU also allowed the RDNS team to conduct the RDNS follow-up assessment at 6 months of age. A small percentage of women had their initial supply of child supplements dropped off at the home by a CHW (6.8%) (Harding et al. 2016). After the initial distribution, almost all of the women reported that the primary mode of child supplement acquisition was CHDP staff delivery at home (98.0%), which was also the women's preferred mode of receiving

supplements (Harding et al. 2016). These deliveries were mostly made by CHWs (85.7%) or in some cases by the CHW and VHV together (13.9%). A few women (2.0%) picked supplements up from BCC or satellite sessions held by CHWs in their villages (Harding et al. 2016).

3.4.5 Delivery of Messages on Supplement Use

Findings from the PEPA-PLW (Harding et al. 2014) indicate that all women reported receiving instruction on supplement consumption at the time of the first maternal supplement distribution. With regard to their most recent supplement distribution, the percentage of women who reported receiving supplement use messages differed by supplement: 46% for LNS recipients vs. 69% for IFA recipients ($p=0.0001$). This difference was no longer significant when postpartum IFA recipients were excluded ($p=0.31$). As previously mentioned, there was a change in the recommended frequency of taking IFA between pregnancy (daily) and postpartum (every other day), which could explain why IFA recipients were more likely to report receiving a supplement use message at the most recent supply distribution.

Besides the standard supplement messages developed by LAMB and RDNS, women reported receiving a number of other supplement-related messages, including contradictory (i.e., “it is fine to take more than one supplement per day”) or conflicting messages (i.e., “take the supplement mixed with food” and “take it without any foods or liquids”). Women also reported being advised regarding specific times of day to take the supplements and what to mix the supplement with, such as sugar or molasses (Harding et al. 2014).

Similarly to what was reported for maternal supplementation, all caregivers reported receiving child supplement use messages when the first supply of LNS or MNP was provided to them, and 90.8% received such messages at the most recent supplement delivery, which did not differ significantly by child supplement (88.9% in the LNS group vs. 92.7% in the MNP group, $p=0.34$). Caregivers were also given messages beyond the standard ones, and in one case an incorrect dose message (“Use two packets of MNP per day”). However, for both child supplements, most of the non-standard messages reported were suggestions to take the supplement as wished.

3.5 Supplement Consumption by Beneficiaries: The Outcomes

The Process Evaluation of Participant Adherence (PEPA) assessments involved subsamples of the RDNS overall sample. Both subsamples were compared to the rest of the RDNS sample on baseline characteristics, and results are shown in **Table 24** and **Table 25**. In general, the PEPA samples were similar to the overall RDNS cohort, except with regard to gestational age at enrollment ($p<0.001$), although this difference was observed only for the Process Evaluation of Participant Adherence among Children (PEPA-C) sample (data not shown).

Table 24. Baseline characteristics of the Process Evaluation of Participant Adherence among Pregnant and Lactating Women (PEPA-PLW) sample compared to the RDNS cohort[1]

Characteristic	PEPA-PLW (n=360)	RDNS (n=3,651)	p-value[2]
Gestational age at enrollment (weeks)	12.6 ± 3.1	13.0 ± 3.4	0.04
Age (years)	21.6 ± 4.8	22.0 ± 5.0	0.23
Nulliparous (%)	37	35	0.69
Body mass index (BMI)	20.3 ± 2.6	20.4 ± 2.8	0.99
Years of education	6.3 ± 3.1	6.2 ± 3.3	0.92
Muslim (%)	78	80	0.39

[1] Mean ± SD for all similar variables.
[2] P-values for categorical variables derived by Rao-Scott chi-square test; p-values for continuous variables derived by generalized linear models, accounting for the cluster design.

Table 25. Baseline characteristics of the PEPA-C sample compared to the RDNS cohort[1]

Characteristic	PEPA-C (n=250)	RDNS (n=3,761)	p-value[2]
Gestational age at enrollment (weeks)	13.5 ± 3.5	13.0 ± 3.4	0.03
Age (years)	22.0 ± 4.9	22.0 ± 5.0	0.98
Nulliparous (%)	33	40	0.04
BMI <18.5 (%)	26	29	0.27
Years of education	6.1 ± 3.0	6.2 ± 3.3	0.47
Muslim (%)	81	80	0.89

[1] Mean ± SD for all similar variables.
[2] P-values for categorical variables derived by Rao-Scott chi-square test; p-values for continuous variables derived by generalized linear models, accounting for the cluster design.

In addition, data from the RDNS cohort were used for the PE specifically to measure self-reported adherence to supplement consumption regime in all RDNS participants. Sample sizes for those assessments are described in **Table 26**.

Table 26. Sample size for self-reported adherence assessment in the RDNS cohort

Follow-Up Visit	Recall Period	Supplement Type	n[1]
42 days postpartum	Pregnancy and postpartum	Maternal	3,703
6 months	Postpartum (42 days to 6 months postpartum)	Maternal	3,678
12 months	First 6-month period (6–12 months)	Child	2,610
18 months	Second 6-month period (12–18 months)	Child	2,574
24 months	Third 6-month period (18–24 months)	Child	2,570

[1] Reduction in sample size for child supplement related to one arm (control) not receiving any supplement.

3.5.1 Beneficiaries' Recall of Messages on Supplement Use

RDNS participants were asked about the supplement use messages received at their first and/or most recent supplement distribution as part of the PEPA assessments (Harding et al. 2014; Harding et al. 2016). Findings from these assessments (which included only beneficiaries who were also involved in the RDNS evaluation study) suggested that most of the participants were given and recalled the correct supplement use messages.

Overall, the most common message women recalled receiving about maternal supplement use during the first supplement distribution (i.e., during pregnancy) was to take one supplement per day (95.4% in the LNS group and 98.6% in the IFA group). With regard to the most recent supplement delivery, most women recalled being told to take one supplement per day (82.0% in all LNS pregnancy and postpartum groups combined and 94.7% in the IFA pregnancy group) or to take one supplement every other day (96.7% IFA early lactation group only).

Similarly, the most common message caregivers recalled being told during the most recent child supplement delivery was on supplement dose: to feed the child two sachets of LNS or one packet of MNP per day, depending on the supplement group the child was in (95.5% and 94.8% of LNS and MNP recipients, respectively; Harding et al. 2016).

3.5.2 Self-Reported Consumption of Maternal Supplements

Results from the PEPA-PLW assessment have been reported in a separate document (Harding et al. 2014). Briefly, in that assessment, mean self-reported consumption of maternal supplements did not differ significantly by physiological status (pregnancy, early lactation, and late lactation) among LNS recipients (p=0.39) or between LNS and IFA recipients during pregnancy (p=0.086). However, the percentage of women who reported not consuming any supplements in the past week was significantly higher among LNS than among IFA recipients during pregnancy (22% and 6%, respectively; p=0.039) and among IFA recipients who were pregnant than among those in the early lactation period (6% and 19%, respectively; p=0.026).

In addition to the PEPA-PLW assessment, we assessed self-reported supplement consumption during the RDNS follow-up visits as part of our assessment of KAP in the RDNS cohort. **Table 27** and **Figures 16–17** show results on self-reported adherence to the maternal supplementation regime in the RDNS cohort. The KAP data indicated that perfect adherence to maternal supplementation recommendations during the past week differed by type of supplement during pregnancy and the early postpartum period, with more women in the IFA group reporting adherence to supplement intake recommendations than those in the LNS group (Table 28). Self-reported perfect adherence to maternal supplementation was 57.6%–69.4% during late pregnancy and 42.8%–50.9% during the early postpartum period.

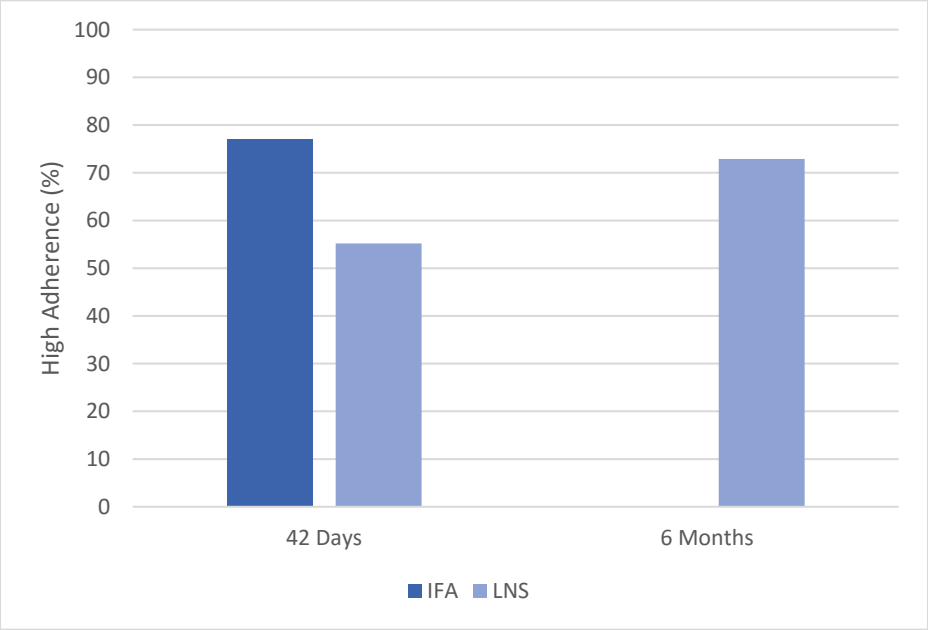
Table 27. Percentage of RDNS women who reported supplement consumption as recommended (perfect adherence[1]) during the past week

Period	Total n (%)	LNS n (%)	IFA n (%)	p-value
36 weeks gestation	1002 (66.4)	217 (57.6)	785 (69.4)	0.033
42 days postpartum	1570 (48.9)	348 (42.8)	1222 (50.9)	0.004

[1] Defined as consumption during the past week of seven LNS sachets or IFA tablets during pregnancy, and seven LNS sachets or three to four IFA tablets postpartum.

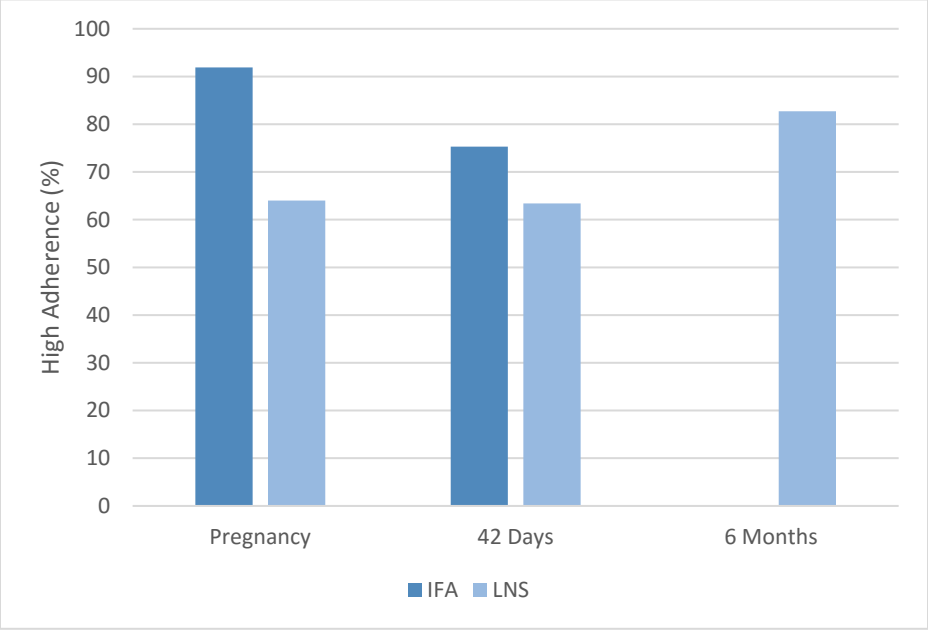
Similarly, "high adherence" to maternal supplementation recommendations during the past week (defined as four or more supplements for LNS mothers, two or more supplements for IFA mothers) differed by type of supplement at 42 days postpartum: 77.1% and 55.2% in the IFA and LNS groups, respectively ($p<0.0001$) (**Figure 16**). A similar pattern was observed for high adherence when assessed using a retrospective recall: 91.9% and 64.0% in the IFA and LNS groups, respectively, during pregnancy ($p<0.0001$), and 75.3% and 63.4% in the IFA and LNS groups, respectively, during early postpartum ($p<0.0001$) (**Figure 17**). Due to differences in scheduled duration of maternal supplementation during the postpartum period (3 months for IFA, 6 months for LNS), no comparisons by group were done at 6 months postpartum, but the percentage with high adherence in the LNS group increased based on both the past week and the retrospective recall analyses (Figures 16 and 17).

Figure 16. Percentage with high adherence to maternal supplementation regime during the past week during the postpartum period[1]



[1] High adherence during postpartum = four or more supplements in the last week for LNS mothers, two or more supplements in the last week for IFA mothers.

Figure 17. Percentage with high adherence to maternal supplementation regime based on retrospective information during pregnancy and postpartum[1]



[1] High adherence = almost every day or regularly, every day (for LNS mothers and IFA mothers during pregnancy) or every other day (for postpartum IFA).

As part of the PEPA-PLW assessment, women were also asked about the mode of supplement consumption in the previous week. Women in the LNS group most often reported that they consumed LNS alone without adding it to any other food or liquid (63.6%), but others mixed LNS with food (19.1%) or water (9.8%). Among those who reported consuming LNS mixed with food, 66.7% ate LNS (the regular peanut flavor) mixed with rice and 24.2% reported mixing it with puffed rice (Harding et al. 2014).

3.5.3 Caregiver Report of Child's Consumption of Supplements

Results from the PEPA-C assessment are also available in a separate report (Harding et al. 2016). Based on maternal report, percent adherence did not differ by supplement group (median percent adherence: 85.7% [IQR: 64.3%–100.0%] vs. 85.7% [IQR 50.0%–100.0%] for LNS vs. MNP respectively; p = 0.23). The percentage of children who were reported to have consumed the number of supplements recommended (i.e., 14 LNS or 7 MNP sachets per week) did not differ by supplement type (42.9% LNS vs. 42.7% MNP; p=0.98), but a higher percentage of MNP recipients reported that the child did not consume any supplements in the previous week (2.4% for LNS vs. 8.9% for MNP; p=0.04).

In addition to the PEPA-C assessment, we assessed the child's supplement consumption as part of the main RDNS KAP data collection activities. **Tables 28–29** and **Figures 18–19** show results for caregivers' report on adherence to child supplementation recommendations in the RDNS cohort. The percentage of caregivers reporting "perfect adherence" to child supplementation regime during the past week ranged between 52.1% and 54.7% at 12 months, 57.9% and 61.8% at 18 months, and 63.0% and 67.7% at 24 months, with no significant differences by type of supplement at any time point (Table 28). Overall, report of "high adherence" to child supplement regime was high (>75%) at any given age, assessed either for the past week (defined as consuming eight or more sachets of LNS or four or more sachets of MNP)

or the past 6 months (defined as "almost every day" or "regularly, every day"). However, prevalence of high adherence during the past 6 months (retrospective recall) differed by type of supplement at 24 months, with lower percentages being reported among those receiving MNP than among those receiving LNS (Table 28). No significant differences by type of supplement were observed for reports of high adherence during the past week (Table 29). Hypothesis testing for the indicator "high adherence" during the past week confirmed that the observed increments between age points were statistically significant for each arm (p-values for 12 vs. 18 and 18 vs. 24 months, respectively: 0.002 and 0.007 for MNP; 0.005 and 0.011 for child LNS; and 0.003 and 0.007 for comprehensive LNS). With regard to "high adherence" during the past 6 months, percentages were higher at 24 months (vs. 18 months) for the MNP (p=0.007) and the comprehensive LNS (p=0.025) arms.

Table 28. Percentage of caregivers who reported perfect adherence for child supplementation during the past week[1] in the RDNS cohort, by study arm

Period	Comprehensive LNS n (%)	Child LNS n (%)	Child MNP n (%)	p-value[2]
12 months of age	477 (52.8)	439 (54.7)	470 (52.1)	0.745
18 months of age	518 (58.2)	488 (61.8)	514 (57.9)	0.504
24 months of age	586 (65.9)	539 (67.7)	556 (63.0)	0.288

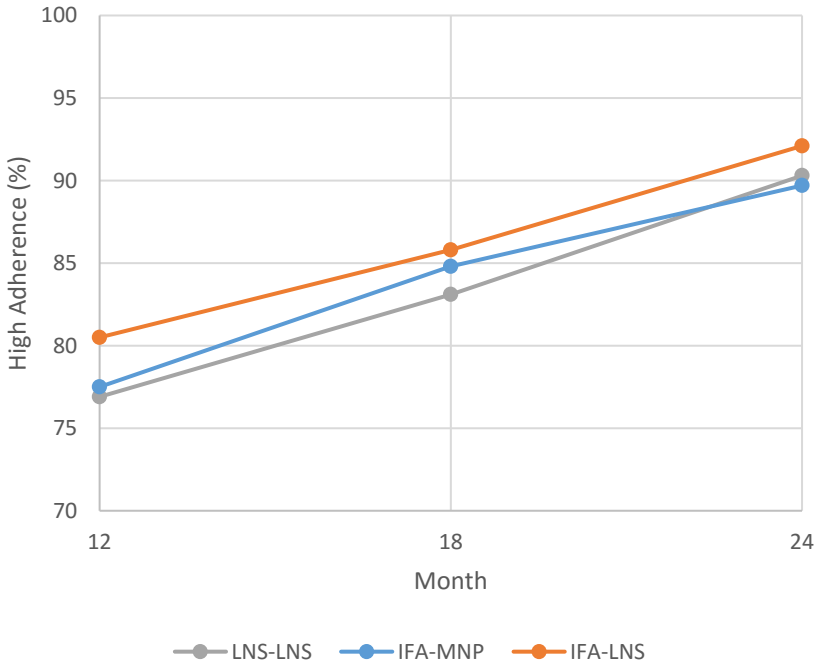
[1] Defined as consuming 14 LNS sachets (both arms) or 7 MNP packets.
[2] P-values derived by generalized linear models, accounting for the cluster design.

Table 29. Percentage of caregivers who reported high adherence for child supplementation in the RDNS cohort, by study arm

Period	Comprehensive LNS n (%)	Child LNS n (%)	Child MNP n (%)	p-value[3]
Past week[1]:				
12 months of age	694 (76.9)	647 (80.5)	700 (77.5)	0.355
18 months of age	740 (83.2)	678 (85.8)	753 (84.8)	0.571
24 months of age	803 (90.3)	733 (92.1)	791 (89.7)	0.450
Past 6 months[2]:				
12 months of age	873 (96.7)	778 (97.0)	850 (94.2)	0.155
18 months of age	870 (97.4)	771 (97.5)	848 (95.1)	0.052
24 months of age	884 (99.3)	788 (99.0)	862 (97.5)	0.007

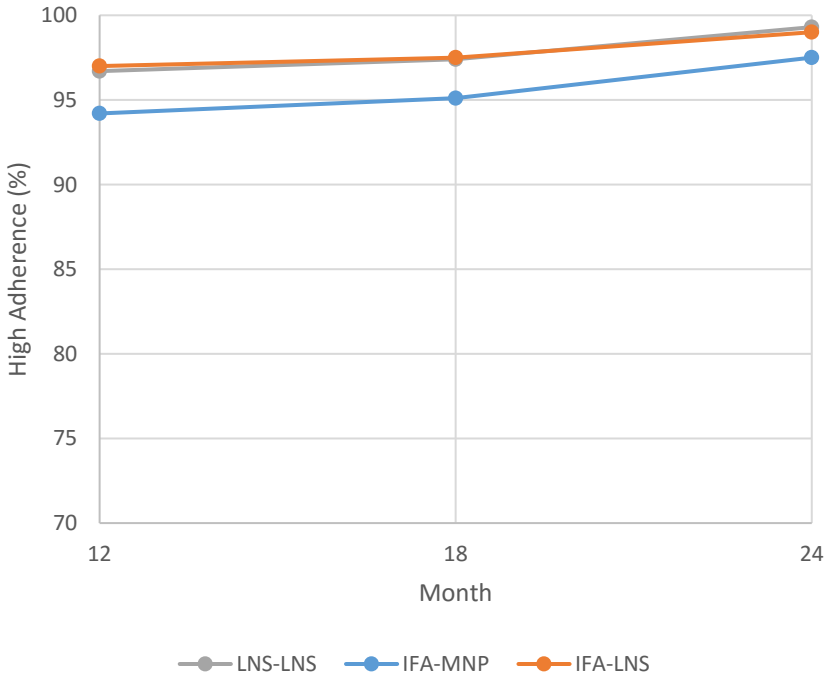
[1] High adherence defined as consuming eight or more sachets of LNS (10 g each) or four or more sachets of MNP.
[2] High adherence defined as "almost every day" or "regularly, every day."
[3] P-values derived by generalized linear models, accounting for the cluster design.

Figure 18. Percent of high adherence to child supplementation regime[1] during the past week



[1] High adherence defined as eight or more sachets of LNS or four or more sachets of MNP.

Figure 19. Percent of high adherence to child supplementation regime[1] since last interview



[1] High adherence defined as "almost every day" or "regularly, every day."

3.5.4 Supplement Sharing, Loss, Exchange, or Selling

The PEPA assessments also provided information on supplement sharing and barriers to adherence. From the PEPA-PLW assessment (Harding et al. 2014) we learned that sharing of maternal supplements was more common among LNS recipients than among IFA recipients (18.0% vs. 3.0%, respectively; $p<0.001$), while loss or destruction of supplements tended to be more common among IFA recipients than among LNS recipients (9.0% vs. 4.0%; $p=0.05$). There were no reports of maternal supplements being sold or exchanged. Information on the participants' reasons for maternal supplement sharing or destruction has been published elsewhere (Harding et al. 2014).

With regard to child supplements (PEPA-C assessment), sharing and loss or destruction of supplements (from the last supply) were more common among LNS than among MNP recipients (sharing: 20.6% vs. 10.5%, respectively, $p=0.008$; loss or destruction: 27.0% vs. 15.3%, respectively, $p=0.004$). No cases of selling or exchanging supplements were reported. Further details, including the reported reasons for child supplement sharing or destruction, have been previously published (Harding et al. 2016).

3.5.5 Other Barriers and/or Facilitators for Program Success

Pertaining to potential barriers to maternal adherence, from the PEPA-PLW assessment we learned that, although overall acceptability and organoleptic scores for the LNS were high, acceptability of LNS-cumin, the product provided to LNS recipients in the first part of the RDNS, was low, with most recipients reporting that they "disliked it a lot." This finding was not consistent with results from an acceptability trial that we conducted in the same area before implementing the RDNS (Mridha et al. 2012), where most (during week 1 of supplement consumption) or all (during week 2) women who consumed the cumin-flavored LNS reported that they liked it (either "liked it a little" or "liked it a lot").

Also, the smell of the maternal LNS products was not appealing to some participants in the PEPA-PLW assessment (28%), and it was the most common reason (15%) for not consuming the supplements among LNS low-adherers (Harding et al. 2014). This may relate to their pregnancy state, as both "bad smell of the supplement" and "feeling nausea or vomiting" were reported most commonly among pregnant LNS low-adherers in comparison to other low-adherers receiving LNS or IFA. Fifteen percent of women disliked the taste of the LNS, with some commenting about it not being sweet enough or having a metallic taste.

Another barrier to maternal supplement consumption identified in the PEPA-PLW assessment was forgetfulness, which was reported for both LNS and IFA low-adherers. Ease of consumption could also play a role in adherence: More than half of the women who received both LNS and IFA (due to a 10-week period of disruption of LNS distribution to comply with a new quality control criterion that required ready-to-use supplementary foods to be free of *Cronobacter sakazakii*) stated that the IFA was easier to consume than was the LNS.

Pertaining to child supplement consumption, forgetfulness and illness were the two most common reasons reported for the child consuming less than the recommendation among both the LNS and the MNP recipients in the PEPA-C assessment (Harding et al. 2016). Only three LNS recipients and no MNP recipients reported that the child consumed more than the recommended number of sachets in the previous week, which reduces concerns about potential risk of toxicity.

Other identified barriers to adherence were related to actual program implementation. Overall, 15% of women reported that they had run out of supplements at least once since starting to receive supplements (Harding et al. 2014). However, this prevalence was lower for the child supplements (9.2% reported running out of child supplements at least once). The LAMB CHDP supplement distribution protocol

indicated that CHDP staff members should have provided women with more than enough supplements for 1 month of consumption, so that their supplement supply would not run out, assuming supplements were used as recommended. Thus, running out of supplements is an indicator that supplements were not distributed per protocol, or that supplements were not used as recommended, or a combination of both. The lower reported prevalence of running out of child supplements could be due to fewer deviations from protocol over time or greater interest (or emphasis) on distributing supplements for the children than for the women.

A key factor that may have influenced program success is the performance of the CHWs, as they were primarily responsible for distribution of supplements and messages on their use. Thus, we attempted to assess the beneficiaries' perspective about the CHWs by using RDNS data. Specifically, we used the KAP and PEPA assessments to ask RDNS participants their opinions and preferences about the home visits and the CHWs. For example, at the 18- and 24-month RDNS follow-up visits, we asked each participant whether a CHW had visited her home and whether the participant attended a BCC session during the previous month. Overall, most RDNS participants reported being visited by a CHW during the previous month (75.3% and 76.4% at the 18- and 24-month visits, respectively). Note that these overall visit rates reported by participants were somewhat lower than those reported by the CHWs in any of the CHDP assessment rounds (see Table 15). However, the proportions of RDNS participants who reported being visited by a CHW (**Table 30**) and attending a BCC session (**Table 31**) during the previous month were significantly higher in the intervention groups than in the control group. Participants in the control group were not receiving any child supplements at the time of these interviews, so it is possible that supplement distribution increased the chances that beneficiaries would be visited by a CHW and attend a group educational session.

Table 30. Percentage of RDNS participants who reported being visited by a CHW during the previous month

RDNS Visit	RDNS Sample n (%)	Comprehensive LNS n (%)	Child LNS n (%)	Child MNP n (%)	Control n (%)	p-value
18-month	2402 (75.3)	775 (93.7)	699 (92.8)	780 (92.9)	148 (19.2)	<0.0001
24-month	2611 (76.4)	838 (94.4)	749 (93.0)	826 (92.2)	198 (23.9)	<0.0001

Table 31. Percentage of RDNS participants who reported attending a BCC session during the previous month

RDNS Visit	RDNS Sample n (%)	Comprehensive LNS n (%)	Child LNS n (%)	Child MNP n (%)	Control n (%)	p-value
18-month	559 (17.4)	146 (17.6)	147 (19.4)	205 (24.2)	61 (7.9)	0.026
24-month	845 (24.5)	240 (26.8)	240 (29.6)	286 (31.6)	79 (9.4)	0.003

From the PEPA assessments, which involved subsamples of RDNS participants, we obtained more-detailed information about beneficiaries' perceptions of the CHWs. For the PEPA-PLW assessment, we asked participants their opinions regarding the frequency of visits that they reported. Most PEPA-PLW assessment participants (61.4%) indicated that the frequency of visits was fine, while 38.6% said that they would like the CHW to come more often. For the PEPA-C assessment, we reworded the question to ask more directly about the participant's preference, in an attempt to reduce any potential social desirability.

Results were similar: 30.9% said that they would like the CHW to visit them more frequently, while 68.7% chose the same frequency, and only one participant said that the CHW should come less often. We also asked the participants whether they would like to continue being visited by the same or a different CHW and the vast majority (97.2%) said that they preferred to stay with the same CHW. These results suggest that program beneficiaries were generally comfortable with the CHWs and welcomed their visits, though we cannot rule out social desirability bias.

3.6 Summary of Results by Process Evaluation Component

This section presents a summary of the results organized by PE component, as described in Section 1.4, with the objective of facilitating understanding among readers who may be more familiar with that PE approach. We have incorporated these PE components into the program impact pathways (from inputs to impact) in Figure 1 (PE Model) and Appendix 1.

3.6.1 Resources

Some of the inputs identified at the outset as being required for implementing the program included the availability of literate health staff (able to keep a register and beneficiary cards and to count supplements) and of storage space (at the union level). Bicycles and motorbikes were also important resources, and staff had access to them from the beginning of implementation. With regard to human resources, CHWs were the key frontline workers for program implementation. They were younger and more educated than the VHVs (who were mostly illiterate), and their supervisors (i.e., CFs and FCs) had even higher education levels.

To conduct the new activities, the CHDP staff needed to be trained. RDNS trainings included an initial orientation and a refresher training session, the latter only for CHWs, CFs, and FCs (i.e., not VHVs). Trainings were received by most of the CHDP staff interviewed and, based on a post-training evaluation, CHWs, CFs, and FCs appeared to have assimilated the information reinforced in the RDNS refresher training. In general, the CHDP staff believed that they were well trained to perform their assigned tasks, and most of them attended monthly CHDP refresher trainings throughout program implementation. However, based on results reflecting job motivation at baseline, a potential barrier to remaining motivated may be the lack of sufficient job-specific training. In addition, most staff found it difficult to manage their workloads and reported being under a lot of pressure at baseline. However, this pressure seemed to decrease as the program moved from the start-up phase to completion. In general, CHDP staff turnover was low through program implementation, with one exception: Around the midpoint of program implementation (follow-up round #1), several supervisors (i.e., CFs and FCs) were new to their position (i.e., they had less than 1 year on the job).

CHDP staff at all levels perceived several challenges, as well as opportunities, related to the new supplement distribution. Among other challenges, staff consistently mentioned an increase in workload. In addition, staff also perceived the potential reluctance on the part of pregnant women to consume the supplement, mainly due to the fear of side effects, as a potential challenge. Perceived potential opportunities related to supplement distribution included not only reduction of malnutrition in the communities where staff worked, but also an increased demand for SDU and CHDP services, along with increased acceptance of the CHDP and its staff.

Supervision of CHDP staff seemed to have decreased during program implementation. In particular, after the start-up phase, CHWs reported fewer meetings with VHVs to discuss their work and less frequent supervision received from the CFs and FCs. CFs and FCs also reported meeting their own supervisor less frequently during the final period of program implementation.

Supplements were available throughout program implementation. However, LNS orders needed to be placed several months in advance given that the product was not locally produced. Also, IFA supplements that contained WHO-recommended doses, which supposedly were the standard of care in Bangladesh, were actually not available and specific arrangements needed to be made for IFA supplements to be produced for the RDNS. Access to MNP supplements, which were already in the market in Bangladesh, was much easier. Overall, PE data on supplement availability at the central and SDU storage sites indicate that the expected supplements (both maternal and child) were available throughout program implementation. This was also true for materials needed for supplement distribution at the SDUs (such as containers and registration cards).

3.6.2 Reach

Identification of pregnant women was the activity mentioned most often by CHWS and VHVs during program implementation. This activity was already a key component of the CHDP and served as a trigger for the provision of other maternal and child health services, that is, services other than supplement distribution. In the context of the RDNS intervention, identifying pregnant women was the main recruitment activity, and it triggered the beginning of maternal supplementation among eligible beneficiaries. Thus, incorporating a maternal nutrition intervention into a program in which pregnancy identification is a regular activity proved to be a successful strategy for reaching potential beneficiaries.

Monitoring rates of beneficiaries' participation (i.e., those receiving supplements though not necessarily enrolled in the RDNS) was not purposively done for this PE. However, data available from the program records suggested that among infants who started receiving supplements at 6 months of age, about 97% were still in the records for receiving a supplement when they were 14–15 months of age and about 79% of them were still receiving supplements at 22–23 months of age. Although these program data need to be considered cautiously, these estimates are consistent with the attrition rates observed for the RDNS evaluation study. Unfortunately, due to enrollment of pregnant women at different gestational ages and differences in the duration of postpartum supplementation, and the specific format in which these program data were recorded, it was not possible to calculate similar estimates for women in the program.

3.6.3 Dose Delivered

Program records, which were kept by CHWs, indicated that once the program was established, most supplement distributions occurred in a timely fashion; however, during the start-up phase about 12% of maternal supplement distributions were delayed. From the beneficiaries' perspective, running out of supplements reportedly occurred more frequently (15% for maternal and 9% for child supplement distributions) than what would be expected based on program records.

Most supplement distributions happened at a home visit, which is consistent with the high proportion of CHWs mentioning these visits as one of their regular activities throughout program implementation. However, beneficiaries reported a somewhat lower frequency of home visits by the CHWs, compared to the CHWs' reports.

Along with the supplements, messages on supplement use were given to most beneficiaries, as reported in the PEPA assessments.

3.6.4 Dose Received

Overall, acceptability of both maternal supplements (IFA and LNS-PLW) was high among RDNS participants. There was some variability in acceptability of LNS-PLW with regard to its smell and taste. Preference for the peanut (regular) vs. cumin flavor in LNS was observed among PLW. There were also

some concerns regarding the monotony of taking the same supplement throughout pregnancy and the postpartum period in this population.

For the supplements to be properly consumed, beneficiaries needed to receive and recall the supplement use messages. Findings from the PEPA assessments suggest that most of the women recalled the correct supplement use messages.

Self-reported consumption during pregnancy was similar between women given LNS-regular and those given IFA, although a significantly higher percentage of the former reported "zero" consumption during the previous week. Adherence to LNS-regular was not significantly different across physiological periods, suggesting sustained adherence through 6 months postpartum. For IFA, the percentage reporting "zero" consumption during the previous week was higher postpartum than during pregnancy.

Reported adherence to both LNS and MNP for children, after 12 months of usage, was relatively high in the RDNS (median adherence >70%). Forgetfulness, illness, child's perceived acceptance of the supplements, and travel were the most common reasons for low adherence. Sharing of supplements and loss or destruction of sachets were reported more often among LNS recipients than among MNP recipients. Greater sharing of LNS could be related to the palatability and novelty of LNS, while greater loss or destruction may be related to attempts by children to open the LNS sachets.

3.6.5 Fidelity

Specific storage conditions were required for the LNS products. At the central storage site, supplement storage recommendations were met most of the time. However, during the summer season, the temperature at the central storage site occasionally surpassed the optimal temperature recommended for LNS (but did not surpassed 40°), and this may have also happened at the SDUs during that season (environmental conditions were not monitored in the SDUs).

Overall, implementation of the supplement distribution program appeared to have occurred as planned. According to the program guidelines, the main supplement distribution mechanism was the delivery of supplements by the CHW at the beneficiaries' homes. Most CHWs consistently reported conducting home visits during the previous month throughout program implementation, and this was confirmed by RDNS participants, though at somewhat lower rates.

Program records suggest that most of the time supplements were distributed in a timely way, although about 12% of beneficiaries had a delayed distribution during the start-up phase of program implementation. Reports of running out of supplements also suggest that supplement distribution did not always occur according to guidelines.

Per CHDP protocol, CHWs were supposed to check supplement stocks in households and retrieve supplements if the stock was greater than a 7-day dose. Per CHWs' reports, among the several new RDNS-related tasks, maternal supplement stocks were checked most of the time. However, checking child supplement stocks was reported less frequently. Other deviations from the protocols included the provision of non-standard messages on supplement use, although these events were isolated.

3.6.6 Context

The RDNS intervention was conducted in the context of an impoverished rural area with a shortage of formally trained health care providers. During program implementation, the political situation in Bangladesh posed extra challenges for implementation, on top of the already difficult conditions that resulted from weak infrastructure and extreme climate (particularly during the rainy season). Motivated

staff and access to adequate supplies and equipment were important elements in overcoming these challenges.

3.6.7 Other Process Evaluation Results

We observed very little variation in responses from the CHDP staff when we used Likert-type scales, which may reflect the unsuitability of this approach for this population. In particular, VHVs tended to provide less-variable answers to Likert-type questions than CHWs, CFs, and FCs did. They may be less inclined for social reasons to respond truthfully to such questions or may not have understood them.

An initial concern was the possibility that adding a new component to an existing program would affect other CHDP activities. The only regular CHDP activity that occurred less frequently than the new component during RDNS implementation was the supervision of VHVs. Consistently, findings from the time and motion assessments indicated that, once supplement distribution was well established, the RDNS-related activities took on average less than 10% of the CHWs' and VHVs' time, with most of that time spent counseling women and completing or checking registers.

On the other hand, an increasing trend in the number of CHWs encouraging women to go to the SDU and providing complementary feeding advice was observed during the RDNS implementation. The latter may relate to the fact that provision of child supplement use messages can be considered complementary feeding advice. An unexpected finding was the higher home visitation and BCC attendance rates among the RDNS participants in the intervention groups (receiving supplements) compared to those in the control group (not receiving supplements). This suggests that adding a nutrient supplement component to an existing program may increase contact with CHWs. Increased access to frontline health workers, as well to those based in the SDUs, could also have other positive health outcomes, beyond the access to nutrient supplements.

4 Recommendations

4.1 Recommendations for Program Implementation

In the RDNS, timely delivery of supplements and key messages to all beneficiaries, while also conducting the regular program activities, was the main programmatic goal. The PE revealed that this goal was largely achieved, but in this and other such programs, adequate training and supervision of and motivation among the staff are critical elements for success.

Addition of new components into an existing program usually involves new tasks and an increase in workload. Besides hiring more program staff, as it was done for the RDNS, preparation of the staff for potential changes in workload, particularly during the start-up phase, is recommended and may lessen any concerns about work overload. Discussions or plans for (temporarily) cutting back on other tasks, or on how to incorporate supplement distribution into existing tasks more efficiently, could also be helpful.

Continuous reinforcement of the supplement distribution guidelines for staff seemed to have been a successful strategy, as most participants reported receiving the supplement use messages. Such continuous reinforcement may also help frontline workers incorporate other new tasks into their regular activities (e.g., checking supplement stock) and might assist them in remembering to provide the intended supplement use messages to beneficiaries.

Ensuring continuous availability of supplements requires careful planning, and logistics related to local versus international sourcing need to be taken into account to avoid supplement shortfalls. In the RDNS, sustained supplement supply was achieved as a result of the close work and continuous communication between the involved partners: UCD, icddr,b (directly and through the supervision of the RDNS field staff), and LAMB.

With regard to infrastructure, appropriate storage sites for LNS products should be available, and they should have working fans (as air conditioners are generally not feasible) to facilitate maintenance of appropriate temperatures during the hot season in settings with similar climates.

Improving adherence to LNS supplements would require addressing some key barriers. Training of frontline health workers on the use of reminder or habit formation techniques that they could easily teach to beneficiaries may help overcome forgetfulness. Involvement of family and community members, such as including all household members in BCC sessions or including informal health care providers in sensitization and educational activities, could increase regular consumption of supplements. For LNS-PLW, the prevalence of illness during pregnancy (especially nausea and vomiting) points to the need for counseling on consumption of supplements with food and at times of the day when nausea is less likely. To alleviate monotony, providing a variety of flavors for women could be useful; this would need to be preceded by testing of acceptability of novel flavors. Since the perinatal period is a time when traveling outside the beneficiaries' villages may occur (some women move temporarily to their parents' home), reminders to take their supply of supplements with them should be part of the standard messages and particularly emphasized during this period; provision of convenient containers for traveling should also be considered. In this project, adherence to LNS among children was quite high, but there was some wastage due to loss or destruction (mostly by children). Wastage might be reduced by highlighting the messages about keeping LNS supplements out of reach of children and inside the containers provided.

4.2 Recommendations for Conducting Similar Process Evaluations

For some of the domains to be assessed in this type of PE, particularly information collected from frontline workers, extensive pilot testing is needed to word the instructions, questions, and statements appropriately. One approach that could be considered is the use of more concrete, tangible materials to express responses (e.g., cards handed to respondents that contain a graduated scale of responses, laminated images portraying answer options). Instead of using Likert-type scales asking for level of agreement with certain statements, it may be more useful to ask about the frequency of specific, concrete behaviors or activities to increase comprehension and potentially reduce social desirability bias.

For projects involving independent evaluation of program outcomes, there should be discussion prior to implementation regarding the program managers' expectations about receiving results from the PE while the outcome evaluation is still under way. Such discussion should include details on which findings will be shared (and when), and how the new information would be used by program implementers.

References

Adu-Afarwuah, S.; Lartey, A.; Okronipa, H.; et al. 2015. "Lipid-based nutrient supplement increases the birth size of infants of primiparous women in Ghana." *American Journal of Clinical Nutrition.* 101(4): 835–846.

Arimond, M.; Zeilani, M.; Jungjohann, S.; et al. 2015. "Considerations in developing lipid-based nutrient supplements for prevention of undernutrition: experience from the International Lipid-Based Nutrient Supplements (iLiNS) Project." *Maternal & Child Nutrition*. 11: 31–61.

Ashorn, P.; Alho, L.; Ashorn, U.; et al. 2015. "The impact of lipid-based nutrient supplement provision to pregnant women on newborn size in rural Malawi: a randomized controlled trial." *American Journal of Clinical Nutrition.* 101(2): 387–397.

BBS. 2012. *Bangladesh Population and Housing Census 2011. National Report, Volume 4. Socio-economic and Demographic Report.*

Centers for Disease Control and Prevention. 2015. "Cronobacter." Available at: http://www.cdc.gov/cronobacter/technical.html.

Harding, Kassandra L.; Matias, Susana L.; Moniruzzaman, Md.; et al. 2014. *Rang-Din Nutrition Study: Assessment of Participant Adherence to Lipid-Based Nutrient and Iron-Folic Acid Supplements among Pregnant and Lactating Women in the Context of a Study on the Effectiveness of Supplements in Bangladesh.* Washington, DC: FHI 360/FANTA.

Harding, Kassandra L.; Matias, Susana L.; Moniruzzaman, Md.; et al. 2016. *Rang-Din Nutrition Study: Assessment of Adherence to Lipid-Based Nutrient Supplements and Micronutrient Powders among Children 6–23 Months in Bangladesh.* Washington, DC: FHI 360/FANTA.

Humber, Jacob; Vosti, Stephen A.; Cummins, Joseph; et al. 2017. *The Rang-Din Nutrition Study in Rural Bangladesh: The Costs and Cost-Effectiveness of Programmatic Interventions to Improve Linear Growth at Birth and 18 Months, and the Costs of these Interventions at 24 Months.* Washington, DC: FHI 360/FANTA.

Kaestel, P.; Michaelsen, K.F.; Aaby, P.; et al. 2005. "Effects of prenatal multimicronutrient supplements on birth weight and perinatal mortality: a randomised, controlled trial in Guinea-Bissau." *European Journal of Clinical Nutrition.* 59(9): 1081–1089.

Lieber ML, Ashley C. *A SAS Macro Implementing an Extension of the McNemar's Test for Clustered Data*. In: Proceedings of the 23rd Annual SAS Users Group International Conference. Cary, NC: SAS Institute 1998; 1-6.

Linnan, L. and Steckler, A. 2002. *Process Evaluation for Public Health Interventions and Research. An Overwiew.* San Francisco: Jossey-Bass.

Mridha, Malay K.; Chaparro, Camila; Matias, Susana L.; et al. 2012. *Acceptability of Lipid-Based Nutrient Supplements and Micronutrient Powders among Pregnant and Lactating Women and Infants and Young Children in Bangladesh and Their Perceptions about Malnutrition and Nutrient Supplements.* Washington, DC: FHI 360/FANTA.

Saha, K.K.; Bamezai, A.; Khaled, A.; et al. 2011. *Alive & Thrive Baseline Survey Report: Bangladesh.* Washington, DC: FHI 360/Alive & Thrive.

UNHCR. 2011. *UNHCR Operational Guidance on the Use of Special Nutritional Products to Reduce Micronutrient Deficiencies and Malnutrition in Refugee Populations.* Geneva: UNHCR.

Appendix 1. RDNS PE Indicators

Step	Component	Indicator	Data collection method	Frequency of data collection	Sample
Inputs	Context	*At the household (HH) level* Average number of HH members Average years of education of head of HH % of HH with access to electricity % of HH with children under 5 y Main construction material of HHs Type of fuel used for cooking Main source of drinking water Disposal of waste *At the Union level* Average number of traditional health care providers Pharmacies selling maternal or child nutrient supplements Presence of other NGOs	RDNS Socio-economic form at baseline	RDNS baseline data	n=4011
	CHDP Staff	<u>Staff characteristics</u> Number of CHWs and VHVs per SDU and Union Average age of CF/FCs, CHWs and VHVs Average years of education of CF/FCs, CHWs and VHVs % of CF/FCs, CHWs and VHVs who have a second work (besides CHDP) % of CF/FCs, CHWs and VHVs whose second work is paid	CHDP staff questionnaires	All three	n=11 CF/FCs n=75 CHWs n= 59 VHVs
		<u>Staff experience and training</u> Average number of years as CF/FC/CHW/VHV for CHDP % of VHVs/CHWs/CF/FCs who have less than one year in that role % of CHWs/VHVs who participated in most recent refresher training	CHDP staff questionnaires	All three	n=11 CF/FCs n=75 CHWs n= 59 VHVs
		<u>Staff motivation and supervision</u> Average score on 6-item motivation scale for CF/FCs, CHWs and VHVs Average score on supervision scale for CF/FCs, CHWs and VHVs	CHDP staff questionnaires	All three	n=11 CF/FCs n=75 CHWs n= 59 VHVs
		<u>Staff activities</u> Distribution of main activities of CF/FC, CHW and VHV Number of days working as CF/FC, CHW and VHV for CHDP last month Number of days that CHW conducted home visits last month Number of home visits by CHW and VHV on days doing home visits last month	CHDP staff questionnaires	All three	n=11 CF/FCs n=75 CHWs n= 59 VHVs

Step	Component	Indicator	Data collection method	Frequency of data collection	Sample
		Average time spent at each home visit by CHW and VHV last month Distribution of main activities at home visit by CHW and VHV Average time spent travelling to villages by CHW per day last month Number of BCC sessions conducted by CHW last month Average time spent by CHW conducting each BCC session last month Amount of time VHVs spent giving advice in their homes last month Average duration of visits to VHV's home last month Average time spent preparing reports by CHW last month Average time spent attending refresher training by CHW and VHV last month Frequency of interaction between CHW and VHV with supervisor to discuss work last month			
		<u>Other activity indicators</u> Start and end time of working day Daily total work time for CHDP activity Time spent working in a different activity (non CHDP) Time spent working for another project alongside CHDP Time spent working only for the RDNS project Time for each activity performed Major activity time length Percent of time worked for CHDP	Time and Motion assessments	Both rounds (1 & 2)	Round 1: 13 CHWs 5 CF/FCs 36 VHVs Round 2: 14 CHWs 5 CF/FCs 37 VHVs
	Resources	<u>Product supply</u> Amount of Alic at central storage site (RDNS office) with a minimum shelf-life of 3 months Amount of LNS at central storage site with a minimum shelf-life of 3 months Amount of MNP at central storage site with a minimum shelf-life of 3 months Amount of Alic at each SDU with a minimum shelf-life of 2 months Amount of LNS at each SDU with a minimum shelf-life of 2 months Amount of MNP at each SDU with a minimum shelf-life of 2 months	Form PE-CS Form PE-SDU	Three rounds: #1,10 and 21 Three rounds: #1,10 and 21	N/A All SDUs in 11 unions
		<u>Infrastructure</u> Number of SDUs that have a locked cabinet to store supplements	Form PE-SDU	Three rounds: #1,10 and 21	All SDUs in 11 unions
		<u>Materials</u>	Form PE-SDU		

Step	Component	Indicator	Data collection method	Frequency of data collection	Sample
		Number of SDUs that have most updated written guidelines for distribution Number of SDUs that have most updated written guidelines for reporting adverse events Number of SDUs that have education materials on supplement use Amount of supplement distribution materials (e.g. plastic containers) available at SDUs		Three rounds: #1,10 and 21	All SDUs in 11 unions
		<u>Equipment</u> % of CHWs who have access to a bicycle for transporting supplements	CHDP staff questionnaires	Baseline round	n=64 CHWs
Processes	Reach	<u>CHDP pilot program training</u> % of SDU staff who completed RDNS initial training % of SDU staff who completed RDNS refresher training % of CHWs who got a passing score (≥75%) on post-test after RDNS training	Attendance sign-in sheet Post-test forms	N/A	n=11 CF/FCs n=75 CHWs n=54 CHWs
		<u>Beneficiaries</u> % of beneficiaries who participated in program within last month	Supplement Distribution and Monitoring Register (SDMR)	SDMR: three rounds	All SDUs
	Fidelity	<u>Storage</u> (ICDDR,B office) Temperature reading below 30° C (measured at noon) Humidity reading (past month) Supplement protected from sunlight Windows protected with screens	Form PE-CS	Five rounds	N/A
		<u>Product distribution</u> % of new beneficiaries who received plastic container with their 1st supplement supply during past month % of new beneficiaries who received supplement registration card with 1st supplement supply during past month % of delayed supplement distributions at several rounds	New Pregnancy Register (NPR) SDMR	NPR: all three rounds SDMR: three rounds	All data available at each round analyzed

Step	Component	Indicator	Data collection method	Frequency of data collection	Sample
	Dose delivered / received	% of beneficiaries who collected their last supplement supply at the BCC sessions % of beneficiaries who collected their last supplement supply from the VHV's home % of beneficiaries who received their last supplement supply during home visit by CHW and/or VHV % of participants who received supplement use message during collection/reception of last monthly supply % of participants who received messages on use at 1st supply at SDU % of participants who attended a BCC session within the past week % of participants who were visited by VHV or CHW within the past month	SDMR PEPA-PL & PEPA-C questionnaires	SDMR: three rounds Both rounds: #1: maternal supplement and #2: child supplement	All data available at each round analyzed n=360 (PEPA) n=250 (PECA)
Outputs	Dose received	% of caregivers who spontaneously recall message on supplement use	PEPA-PL & PEPA-C questionnaires	Both rounds	n=360 (PEPA) n=250 (PECA)
Outcomes		Amount of supplements consumed by participant during past week % of participants who consumed the supplements as recommended (right frequency and dose) during the past week Amount of supplements consumed by other HH members since last supply Amount of supplements lost or destroyed since last supply	PEPA-PL & PEPA-C questionnaires. KAP forms	Both rounds KAP forms: 42 days, 6, 12, 18 and 24 months	n=360 (PEPA) n=250 (PECA) RDNS sample at follow-up

Appendix 2. Nutritional Composition of LNS-PLW

Nutrient	Unit	LNS-PL
Dose	--	20 g
Energy	kcal	118
Protein	g	2.6
Fat	g	10
Linoleic acid	g	4.6
α-Linolenic acid (g)	g	0.6
Calcium	mg	280
Copper	mg	4
Folate	µg	400
Iodine	µg	250
Iron	mg	20
Magnesium	mg	65
Manganese	mg	2.6
Niacin	mg	36
Pantothenic acid (B5)	mg	7
Phosphorous	mg	190
Potassium	mg	200
Riboflavin (B2)	mg	2.8
Selenium	µg	130
Thiamine (B1)	mg	2.8
Vitamin A	µg	800
Vitamin B12	µg	5.2
Vitamin B6	mg	3.8
Vitamin C	mg	100
Vitamin D	µg	10
Vitamin E	mg	20
Vitamin K	µg	45
Zinc	mg	30

Appendix 3. Nutritional Composition of LNS-C and MNP

Nutrient	Unit	LNS-child	MNP
Dose	g	20	1
Energy	kcal	118	
Protein	g	2.6	
Fat	g	9.6	
Linoleic acid	g	4.46	
α-Linolenic acid	g	0.58	
Calcium	mg	280	
Copper	mg	0.34	0.56
Folate	µg	150	150
Iodine	µg	90	90
Iron	mg	9	10
Magnesium	mg	40	
Manganese	mg	1.2	
Niacin	mg	6	6
Pantothenic acid (B5)	mg	2.0	
Phosphorous	mg	190	
Potassium	mg	200	
Riboflavin (B2)	mg	0.5	0.5
Selenium	µg	20	17
Thiamine (B1)	mg	0.5	0.5
Vitamin A	µg	400	400
Vitamin B12	µg	0.9	0.9
Vitamin B6	mg	0.5	0.5
Vitamin C	mg	30	30
Vitamin D	µg	5	5
Vitamin E	mg	6	5
Vitamin K	µg	30	
Zinc	mg	8	4.1

Appendix 4. Messages on Use of Supplements

1. Sonamoni for children only. Sonamoni is a special food for children 6-24 months of age. There are vegetable fate, dry skimmed milk, peanuts, sugar, mineral and vitamin complex, maltodextrin and emulsifier- lecithin in the Sonamoni.
2. Feed two sachets of Sonamoni per day, one in the morning and one at night.
3. Sonamoni will feed two sachets per day from 6 months complete to 24 months of age. It should not replace breast milk. Infants should receive only breast milk for the first 6 months of life. Breastfeeding should be continued along with other infant foods afterwards. Give your baby meat, fish, eggs, dairy, fruits and vegetables whenever you can. Babies need these foods and breast milk even if they receive Sonamoni.
4. Do not give more than two sachets Sonamoni each day because it is not good for baby to have too much. If you forget to give Sonamoni one day, do not take extra the next day—it is always two sachets per day.
5. Each time you feed your child Sonamoni, mix the entire sachet of Sonamoni with 2–3 spoonfuls of already-prepared food that you normally feed your child. Never cook the supplement with the food. Feed your child the whole mixture of food and Sonamoni at a time.
6. Store the Sonamoni in the container we are providing, where it will stay dry and out of the reach of children. Store it in the coolest and driest place that you can find in your house.
7. Please come with rest Sonamoni sachets with container and registration card for receive resupply.
8. We do not expect any side effect taking after Sonamoni but if so (like vomiting, pain in stomach, boil/etching in body, loose motion), please call respective VHVs or CHWs.
9. When you are feeding Sonamoni baby don’t need any other vitamins/minerals.
10. If your child suffers from any Serious Adverse Event’s (SAE) or admit in a hospital for any reason, please call your assigned VHVs or CHWs.

Appendix 5. Time Motion Results for VHVs

Table 1. Summary of the data collected on Village Health Volunteers (VHVs) of the Community Health and Development Program (CHDP) for the Rang-Din Nutrition Study (RDNS) time motion study

	Round 1	Round 2
Dates of observation [earliest date – latest date]	09 Oct 2011 – 11 Oct 2011	21 May 2013 – 19 Jun 2013
Number of village health volunteers observed [n]	36	37
Number of days observed [n]	36	37
Average time observed each day in hours [mean (SD)]	2.2 (1.2)	2.5 (0.9)
Total time observed in hours [sum]	75.5	91.2

Figure 1. Percent of village health volunteer time spent carrying out different types of activities round 1

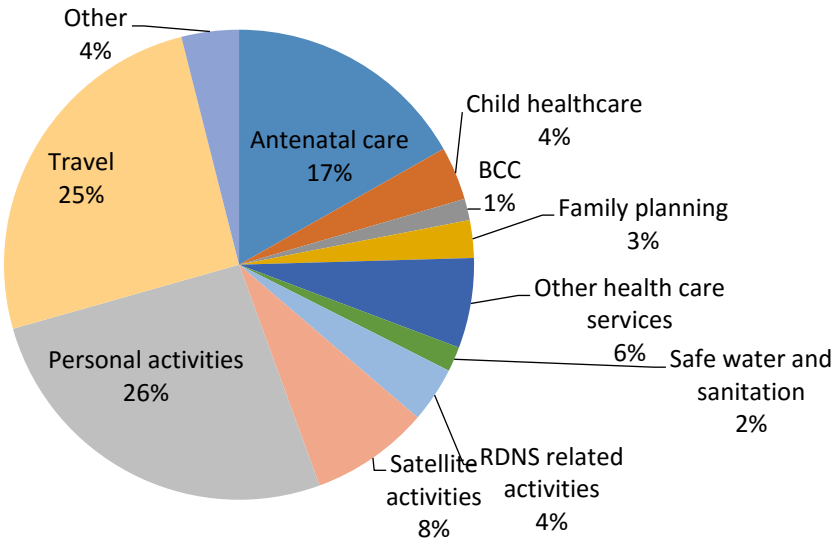


Figure 2. Percent of village health volunteer time spent carrying out different types of activities round 2

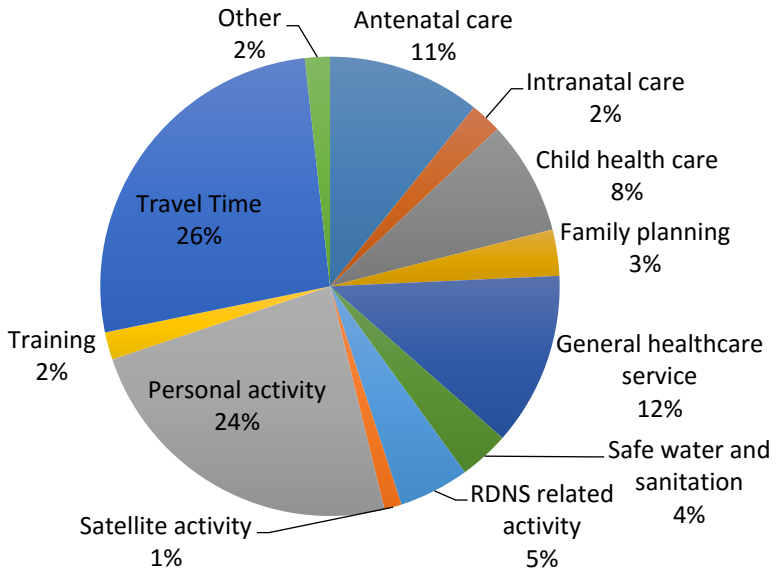
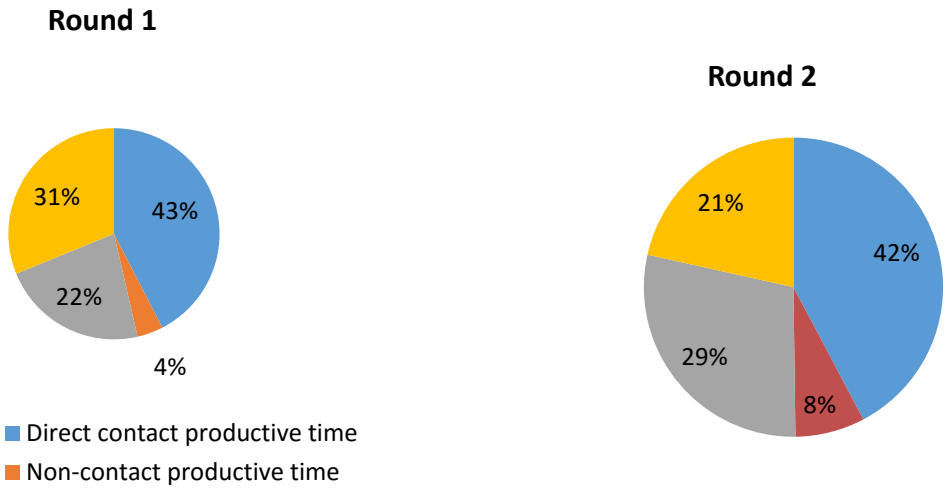


Figure 3. Percent of village health volunteer time spent in time motion code categories



During round 1, the breakdown of VHV time by sub-district was similar (**Figure 4a-5b**). In round 2, Chirirbandar VHVs spent more time in non-contact productive time compared to round 1 and compared to Badarganj VHVs. The majority of inevitable unproductive time was spent on travel time (round 1 and 2: 87% and 89%) and almost all of the avoidable unproductive time was spend on personal activities (round 1 and 2: 80% and 95%).

Figure 4a-4b. Percent of village health volunteer time spent in time motion code categories by sub-district during round 1

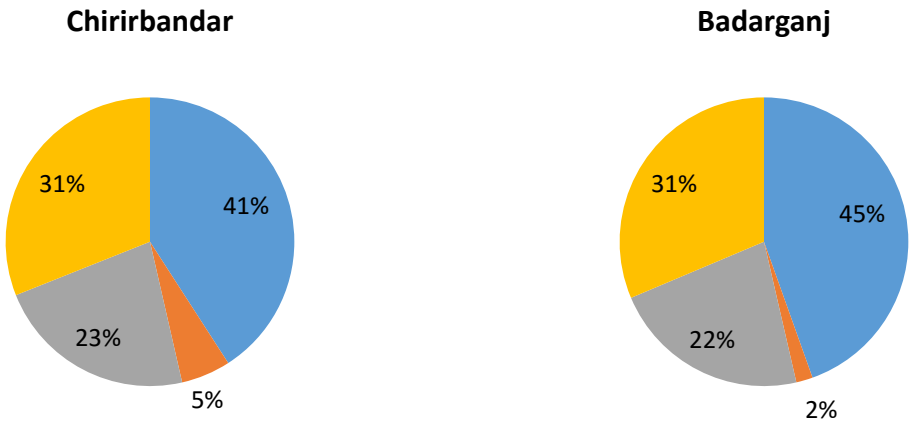


Figure 5a-5b. Percent of village health volunteer time spent in time motion code categories by sub-district during round 2

Appendix 6. Time Motion Results for CHVs

Table 1. Summary of the data collected on Community Health Workers (CHWs) of the Community Health and Development Program (CHDP) for the Rang-Din Nutrition Study (RDNS) time motion study

	Round 1	Round 2
Dates of observation [earliest date – latest date]	09 Oct 2011 – 17 Nov 2011	22 May 2013 – 17 June 2013
Number of community health workers [n]	13	13
Number of days observed [n]	38	39
Average time observed each day in hours [mean (SD)]	6.4 (1.3)	6.9 (1.1)
Total time observed in hours [sum]	243.5	267.0

Figure 1. Percent of community health worker time spent carrying out different types of activities round 1

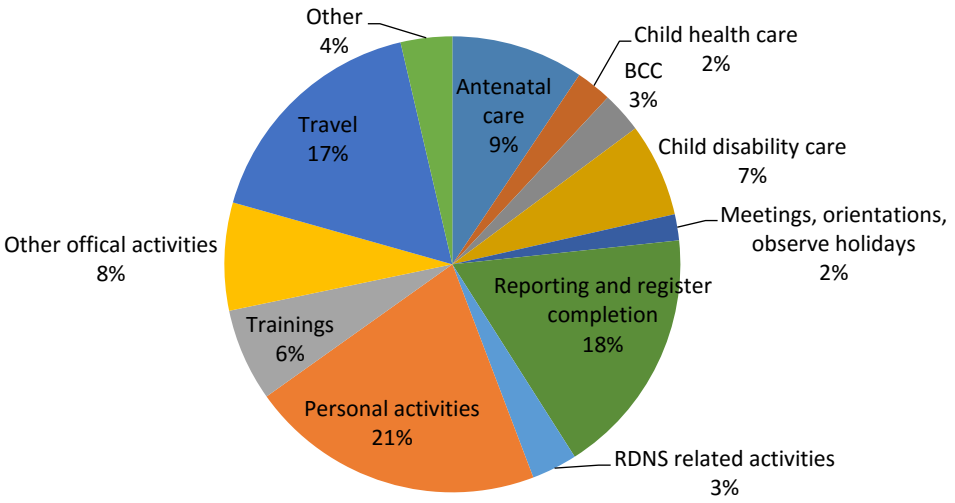


Figure 2. Percent of community health worker time spent carrying out different types of activities round 2

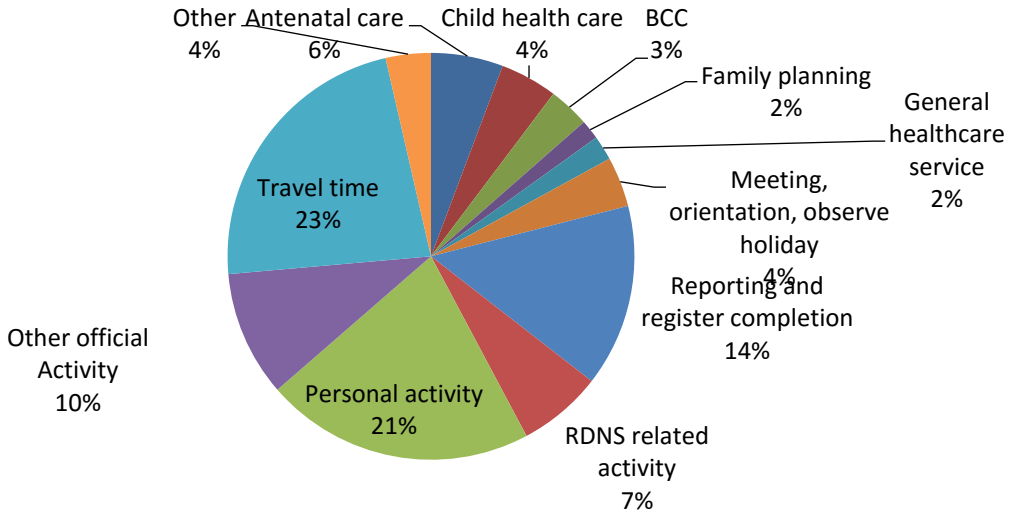
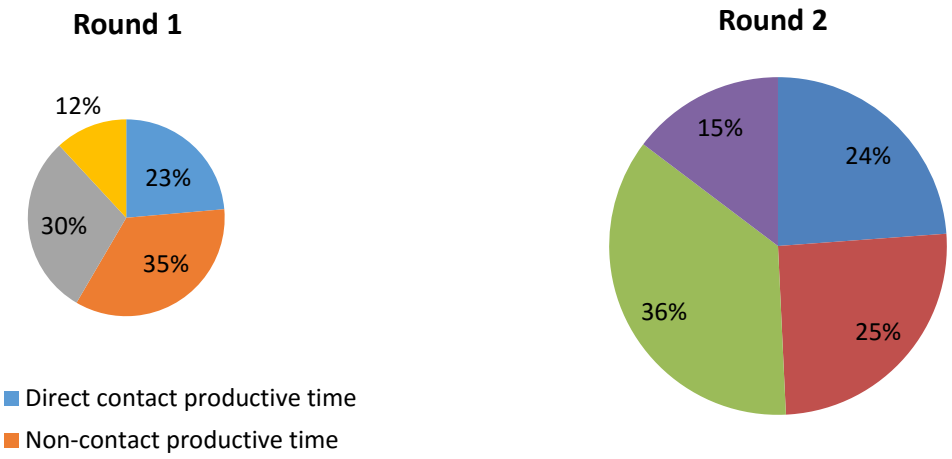


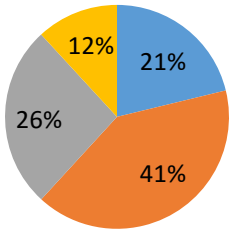
Figure 3. Percent of community health worker time spent in time motion code categories



Chirirbandar CHWs spent more time in non-contact productive work during round 1 compared with Badarganj, which decreased in round 2 (**Figure 4a-5b**). Badarganj CHWs non-contact productive time also decreased during round 2, and their avoidable non-productive time increased.

Figure 4a-4b. Percent of community health worker time spent in time motion code categories by sub-district during round 1

Chirirbandar



Badarganj

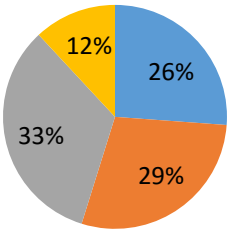
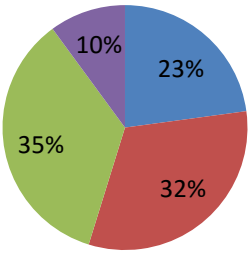
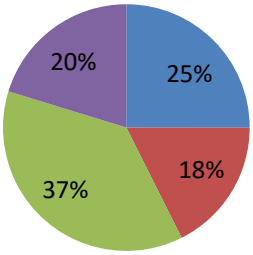


Figure 5a-5b. Percent of community health worker time spent in time motion code categories by sub-district during round 2

Chirirbandar



Badarganj



Appendix 7. Time Motion Results for CFs/FCs

Table 1. Summary of the data collected on Community Facilitators (CFs)/Field Coordinators (FCs) of the Community Health and Development Program (CHDP) for the Rang-Din Nutrition Study (RDNS) time motion study

	Round 1	Round 2
Dates of observation [earliest date – latest date]	14 Nov 2011 – 28 Nov 2011	09 June 2013 – 09 July 2013
Number of CFs/FCs observed [n]	5	5
Number of days observed [n]	15	15
Average time observed per day in hours [mean (SD)]	7.4 (0.7)	7.5 (0.6)
Total time observed in hours [sum]	110.8	112.8

Figure 1. Percent of community facilitator/field coordinator time spent carrying out different types of activities round 1

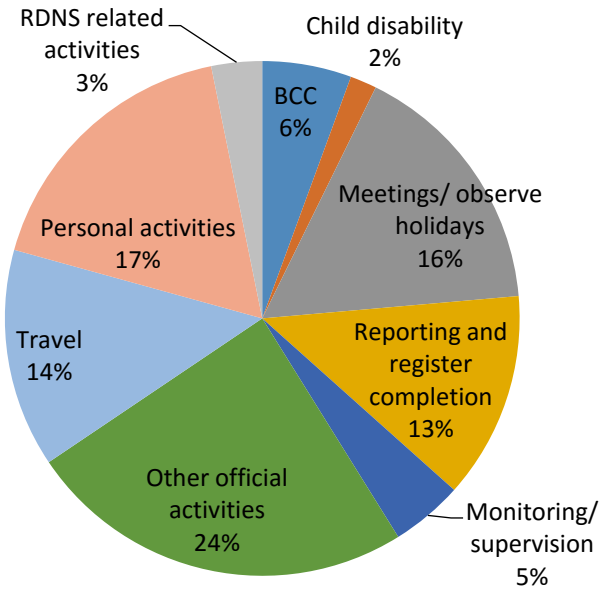


Figure 2. Percent of community facilitator/field coordinator time spent carrying out different types of activities round 2

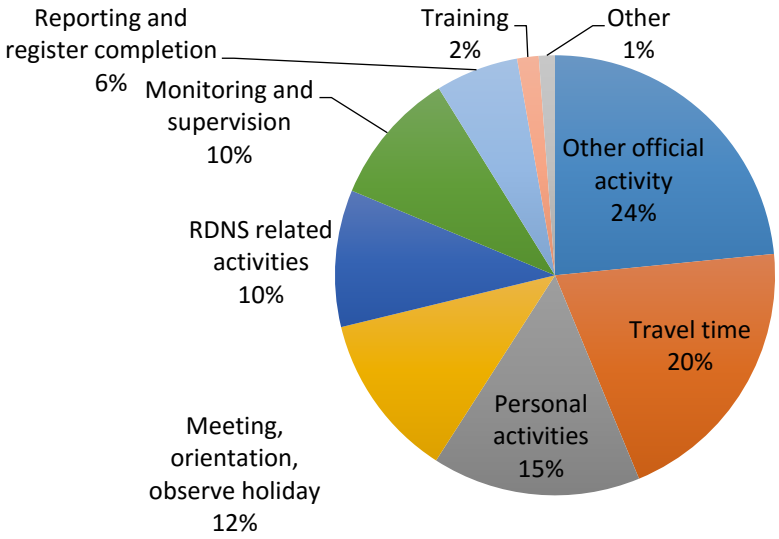
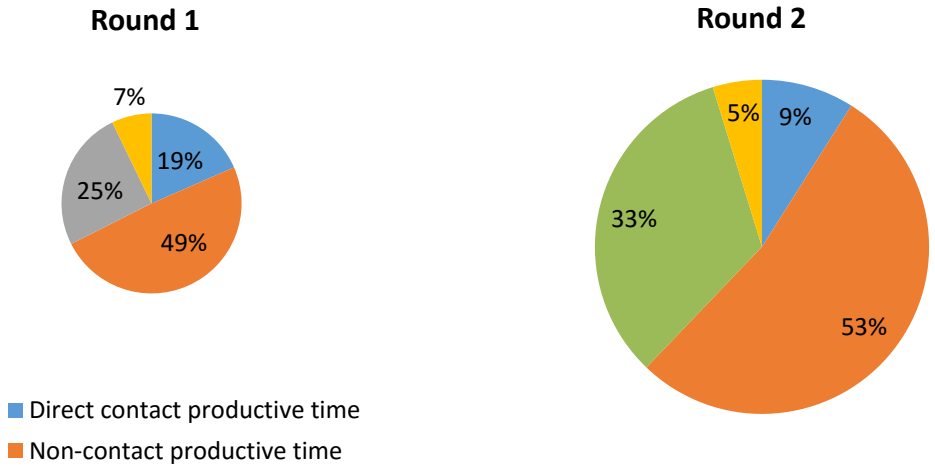


Figure 3. Percent of community facilitator/field coordinator time spent in time motion code categories



In Chirirbandar CFs/FCs increased the non-contact productive time and decreased the direct contact productive time in round 2, while in Badarganj CFs/FCs increased inevitable nonproductive time while decreasing non-contact productive time and avoidable unproductive time in round 2, compared with round 1 (**Figure 4a-5b**). The majority of inevitable unproductive time was spent on travel time (round 1 and 2: 53% and 61%) and personal activities (round 1 and 2: 41% and 32%) and all of the avoidable unproductive time was spent on personal activities.

Figure 4a-4b. Percent of community facilitator/field coordinator time spent in time motion code categories by sub-district during round 1

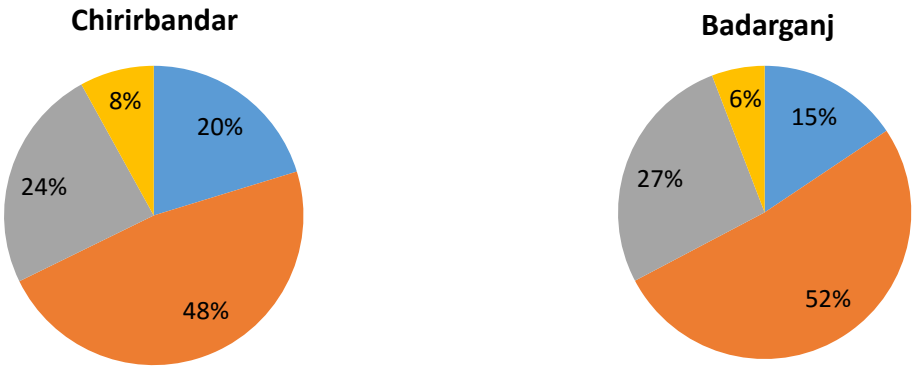


Figure 5a-5b. Percent of community facilitator/field coordinator time spent in time motion code categories by sub-district during round 2