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Protocol for a quasiexperimental study testing the effectiveness of strengthening growth monitoring and promotion in community clinics for improving the nutritional status of under-two children in rural Bangladesh

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ABSTRACT

Introduction The Government of Bangladesh is implementing growth monitoring and promotion (GMP) through community clinics (CC) to improve the nutritional status of children. However, little primary evidence is available on the effectiveness of GMP when delivered through CCs. We aim to examine the effectiveness of GMP activities strengthened in CCs to improve the nutritional status of children under 2 years of age.

Methods and analysis This is a quasiexperimental, two-arm, mixed methods study. In the intervention arm, a non-governmental organisation is providing support to strengthen GMP implementation in the 30 CCs. The comparison arm has no intervention to strengthen GMP implementation in the 30 CCs. Study participants will be under-two children and their caregivers, and CC service providers (community healthcare provider, CHCP). We will collect quantitative information on children and mothers' anthropometry, sociodemographic condition, food security, children's feeding practices, morbidity and vaccination history at baseline, and follow them up every third month thereafter for 12 months. We will collect qualitative information on (1) knowledge, skill and practice of CHCPs to implement GMP; (2) mothers/caregivers' perception, knowledge and experience of GMP from CCs; (3) experience and suggestions of programme managers about operational challenges and for improving quality of GMP service delivery; and (4) views of the concerned policy planners to strengthen GMP at the CC level. Qualitative information will be collected through key informant and in-depth interviews at baseline and endline. The primary outcome will be the change observed in length-for-age Z-score of children. A difference-in-difference and linear mixed effects analysis of quantitative data will be done. Thematic analysis will be conducted for qualitative information. Triangulation of data derived from different methods will be carried out.

Ethics and dissemination This study received ethical approval from the Institutional Review Board of International Centre for Diarrhoeal Disease Research, Bangladesh, and results will be disseminated via peer-reviewed publications and conference presentations.

Strengths and limitations of this study

- This study will be among the first to evaluate the effectiveness of strengthening the growth monitoring and promotion (GMP) programme in improving the growth of rural Bangladeshi children.
- The mixed methods approach will allow measuring the changes in outcome indicators in under-two children and in community clinics, both quantitatively and qualitatively.
- The closed cohort of enrolled children will help to understand feasibility and adherence to GMP programme within a community over a 12-month period.
- The quasiexperimental design limits the choice in the selection of study area and random selection of community clinics.

Trial registration number NCT03824756

INTRODUCTION

Bangladesh has partially achieved the targets of Millennium Development Goals for nutrition and is committed to achieving the targets of Sustainable Development Goal-2. Between 1997 and 2014, the prevalence of childhood stunting reduced from 60% to 36% nationally, and wasting has declined from 21% to 14%.[1] However, 6.4 million children remain stunted in regional and socioeconomic pockets, creating a challenge to develop to their full physical and mental potential.[1] Rights of children are protected by the National Children Policy 2011, which includes rights to optimum nutrition. Yet, only 55% of children below 6 months of age are exclusively breast fed, and 23% of children aged 6–23 months are fed as per appropriate feeding recommendations.[1]

Micronutrient deficiencies are also reported. Therefore, the Government of Bangladesh (GoB) has identified growth monitoring and promotion (GMP) as a priority activity in the National Nutrition Services (NNS) operational plan (OP). The NNS OP aimed to implement GMP in all government primary healthcare facilities including the community clinics. In this connection, the NNS has completed nutrition training for relevant staff, which primarily focused on infant and young child feeding (IYCF) counselling and growth monitoring (GM).

GM follows the growth velocity of a child through 'periodic, frequent anthropometric measurement'[2] and compares it with a global standard, while GMP links GM with growth promotional activities through counselling for child growth, caring practices and other services, as required.[3] GMP is a preventive activity that increases awareness among the caregivers about child growth and improves caring practices. In addition, GMP ensures frequent contact with the health workers and acts as a conduit to child health interventions.[4]

The recommended practice in GMP is primarily focused for under-two children and includes periodic weight and length/height measurement of both sick and healthy children. Measurements should start at birth, recorded/plotted accurately on a growth chart and interpreted and explained to the caregivers for good caring practices. Ideally, health workers should give information through counselling, facilitating communication and interacting with mothers/caregivers based on the child's status on the growth chart, aiming to generate adequate maternal and family-based action to promote child growth. Although GMP appears as a widespread promoted intervention for monitoring and maintaining appropriate growth of children, several studies have identified gaps between original purposes and actual practices of GMP.[3–6] Multicountry reports from ministries of health in 178 countries have identified numerous conceptual problems associated with GMP, including inadequate interpretation of the growth curve (48%), inaccurate plotting of anthropometric data (40%) and poor understanding of growth reference curves (29%) by healthcare workers.[7] The high prevalence of malnutrition in many low and middle-income countries seems to indicate this fact.[8] Recent systematic reviews question the effectiveness and relevance of GMP programmes in general.[9 10] Lack of coordination, inadequate training, supervision and logistic supplies were identified as challenges against GMP implementation in primary healthcare facilities. The situation is quite similar to a low and middle-income country like Bangladesh.

The GMP programmes by the GoB have been running for the past 20 years. Nevertheless, the functionality of GoB's GMP programmes to improve child growth and development through early detection and prevention of malnutrition has been repeatedly identified with several gaps.[4] To strengthen the GoB's GMP programme, a non-governmental organisation (NGO) is currently supporting GoB to implement GMP at selective CCs. This type of programme has shown success in other low and middle-income countries.[3 5] However, further evidence is needed on this programme effectiveness before scaling up. This protocol describes a quasiexperimental study examining the effectiveness of GMP for improving growth and feeding practices of under-two children, by strengthening the GMP-related activities in CCs.

METHODS AND ANALYSIS

Conceptual framework

The GMP conceptual framework is illustrated in figure 1 (adapted from UNICEF's Report of the Technical Consultation on Growth Monitoring and Promotion[2]). This framework demonstrates the various steps of the GMP process and interactive ways through which family and communities have an impact. The first step of GMP is proper GM, which should take place regularly at CCs, and focus on children's growth status. To improve children's linear growth through GMP in CCs, it is necessary to link the family, community and CC service providers for smooth implementation of the GMP programme. The next step should target improving community coverage, so the programme needs to increase the contact between children's caregivers and health service providers through information sharing. In addition, the community can also play a major role by motivating and assisting community workers and caregivers, to ensure that all children are participating in regular GM. Hence, regular GM and high community coverage are essential for the programme in early identification of its potential barriers in implementation and guide the programme managers/implementers to take better targeted actions accordingly to improve the programme quality. As a result of these steps, the service provider's knowledge and skills on GMP will improve, and the perception of caregivers about GMP will also be improved. Thus, the GMP services will be functional at both service and demand side. IYCF messages delivered to caregivers/mothers of under-two children through GMP will improve their IYCF practice and will ultimately improve the growth of their children. Eventually, the improvement in linear growth or at least recuperation from faltering will improve the nutritional status of under-two children.

Objectives

The general objective of this study is to assess the effectiveness of GMP activities strengthened in CCs to improve growth and IYCF practices of children under 2 years of age.

The specific objectives are to assess changes in:

- Mothers/caregivers' knowledge, attitude and practice (KAP) on GMP.
- Adherence to the GMP programme among the beneficiaries.
- Mothers/caregivers' KAP on IYCF practices.
- Service providers' skills and perception of GMP.
- Quality of GMP implementation in CCs.

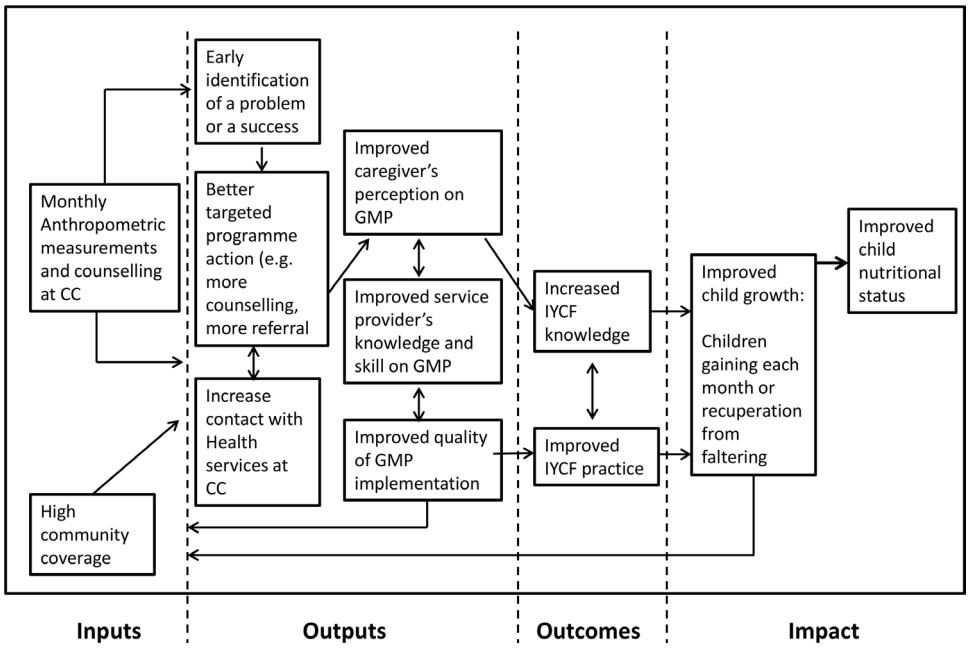

Figure 1 Conceptual framework of the study (adapted from UNICEF's Report of the Technical Consultation on Growth Monitoring and Promotion[2]). CC, community clinic; GMP, growth monitoring and promotion; IYCF, infant and young child feeding.

Study design and study site

This study is following a quasiexperimental, two-arm, mixed methods design. A quasiexperimental design was since randomisation of community clinics in the intervention or comparison arms were not possible as the NGO already selected the subdistricts where they would provide facilitation support to strengthen GMP at community clinics. The study is conducted in six subdistricts of Mymensingh district under Dhaka division over a 12-month period (figure 2). We selected three subdistricts (*Mymensingh Sadar*, *Muktagacha* and *Fulbaria*) as intervention area where World Vision Bangladesh (WVB), an NGO, is implementing GMP activities in 72 CCs from January 2018. CCs other than in these three subdistricts are running without any external facilitation on GMP that we selected as the comparison area. The selection criteria included: (A) time of implementation of the programme matching with the study timeline; (B) staff and logistics in CCs supported by WVB; and (C) an adequate number of CCs in subdistricts to satisfy the sample size. CCs in the comparison area were selected from three neighbouring subdistricts (*Ishwarganj*, *Gauripur* and *Trishal*). The participants included in the cohorts and analysis workflow are described in figure 3, based on the Consolidated Standards of Reporting Trials diagram,[11] and Standard Protocol Items: Recommendations for Interventional Trials reporting guidelines.[12]

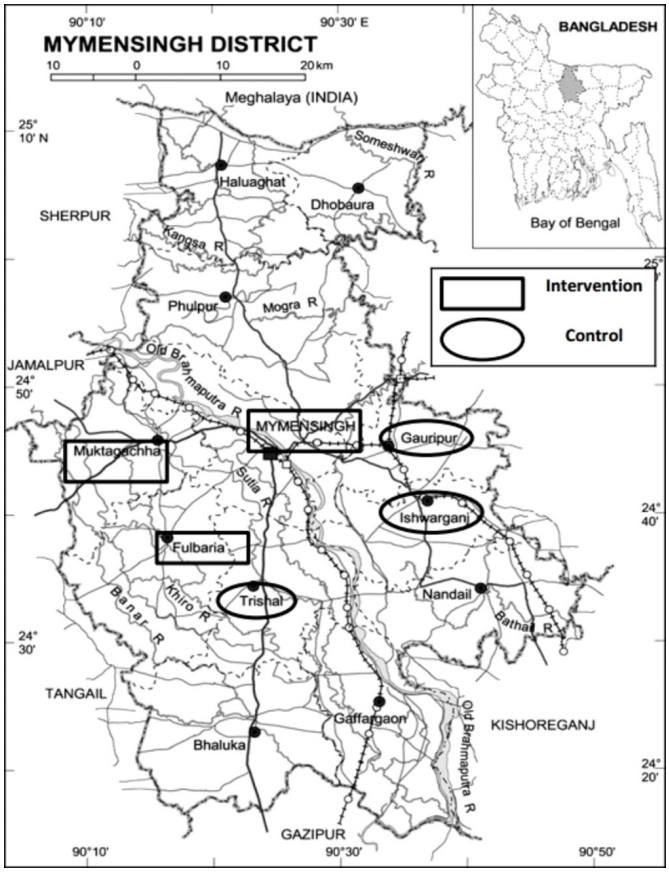

Figure 2 Intervention and control area.

Intervention description

The under-two children in the intervention area will receive GMP services in CCs, where community healthcare providers (CHCP) are designated to provide GMP. The components of regular GMP include: (1) regular monitoring (at least one in every 3 months) of growth through measurement of weight, length/height, or mid-upper arm circumference; plotting these measurements on a standard chart; conversion of these measurements to

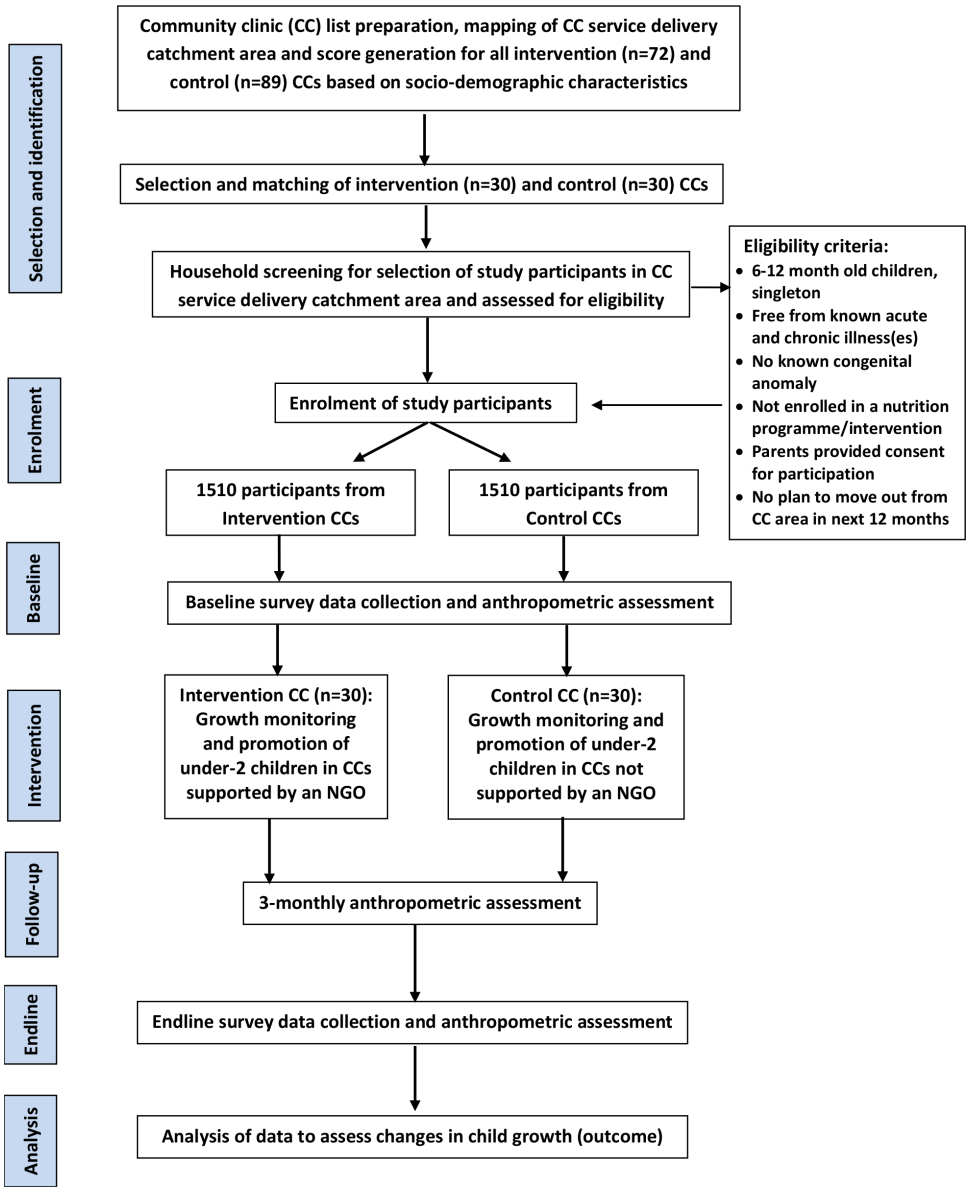

Figure 3 Flow of participant diagram. NGO, non-governmental organisation.

weight-for-age Z-score (WAZ), height/length-for-age Z-score (LAZ) and/or weight-for-height Z-score for understanding nutritional status; combined with (2) interventions targeted to those with faltering growth, such as (A) counselling the mother/caregiver, (B) micronutrient supplementation, (C) home visits by community workers, and (D) medical treatment or referral to acutely ill children or children with growth faltering.[13] In our intervention area, regular GMP is being strengthened by an additional workforce from WVB known as the 'community volunteer', to support the government staff at CC known as CHCP.

Description of the comparison arm

Children living in the catchment area of comparison CCs will receive usual GMP services from CHCP. The CHCPs will have no additional support from any NGO or similar organisation. GMP components will be the same as described in the Intervention Description section.[13]

Sample size

Quantitative survey

We hypothesised that appropriate GMP will improve LAZ of under-two children by 20% in the intervention arm compared with those in the comparison arm. We considered several assumptions for sample size calculations based on the divisional estimates from Bangladesh Demographic and Health Survey, 2014[1]: (1) mean LAZ of 6–12 months child age group in the control arm would be −1.8[1]; (2) 1.3 SD; (3) 80% power, 5% level of significance and 0.02 intracluster correlation coefficient; and (4) 15% dropouts (non-response, deaths and loss to follow-up) after enrolment. Accounting for all these considerations, the sample size of children is 50 per cluster, 1510 per arm and 3020 in total. We have employed the 60 clusters

design,[14] meaning we will need 30 clusters (ie, CCs and their catchment area) in each arm. Through mapping, listing and scoring of clusters, we selected 30 intervention and 30 control clusters. Based on the household listing of under-two children, required numbers of study participants (children and their mothers) will be enrolled in each cluster.

Qualitative interviews

The qualitative interviews will aim to understand the (1) KAP and skill of CC service providers required for the implementation of GMP services; (2) mothers/caregivers' perception, knowledge and experience of GMP services; (3) experience and suggestions of programme managers about operational challenges and ways of improving quality of GMP service delivery; and (4) views of the concerned policy planners to strengthen GMP at the CC level. The interviews will be conducted by trained moderators and interviewers whose native language is Bangla with purposively selected respondents. In-depth interview (IDI) will be conducted with CHCP and CHCP's supervisors. Key informant interviews (KII) will be conducted with subdistrict health and family planning officer, programme managers of NNS, line director of NNS and WVB manager. Duration of each KII will be 60–90 min. IDI will be conducted with the mothers/caregivers of under-two children. KII and IDI will have separate open-ended guidelines. The numbers of interviews will be decided following an iterative process to achieve saturation of information, that is, we will continue interviewing until no new information emerges. For community clinic observation, a checklist will also be prepared. The interview guidelines and questioning routes will be prepared in English and translated into Bangla thereafter.

Selection of intervention and control CCs

In this study, CCs and its service delivery catchment area are considered as clusters. Initially, study-specific general information was collected on each CC and its catchment area through discussions with three groups of residents: (1) CHCPs, (2) mothers/caregivers of under-two children, and (3) members of CC-associated community group (CG). Discussions focused on: (1) GMP service availability and utilisation, (2) availability of other nutrition services at the CCs for women and children, (3) components of GMP provided by CHCP, and (4) socio-demographic status of people living in the CC catchment area. One point was given to a response if it contains more than or equal to 90% response rate (positive or negative), and less than 90% response got zero, totalling to a maximum of 5 points for a given CC. All the points were then summed to generate a combined score for each CC. Majority of the intervention area CCs (more than 90%) scored 3 out of 5. In the next stage, due to the similarities of scores, 30 intervention CCs were selected by computer-generated simple random sampling from the total 72 CCs in the intervention subdistricts. Similar scores were generated for each control CC. The 30 control CCs were then individually matched with the 30 intervention CCs based on the closest scores. Thus, the intervention-to-control CC ratio was 1:1. This matching exercise was done to maximise the balance between intervention and comparison CCs and their catchments to reduce chances of selection bias driven by the non-randomised study design.

Selection and recruitment of study participants

For evaluation of effectiveness, the study participants will be children 6–12 months old at enrolment and their mothers/caregivers. A thorough household listing of all under-two children was conducted in parallel to the discussion sessions. From this list, those aged 6–12 months will be contacted at home. On confirmation of eligibility, mother–child pairs will be enrolled with informed written consent. Mothers/caregivers who are unable to write will be asked to provide a witnessed thumbprint. The children enrolled in this study will be under a closed cohort, meaning the children who will be lost due to any reason will not be replaced with another participant; this will help us to understand the feasibility and adherence to GMP programme by the participants within a community. The enrolled children will be followed up periodically (every third month) for the next 12 months for the assessment of intervention exposure and outcome indicators.

Other than mother–infant pairs, CHCPs from every CC will also participate in the evaluation of this study.

Eligibility criteria

Inclusion criteria

1. Children aged between 6 and 12 months at the time of enrolment.
2. Free from known acute or chronic illness(es), and/or a congenital anomaly or chromosomal abnormality assessed by trained field staff.
3. Not severely stunted (LAZ, below −3), wasted (weight-for-length Z-score, below −3) or underweight (WAZ, below −3).
4. Not enrolled in similar nutrition intervention or programmes at the time of enrolment.
5. Parents/legal guardians willingly providing consent to participate in the study.
6. Caregivers have no plan to move out of the catchment area in the next 6 months after enrolment.

Exclusion criteria

1. Enrolled children subsequently becoming severely undernourished during the course of the study will be enrolled in another nutrition programme of WVB or referred to the nearest government health facility for further treatment.
2. Parents/caregivers who will decline to provide consent.

Time points for data collection

Baseline data will be collected at enrolment, and follow-up data will be collected on every third month. Anthropometric measurements of children and mothers, information on IYCF and children's morbidity, and quality of GMP will be collected at baseline and every third month

Table 1 Data collection methods and tools as per study objectives

Objectives	Methods	Tools
To assess change in nutritional status of children under 2 years of age	Household survey	A semistructured questionnaire, CC records and logbook
To assess change in mothers/caregivers' knowledge on IYCF practice	Household survey	Semistructured questionnaire
To examine the IYCF practices of children under 2 years of age	Household survey	Semistructured questionnaire
To measure attendance and quality of GMP	Follow-up visits	Records and logbook, checklist
To assess service providers' skill and perception about GMP	Interviews, observation	Guideline and checklist
To understand caregivers' perception of GMP	Interviews	Interview guideline
To examine the quality of GMP implementation	Observation, interviews	Observation checklist

CC, community clinic; GMP, growth monitoring and promotion; IYCF, infant and young child feeding.

thereafter. Mothers' KAP on IYCF, and service providers' skills and KAP on GMP will be assessed at baseline and at an endpoint. Contact, timing, tools and topic covered during data collection are shown in tables 1 and 2.

Staff recruitment and training

The field staff was recruited during July 2018. The field staff received three different training sessions based on study requirements: (1) for scoring and selection of CCs and communities, a 6-day training (during July 2018) was given to conduct informal discussions with CHCPs, mothers/caregivers of under-two children and members of CC-associated CG, using a semistructured questionnaire; (2) for screening of eligible children from the households of CC service area, a 3-day training (during January 2019) was given using a standard checklist; (3) for data collection at baseline and follow-up for intervention evaluation, a 12-day training (during June 2019) was given on all components and methods which included participant enrolment, consent taking, collecting questionnaire-based information and anthropometric measurements of children and their mothers. Five days were exclusively dedicated to anthropometric measurements. Master trainers who received child and adult anthropometry training from WHO and UNICEF conduct this part.

Anthropometric measurements

The major outcome of this study is the linear growth of children measured in LAZ. LAZ will be calculated following WHO growth standards[15] using the child length and age. Anthropometry will be conducted by all trained research staff following standard operating procedures as described by WHO.[15] Child length will be

Table 2 Time schedule for study tool administration

		Baseline	Follow-up			Endline
Contact point	Questionnaire topic	0 month	3 months	6 months	9 months	13 months
Household (mothers/ caregivers)	► Socioeconomic status	x				x
	► Nutritional status by anthropometry	x	x	x	x	x
	► IYCF practice	x	x	x	x	x
	► Food security	x	x	x	x	x
	► Children's morbidity and vitamin A supplementation	x	x	x	x	x
	► Mothers' KAP on IYCF	x				x
	► Mothers' KAP on GMP	x				x
Community clinic	► Service providers' skill, knowledge and practice	x				x
	► GMP attendance checklist	x	x	x	x	x
	► GMP quality	x	x	x	x	x
	► Community clinic service delivery quality assessment	x	x	x	x	x

GMP, growth monitoring and promotion; IYCF, infant and young child feeding; KAP, knowledge, attitude and practice.

measured with the Seca Infantometer (model No 417, Hamburg, Germany), with 1 mm accuracy. Child weight will be measured with the Seca 727 Baby Scale (Hamburg, Germany), with an accuracy of 10 g. Measurements would be taken at baseline and every 3 months thereafter for 12 months, with minimal clothing, and without any shoes and accessories. Mothers' weight will be measured both at baseline and endline and height will be measured only at baseline. Mothers' weight will be measured with minimal clothing and without any shoes and accessories in kilograms using a portable Tanita scale with an accuracy of 100 g. All measuring tools would be placed on flat surfaces, and readings will be noted when participants become steady on the scale. One research assistant will read the reading and the other will write it on the form. All measurements will be taken twice unless there is a difference beyond the acceptable accuracy/precision between the two readings, in which case a third reading will be taken. All the instruments will be calibrated every morning with a standard weight and a length stick, accordingly, prior to data collection.

Quality control of anthropometric measurements

To ensure consistency of anthropometric measurements, all staff would be initially standardised against two gold standards from an ongoing International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) research team who are certified and have formal anthropometric training from international organisations. Thereafter, data collection and anthropometry measurements will be monitored and supervised regularly by field supervisors, and monthly by study investigators. Quality control (QC) sessions and refreshers' training will be conducted by two gold standards and will include all field staffs' assessment on measurement and data collection, feedback, discussions and practice sessions. Before taking the anthropometry these things will be carefully monitored to minimise the measurement error or bias, like (1) cleanliness of scale, (2) functionality of scale, (3) scale calibration, (4) positioning of participant, assistant and measurer, (5) determine the measuring points or bony landmarks, (6) measurement accuracy, and (7) documentation.

Study outcome

The primary outcome of this study will be 20% improvement in mean LAZ of under-two children in the intervention compared with control area participants from baseline. Secondary outcomes are changes in: (1) mothers/caregivers' KAP about IYCF, (2) service providers' skills and KAP on GMP, (3) quality of GMP implementation in CC, (4) mothers/caregivers' KAP on GMP, and (5) views of the concerned policy planners to strengthen GMP.

Data management

The QC of the data collection will be assured through training, refresher training and extensive monitoring and supervision of the field staffs. Two field research officers (FRO) will be in charge of supervising 14 research assistants, that is, FRO-to-data collectors ratio will be 1:7. A monitoring and supervision team will be formed by involving the FROs and the study investigators. The team members will make unscheduled field site visits to supervise the field activities. During these visits, the supervision team members will randomly select one of the participants and revisit her to check the collected data on key questions for validation. In case of any major variations found during these validation checks, further investigation will be conducted as needed. FROs will frequently visit the field on a daily basis and recheck ~5% of participants for their anthropometry and other data to validate the enumerators' activities. The study investigators will make unannounced monthly visits to monitor field activities. All questionnaires and data forms will be reviewed for accuracy, consistency and completeness, immediately after data collection and before final submission for data entry. The data collectors will make additional visits to clarify inconsistencies or to collect missing information if required. Data entry, cleaning and verification will follow shortly after the start of fieldwork and any inconsistencies will be relayed to the field teams and supervisors for further attention. The integrity of the database will be maintained. Necessary checks of data analysis syntax and consistency of results will be conducted.

Data analysis

Quantitative data

All quantitative data will be entered into a computer using Office Access (Windows 2007). All quantitative data will be analysed using SPSS (V.20)/STATA software (V.13). Data will be checked for normality, and outliers will be managed according to standard procedure. For a normally distributed continuous variable, mean±SD will be presented; the median and IQR will be presented for non-normally distributed continuous variables. Categorical variables will be presented as proportions. All possible confounders and effect modifiers will be addressed in the analysis. Missing data will be accounted for on three levels: single imputation or prorating for sporadic missing item-level data that contribute to scores, multiple imputations for entirely missing scales or factors and listwise deletion for those with insufficient data to allow plausible imputation. To find out the true effect of the intervention (GMP) on child LAZ (outcome), linear mixed effects models will be performed. All independent variables will be analysed initially in bivariate models and the attributes that will be significantly associated with LAZ (dependent variable and primary outcome) and biologically plausible will be included in the final linear mixed effects models with time–group interaction and baseline LAZ. Since the unit of intervention and comparison area selection is community clinic catchments and considered as clusters, the clustering effect will be adjusted in the model. The model will be further adjusted by including differing baseline characteristics or potential confounders (if any) to find out the true effect of the intervention (GMP).

The same approach will be followed for analysing other secondary outcomes. Results with p values <0.05 will be considered as being statistically significant. A difference-in-difference analysis of quantitative outcomes will be conducted to explore changes over time. To identify significant predictors associated with the main outcome indicators, bivariate and multiple regression analyses will be employed.

Qualitative data

Thematic analysis will be followed for all qualitative information. From transcribed interviews, responses will be coded according to themes (a priori), subthemes and emergent issues. Data from different methods will be triangulated for information validation. Finally, qualitative analysis will include thematic descriptions, analysis and respondent quotations.

Patient and public involvement

The investigators who form the study leadership have extensive experience in the design and conduct of trials focused on improving growth and feeding practices in children in Asia. The study was designed specifically to reflect patient (improved child growth and feeding practices) and public priorities (improved nutritional status of children, raise community awareness about child nutrition and GMP programme, strengthen the GMP programme, and so on). Working closely with the community people, CG, stakeholders as well as with a robust social science team of researchers, patient (caregivers/mothers, children) priorities, experience and preferences were carefully considered in the design and development of the protocol and data collection instruments. However, the participants were not involved actively in the design of the study. At the initial stages of the study, we established a technical interest group (TIG), a small advisory panel comprising 15–18 members. The members of TIG comprised government stakeholders, national and international NGOs, donor, public health nutrition researchers, study investigators, and so on. This group has informed all stages of the project, including research and intervention design (eg, reviewing all the materials given to participants during the intervention), methodology, and the format and manner of communication to participants. The research questions were also discussed with a number of meetings with this group. Future involvement includes plans to share the study progress from time to time up to preliminary dissemination.

Ethics

The study protocol was approved by the Institutional Review Board (IRB) of icddr,b (PR-17123, version No 1.02) on 8 March 2018. Formal approval for any important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) will also be taken from IRB. The study was prospectively registered in January 2019 at ClinicalTrials.gov. Verbal consent was taken from mothers/caregivers, CHCPs and members of CG during informal discussions for the purpose of CC score generation. Written informed consent with full disclosure about the study will be taken prior to all interviews. No major physical risk is involved in the study subjects to participate in this study. The privacy, anonymity and confidentiality of data/information identifying the study participants will be strictly maintained. Personal identifications taken during the survey will be kept under lock and key. None other than the study personnel will have access to information on personal identification and other sensitive information.

Dissemination

The results of this study will be presented at national and international conferences. The study investigators will disseminate study results to study participants via seminars and outreach events. A manuscript with the results of the primary study will be published in a peer-reviewed journal. Separate manuscripts will be written on the secondary aims, and these will also be submitted for publication in peer-reviewed journals. The data, results and other findings resulting from this study will be published only after approval by a committee consisting of the investigators of the protocol. The International Committee of Medical Journal Editors guidelines will be used to establish authorship on papers.

Study status

We have completed study site selection, CC listing, score generation and matching by December 2018. Door-to-door household and eligible children listing was conducted from January to June 2019. Starting from 1 July 2019, currently, we are enrolling eligible child–mother pairs and collecting baseline data. Participant recruitment and baseline data collection are expected to end by October 2019.

DISCUSSION

In Bangladesh, GMP is being implemented through the government's CCs, either independently or with technical support from NGOs. However, the availability of routine GMP data on both the length and weight of under-two children is limited. In this backdrop, it was vital to assess the GMP implementation practices and their effects on children's growth. The current study, to our knowledge, is among the first to assess the effectiveness of GMP for improving the nutritional status of under-two children by strengthening the GMP-related activities in CCs. The result of this study will help us produce knowledge on the effectiveness of the strengthened GMP programme in improving the nutritional status of under-two children. The mixed methods approach will allow us to measure the changes in outcome indicators quantitatively and the qualitative components will help us understand the KAP and perception on GMP in improving IYCF practice and child growth by the mothers/caregivers and service providers, and also to assess the quality of GMP

implementation. The study results will also help identify gaps in GMP implementation through rigorous monitoring of implementation activities and to address them through integrated approaches.[2] One of the limitations of our study is that as we are having multiple contacts for process and outcome assessment during the intervention period, there is likely that the visits may influence some elevated good practice (Hawthorne effect). However, we assume the effect will be similar in both intervention and comparison arm, therefore may only somewhat underestimate the true impact. Given the lack of evidence regarding effective interventions for these young children, particularly within the CC setting, this work is especially crucial to public health as it could inform the robust, achievable and ethically designed programme that could be easily adapted and scaled up by the GoB. It will also help the policymakers and the health sector to take necessary steps for further improvement of the GMP programme.

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