QUALITY IMPROVEMENT STORIES

Improving the System of Care for Malnourished Children Infected with HIV in Delhi, India

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- Ms. Manju Sharma, Social Worker, WAG…Chelsea; monitored nutritional status of children in the field, provided nutritional rehabilitation services to children at the NGO and community under the guidance of a dietician and doctor.
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Foreword

An estimated 10.9 million children under five die in developing countries each year of which 60% of deaths are due to malnutrition and hunger-related diseases. More than one third of the world's children who are wasted live in India. Around 43% of Indian children less than five years are underweight and India accounts for more than 3 out of every 10 stunted children in the world. A child with HIV/AIDS requires more calories for adequate growth and development. In addition, diarrhoea caused by opportunistic infection leads to loss of nutrients from the child's body.

Effective management of malnutrition has been a challenge in India and many other developing nations. Under United States Agency for International Development (USAID) supported SAMARTH project, FHI 360 along with a local non-governmental organization Women Action Group (WAG)…Chelsea worked together to address the issue of malnutrition among HIV infected children. Using a Quality Improvement framework and community-based approach, the project team was successful in treating Moderate Acute Malnutrition (MAM) and Severe Acute Malnutrition (SAM) and improving nutritional status of HIV infected children.

The report describes the process of developing a Quality Improvement (QI) Monitoring System and how the project went about identifying, implementing and studying changes to meet set objectives. The report will be useful for program managers and technical staff members who want to use Plan Do Study Act (PDSA) quality improvement model for any public health issue as well as approaches in addressing malnourishment among children irrespective of HIV status.

I would like to thank Guru Tegh Bahadur (GTB) Hospital and WAG…Chelsea in participating in this project. My special thanks to Late Dr. Tripti Pensi, Head of Department, Paediatrics, Ram Manohar Lohia (RML) Hospital, New Delhi who provided technical inputs at all stages of the project. I am especially thankful to the HIV infected children and their caregivers who participated in the project. Lastly, I am very proud of my FHI 360 team in India Office, Asia Pacific Regional Office and United States who demonstrated a unique concept in public health programming.

Dr Bitra George

Country Director, India
FHI 360

Acronyms

AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Treatment/Therapy
ARV	Antiretroviral
BMI	Body Mass Index
BPL	Below Poverty Line
CCC	Community Care Center
CLHIV	Children living with HIV
DSACS	Delhi State AIDS Control Society
GTB Hospital	Guru Tegh Bahadur Hospital
HIV	Human Immunodeficiency Virus
HSS	HIV Sentinel Surveillance
MAM	Moderate Acute Malnutrition
MuAC	Mid Upper Arm Circumference
NACO	National AIDS Control Organization
NIHFW	National Institute of Health and Family Welfare
NHRC	Neonatal High Risk Clinic
NGO	Non-Governmental Organization
OI	Opportunistic Infection
OVC	Orphans and Vulnerable Children
PDSA	Plan, Do, Study, Act
PDS	Public Distribution System
PEPFAR	President's Emergency Plan for AIDS Relief
PLHIV	People Living with HIV
PPTCT	Prevention of Parent to Child Transmission
QI	Quality Improvement
RTI	Reproductive Tract Infections
SAM	Severe Acute Malnutrition
SAMARTH	Strengthen Abilities to Manage and Respond Effectively to HIV/AIDS
SMART	Specific, Measureable, Achievable, Relevant, Time-Bound
SOP	Standard Operating Procedure
STI	Sexually Transmitted Infection
STD	Sexually Transmitted Disease
TB	Tuberculosis
USAID	United States Agency for International Development
USG	United States Government
WAG…Chelsea	Women's Action Group
WHO	World Health Organization

Definitions

Child

A child is defined as any person, in the age group of 0-17 years or a person below the age of 18 years of age. Since there is no common definition of a child in India, the Indian legislation has minimum ages defined under various laws related to the protection of child rights. Minimum compulsory age for education is 14 years and various labor laws prohibit a person under the age of 14 years to work. The UN Convention on child rights defines children, as human begins below the age of 18 years. The Juvenile Justice (Care and Protection) Act 2000 also defines children as persons below 18 years of age.

An HIV exposed child

An HIV exposed child is defined as an infant born to a mother living with HIV whose own HIV infection has not been reliably excluded and the infant or child is no longer exposed through breastfeeding.

An HIV affected child

An HIV affected child is defined as a child who:

- Has a family member living with HIV; or one or both parents or guardian living with HIV;
- Has lost a parent or caregiver such as guardian or care provider due to AIDS, or lost an extended family member(s) and /or sibling (s) to AIDS;
- Is/was orphaned by HIV; or
- Is living with HIV.

An HIV infected child

AN HIV infected child is defined as a child living with HIV. An infected child is considered a sub-set under HIV affected child.

Orphan

According to the Juvenile Justice Rules, an orphan is defined as a child under age 18 years who has lost one or both parents.

Executive Summary

In 2006 the USAID-funded SAMARTH Project was launched, which provided the Indian National AIDS Control Program technical assistance on evidence-based HIV policies and programs to support a comprehensive response to the HIV/AIDS epidemic. Through the SAMARTH Project, FHI 360 worked with WAG...Chelsea, a nongovernmental organization (NGO) that provides health, education and other development services to marginalized and vulnerable communities in the north-eastern slums of Delhi.

In 2009, WAG...Chelsea provided community and home-based care to 346 children affected with HIV/AIDS including 78 HIV infected children. Staff did not know how to recognize signs of malnutrition and were addressing it by providing food supplements to the households. In response to this gap, FHI 360 launched a quality improvement (QI) project in 2009 to introduce appropriate solutions to manage malnutrition in HIV infected children within the WAG…Chelsea catchment area more effectively. FHI 360 provided training and technical assistance in quality improvement methods, monitoring, and interpretation of results.

The Plan Do Study Act (PDSA) quality improvement model was used to guide implementation of the pilot. Following training, a QI team was developed, which established the QI aim and objectives. The aim was to improve nutritional status of HIV infected children in WAG…Chelsea, and QI objectives were:

- To prevent occurrence of malnutrition in HIV-infected children;
- To detect early children at high-risk of malnutrition and beginning of growth faltering; and
- To rapidly recover malnourished children.

Next, the team performed several analyses to identify six root causes on which the pilot would focus: 1) lack of equipment: infantometer, height stand, digital weighing machine, mid-upper arm circumference (MuAC) measuring tape; 2) poor growth monitoring; 3) quality of counseling on infant feeding practices; 4) lack of information on nutritious food and hygiene; 5) poor ownership of ART clinic by the hospital; and 6) lack of formal referral system between GTB Pediatric Department and WAG...Chelsea. A comprehensive action plan describing the list of changes to be introduced was developed.

Next the QI team decided on three key indicators to monitor in order to assess the progress of the QI pilot project:

- % of children under follow-up developing Moderate Acute Malnutrition(MAM)/Severe Acute Malnutrition (SAM) each month;
- % of children under follow-up demonstrating decrease in weight/mid-upper arm circumference (MuAC) /Body Mass Index (BMI) (as applicable for age) each month; and
- % of children with malnutrition (MAM/SAM) demonstrating increase in weight/MuAC/BMI (as applicable for age) each month.

Implementation of the changes began in August 2009 with the enrollment of children in WAG…Chelsea. Each month the QI team reviewed the progress of implementation of the systemic changes, the challenges encountered and the results obtained. The QI work continued for 22 months from August 2009 to May 2011. Proposed changes were introduced in three main phases: 1) August 2009 to May 2010; 2) June to November 2010; and 3) December 2010 to May 2011.

Overall, results from Phase One did not demonstrate substantial improvements in the nutritional status of children enrolled in the pilot. However, upon introduction of new changes in Phase Two, modest improvements were observed. Phase Three, during which additional changes were incorporated, improvements were the most considerable.

For example, in Phase One, no clear trend was observed for the proportion of children that demonstrated a decrease in weight/MuAC/BMI according to age. During the last phase, beginning in December 2010, large fluctuations seem to diminish, with proportions consistent across a 20-point range, between 11% and 31%. Similarly, no significant decrease trend of the proportion of malnourished children demonstrating an increase in weight was found in Phase One. However, in Phase Two, the proportion of malnourished children with weight gain did improve. In June 2010, 25% of malnourished children demonstrated an increase in weight, which increased to a high of 88% in July 2010, and leveled off at around 50% for the remainder of Phase Two. This decreasing trend of malnutrition was sustained during Phase Three and by May 2011, 100% of the malnourished children demonstrated an increase in their anthropometric measurements. Lastly, the proportion of SAM/MAM children remained somewhat consistent, ranging from 23 to 33% in Phase One. This proportion dropped considerably during Phase Two, from 27% in June 2010 to 15% in November 2010. The downward trend continued in Phase Three, which averaged just over 3% of children with severe or moderate acute malnutrition.

This pilot is the first documented program for HIV infected children that utilized a quality improvement approach within the nutrition sphere in India. The work demonstrated that it is possible to manage malnutrition among HIV-infected children in resource-constrained settings. Effective management can be accomplished in spite of limited funding, with the proper commitment of stakeholders, motivation of service providers, provision of training, and availability of counseling for parents and guardians. Community-based nutrition services are much more effective for HIV affected children than a hospital-based system. However, clear linkages must be established with the hospital for HIV infected children in need of ART, management of opportunistic infections and malnutrition with complications. Lastly, a comprehensive approach was shown to be effective in treating and preventing malnutrition, as the pilot included an emphasis on clean, safe drinking water, hygiene, OI prevention and treatment, diet maintenance in periods of illness, psychosocial support and counseling.

The lessons learned in the QI nutrition pilot offer several recommendations:

- Government and non-government agencies need to develop policies which make nutrition counseling mandatory and therapy available through sustainable community and public health delivery systems;
- The national and state level HIV/AIDS programs should train ART center and Community Care Center (CCC) staff to detect and manage malnutrition among HIV infected children;
- Government of India's Integrated Child Development Services (ICDS) should strengthen their malnutrition management program; and
- Advocacy among a variety of stakeholders on the specific nutrition needs of children is crucial to scale up of quality child malnutrition programs.

Introduction

In 2006 the USAID-funded SAMARTH Project was launched, which provided the Indian National AIDS Control Program and the US mission to India with technical assistance on evidence-based HIV policies and programs to support a comprehensive response to the HIV/AIDS epidemic in India. FHI 360 partnered with the Christian Medical Association of India, the Indian Network for People Living with HIV/AIDS, and the Solidarity & Action Against the HIV Infection in India to implement the project.

Through the SAMARTH Project, FHI 360 worked with WAG...Chelsea, a nongovernmental organization (NGO) that provides health, education and other development services to marginalized and vulnerable communities in the north-eastern slums of Delhi. The primary aim of the NGO is to prevent the spread of HIV and ensuring the dignity of those living with HIV. The organization reaches out to high-risk communities, providing information, links to services and advocates reduction of stigma and discriminatory practices. The project has served as a learning site for USG partner agencies, government and other NGOs.

WAG…Chelsea works in nine urban slums of Old Seemapuri, New Seemapuri, Jain Mandir Colony, Tahirpur, Sunder Nagri, Nand Nagri, Kardampuri, Karawal Nagar, Bhajanura in the north-eastern part of Delhi. Delhi has a large migratory population that resides in slum clusters in different parts of the metropolitan city. Poverty, under-employment and illiteracy are rampant, increasing the vulnerability of women and children to exploitation. Family sizes are generally large with high school drop-out amongst the children. Children are exposed to substance use, alcohol and gambling. There are many health problems including tuberculosis, sexually transmitted infections (STI), reproductive tract infections (RTI) and HIV/AIDS[1]. There is a high level of HIV/AIDS related stigma and discrimination with limited or no access to adequate health care, educational support and livelihoods. Additionally, approximately 20% of the children enrolled in WAG…Chelsea were single or double orphans.

The prevalence of child malnutrition is high in the area[2], aggravated for children infected with HIV. The reasons for the malnutrition are many - HIV and other associated ailments, low socioeconomic status, low literacy among parents, poor dietary habits and intake, very poor knowledge of nutrition among parents and mothers suffering from HIV/AIDS. Due to their own health and other problems, mothers are unable to give attention to their children. Additionally, nutritional rehabilitation of the children has been very poor.

In 2009, WAG...Chelsea was providing community and home based care to 346 children affected with HIV/AIDS including 78 HIV infected children. There were 260 households affected by HIV registered with WAG...Chelsea. They did not know how to recognize signs of malnutrition and were dealing with it in their own way by providing food supplements to the households.

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[1] The estimated adult HIV prevalence in Delhi is 0.20%; around 2.9% of STD patients were found HIV positive; an estimated 2.1%, 7.9% and 18.6% of female sex workers (FSW), males having sex with males (MSM) and injection drug users (IDU) were found HIV positive (Annual HSS, Country report 2008-09, NIHFW-NACO). Though Delhi is a HIV low prevalent state, there are pockets like slums of northeastern population where there is a higher concentration of PLHIV.

[2] In parts of India, 42 percent of all children under age 5 suffer from malnutrition (Nandi Foundation) http://www.nytimes.com/2012/01/11/world/asia/malnutrition-in-india-is-widespread-report-finds.html

In response to this gap, FHI 360 launched a quality improvement (QI) project in 2009 to identify and introduce appropriate solutions to manage malnutrition in HIV infected children more effectively. The pilot focused on children infected with HIV in nine slums in the north-eastern part of Delhi, covering a population of 847,936 (census 2001). FHI 360 provided training and technical assistance (TA) in quality improvement methods, monitoring, and interpretation of results.

FHI 360's Model for Quality Improvement

FHI 360 used the quality improvement model represented in Figure 1. This model guides a team of service providers as they test system changes through the use of the Plan Do Study Act (PDSA) cycle.

The four main steps are:

1. *Identify the explicit improvement aim and objectives*

These should express a benefit for the beneficiaries/population in measurable terms.

2. *Develop the improvement measurement system*

In this system, the improvement team collects a few indicators on a frequent basis, using a small sample of sites or beneficiaries, and then plots the results on run charts.

3. Generate ideas for changes

Accomplish this step through brainstorming, benchmarking and referring to a list of known change concepts.

4. *Test and implement the system changes (with the PDSA cycle)*

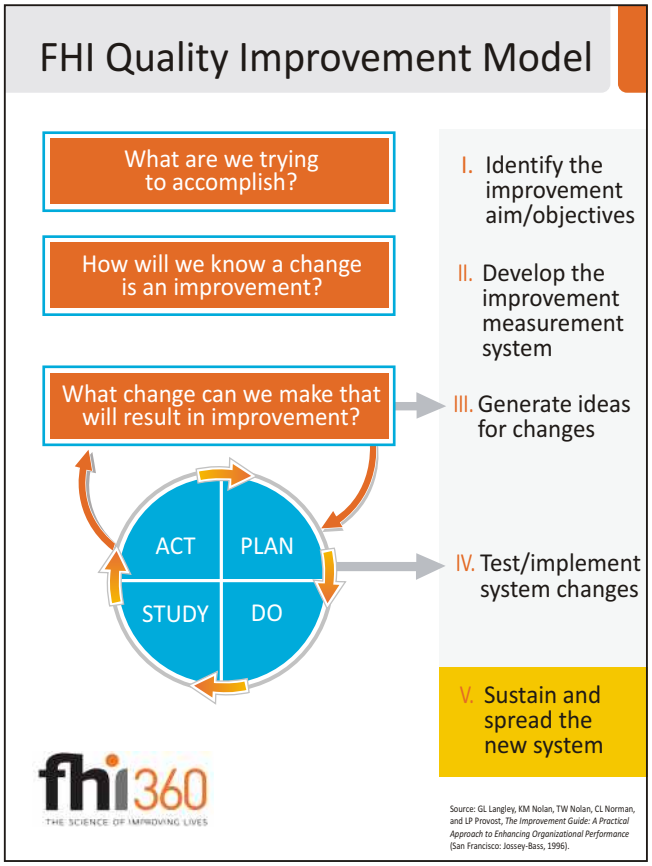


Figure 1: FHI 360's Model for Quality Improvement

Changes are introduced on a small scale (a few units), either one by one or as a package of changes, and their effect on the improvement aim/objectives is assessed through the measurement system established in step 2. If a specific change yields improvement, it is sustained and replicated into the rest of the system. If the change does not yield the expected improvement, it is then abandoned and another change is tested.

Development of Aims and Objectives

In March 2009, FHI 360 first oriented stakeholders on the QI model and processes. Meetings were held with WAG…Chelsea and representatives from Guru Tegh Bahadur (GTB) Hospital, the nearby local Government hospital and primary referral facility for WAG…Chelsea, and senior pediatrician from Ram Manohar Lohia Hospital (RML), a national Referral Hospital. The representatives were involved with health and nutrition services for the children affected by HIV/AIDS.

Next, a six member QI team was formed to provide overall leadership and technical support for the pilot. This core team consisted of: Dr. Ashok Agarwal, Director, DAKSH and SNEH, FHI 360/India; Late Dr. Tripti Pensi, Pediatric Head of the Department, RML Hospital; Dr Sunil Gomber, Pediatric Head of the Department, GTB Hospital; Dr. Umesh Bhatnagar, Doctor, WAG…Chelsea; Ms. Manju Manak, Program Manager, WAG...Chelsea; and Pankaj Pokhriyal, Data Analyst, WAG…Chelsea.

An extended team was also involved in the pilot, providing frequent support and monitoring. Included in this team was Dr. Prasanta Bandyopadhyay, ex-Associate Director - Technical, SAMARTH Project, FHI 360/India; Ms. Manju Sharma, social worker, WAG…Chelsea; Mr. Deepak Sharma, counselor, WAG…Chelsea and Ms. Bublee Sharma, mother. Dr. Bandyopadhyay made regular visits to the NGO and GTB Hospital and closely monitored QI implementation. Ms. Sharma and Mr. Sharma closely interacted with children and parents/guardians; they were able to give the community insight to the larger QI team. Lastly, Ms. Bublee Sharma, mother of a child receiving nutrition services, was able to influence other beneficiaries in the community.

Following a brainstorming meeting, the QI team developed the QI aim and objectives. The aim was to improve nutritional status of HIV infected children in WAG…Chelsea, and the QI objectives were:

- To prevent occurrence of malnutrition in HIV-infected children;
- To detect early children at high-risk of malnutrition and beginning of growth faltering; and
- To rapidly recover malnourished children.

Establishing a QI Monitoring System

The QI team developed indicators to measure the change in nutritional status. In total, six input, six output, 11 outcome, and one impact indicators were developed (see Appendix 1 for detailed indicators). The QI team decided to follow three key indicators to assess the progress of the QI pilot project:

- % of children under follow-up developing malnutrition (Moderate Acute Malnutrition/Severe Acute Malnutrition) each month;
- % of children under follow-up demonstrating decrease in weight/MuAC/Body Mass Index (BMI) (as applicable for age) each month; and
- % of children with malnutrition (MAM/SAM) demonstrating increase in weight/MuAC/BMI (as applicable for age) each month.

These indicators were plotted monthly on run charts over the period of the study. The rest of the indicators listed in Appendix 1 were used to track implementation of the project.

Identifying changes to introduce from System Analysis

The team conducted an analysis using flow charts to determine the existing system of providing nutrition services to children infected with HIV by WAG...Chelsea and GTB Hospital (see Appendix 2).

The GTB flow chart described the existing system of providing nutrition services to mothers during antenatal period by the Antenatal Care Unit (and Prevention of Parent to Child Transmission (PPTCT) counselor in case of the HIV infected mother), after delivery by the post-partum unit, and later through the Neonatal High Risk Clinic (NHRC) for babies born to HIV infected mothers. The analysis revealed there was no formal referral system between GTB Hospital and WAG...Chelsea resulting in considerable lost to follow-up of HIV exposed children. After a baby was diagnosed as HIV infected, NHRC referred the case to the ART clinic in GTB Hospital. At the ART clinic, the body weight was measured every month but not plotted on a growth chart. The child did not receive advice from a dietician during the Out Patient Department (OPD) based treatment.

The WAG...Chelsea flow chart described the existing system of providing nutrition services in the community from the time an HIV exposed child was identified in the community after birth. The flow chart showed that even though the WAG...Chelsea field worker followed the child every fortnight through home visits or the child visiting the WAG...Chelsea clinic, the nutritional assessment was mostly visual and did not include measurements. Any child with malnutrition was managed under the guidance of the WAG...Chelsea doctor (General physician). WAG...Chelsea was not emphasizing rapid weaning of a breast-fed child. With Clinton Foundation support, WAG...Chelsea was providing nutritional supplements to children above two years based on self-developed socio-economic criteria. No dietician was ever consulted.

Next, the team performed a fishbone analysis in order to identify the root causes for malnutrition in children (see Appendix 3). This analysis identified eleven major causes leading to poor nutritional status of HIV infected children:

1. Poor growth monitoring;
2. Poor quality of counseling on infant feeding practices;
3. Lack of IEC materials/tools;
4. Poor ownership of ART clinic by hospital;
5. Lack of formal referral system between GTB Pediatric department and WAG...Chelsea;
6. Lack of information on nutritious food and hygiene;
7. Poor maternal nutritional status;
8. Lack of infantometer, height stand, electronic weighing machine, mid-arm circumference tape;
9. No provision of nutrition counseling to OPD children beyond one year in GTB hospital;
10. Poor family socio-economic condition; and
11. Poor water supply, sanitation and hygiene.

The important causes were validated by discussions with parents/guardians and service providers.

The QI team felt most of the causes could be addressed in the pilot except the last two - poor family socio-economic condition and poor water supply, sanitation and hygiene -which would require a larger, sustained intervention with the participation of multiple government departments.

Feedback from service providers and guardians on the root causes identified through fishbone exercise was used to develop a Pareto chart (see Box 1).[3] The Pareto principle describes a phenomenon in which 80 percent of variation observed in everyday processes can be explained by 20 percent of the causes of that variation. The Pareto chart is based on this principle; it places the root causes in descending order of frequency, making it easy to discern those problems that are of greatest importance or those causes that appear to account for most of the variation. The Pareto's analysis helped to further refine the eleven root causes identified by the fish bone analysis. It found that eight of the eleven causes were responsible for 80% contribution to poor nutritional status of HIV infected children (see Figure 2).

Steps to Develop a Pareto Chart

- √ **Step 1.** Develop a list of problems, items, or causes to be compared.
- √ **Step 2.** Develop a standard measure for comparing the items.
- √ **Step 3.** Choose a time frame for collecting the data.
- √ **Step 4.** Tally, for each item, how often it occurred (or cost or total time it took). Then add these amounts to determine the grand total for all items. Find the percent of each item in the grand total by taking the sum of the item, dividing it by the grand total, and multiplying by 100.
- √ **Step 5.** List the items being compared from the most frequent to the least frequent. The cumulative percent for an item is the sum of that item's percent of the total and that of all the other items that come before it in the ordering by rank.
- √ **Step 6.** List the items on the horizontal axis of a graph from highest to lowest. Label the left vertical axis with the numbers, then label the right vertical axis with the cumulative percentages (the cumulative total should equal 100 percent). Draw in the bars for each item.
- √ **Step 7.** Draw a line graph of the cumulative percentages. The first point on the line graph should line up with the top of the first bar.
- √ **Step 8.** Analyze the diagram by identifying those items that appear to account for most of the difficulty.

Box 1: Steps to Develop a Pareto Chart

The QI group decided to ignore these three causes for the time being: lack of IEC materials/tools; no provision of nutrition counseling to OPD children beyond one year in GTB hospital; and poor maternal nutritious status. Out of the eight causes, the QI team dropped two additional causes (poor family socio-economic condition; and poor water supply, sanitation and hygiene) as they were beyond the scope of this project. Therefore, the pilot focused on six root causes: 1) lack of infantometer, height stand, digital weighing machine, mid-upper arm circumference (MuAC) measuring tape; 2) poor growth monitoring; 3) quality of counseling on infant feeding practices; 4) lack of information on nutritious food and hygiene; 5) poor ownership of ART clinic by the hospital; and 6) lack of formal referral system between GTB Pediatric Department and WAG...Chelsea.

[3]Healthcare Improvement Project. Pareto Chart. Accessed on 9 March 2012 at http://www.hciproject.org/improvement_tools/improvement_methods/analytical_tools/statistical_data_presentation/pareto_chart

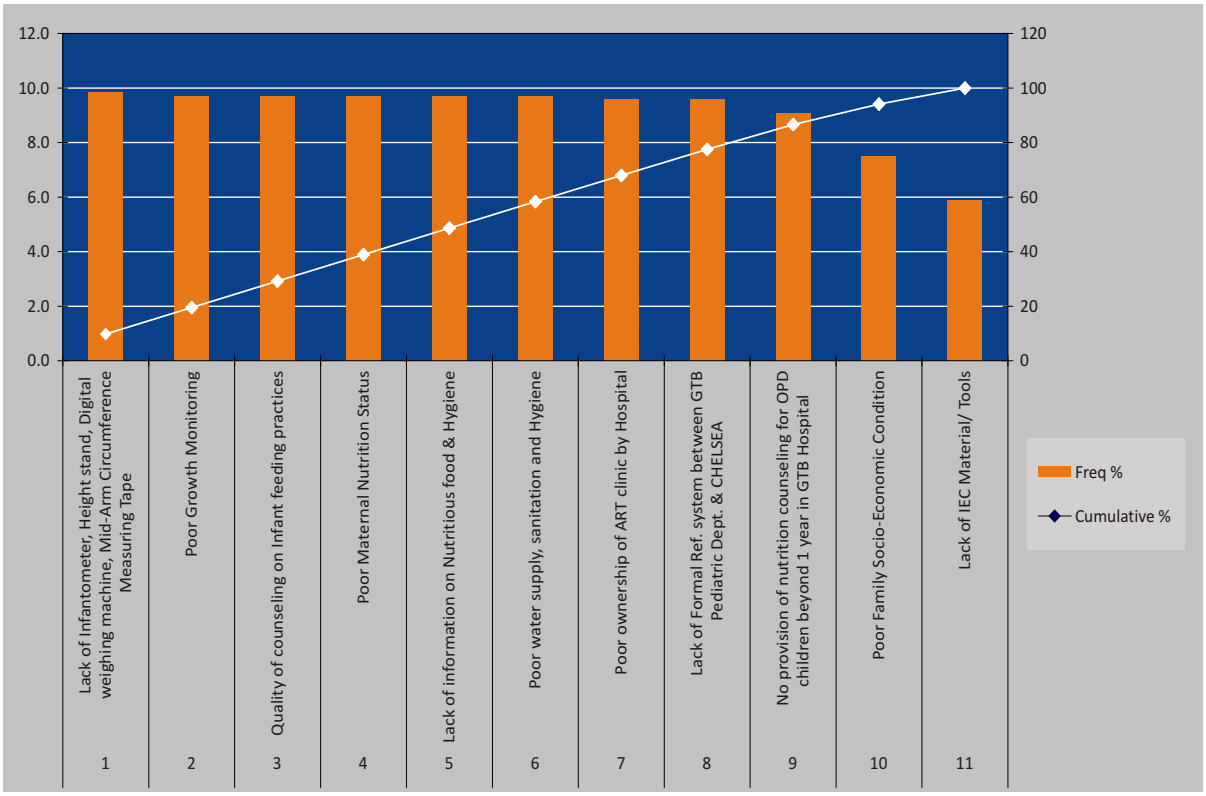


Figure 2: Pareto's analysis of major causes of malnutrition of children

A comprehensive action plan describing the list of changes to be introduced was developed (see Appendix 4). Some of the key actions included GTB Hospital to procure (from their budget) one infantometer, height stand and digital weighing machine specifically to be placed in the ART center. GTB hospital would also ensure that growth measures were collected every month for all children attending the Pediatric ART center and a process for accuracy check of the measures would be initiated. FHI 360 would supply MuAC measuring tapes. GTB Hospital would organize trainings on growth measurements of children in the hospital. Being a large public health facility with a sizeable patient load, coupled with limited availability of human resources, GTB was not able to implement all changes that were planned.

The changes to be implemented by WAG…Chelsea included procurement of one digital weighing machine for its drop-in center. WAG…Chelsea counselors and social workers would attend the trainings conducted by GTB Hospital. The WAG…Chelsea doctor would train project social workers on growth monitoring procedures and documentation; he would also conduct random checks of the measurements taken by them. WAG…Chelsea would place one social worker dedicated for taking growth measures on Pediatric ART day - every Thursday afternoon- at GTB Hospital ART center and WAG…Chelsea would plot WHO growth charts for each child every quarter; copy of the growth charts will be shared with GTB Hospital for the doctor to explain to parent/ guardians during the ART visit.

Implementing changes

Implementation of the changes began in August 2009 with the enrollment of children in WAG…Chelsea who met the following criteria:

- Children infected with HIV;
- Children between the age of 0-14 years;
- Children residing in the WAG…Chelsea project area (nine slums of North-East Delhi); and
- Children registered with both WAG…Chelsea and GTB ART center.

A total of 41 HIV infected children (0-14 years) met the criteria at the beginning of the project in August 2009. Parents were informed of the improvement initiative and gave permission for their children to be followed up. Each month, the nutritional measures were collected and the children graded per the World Health Organization (WHO) growth monitoring criteria (see Box 2). The first month measures were taken as baseline for the project.

WHO Growth Monitoring criteria (2007)

- **SAM (Severe acute malnutrition):** A child is defined under SAM if s/he falls under any of the criteria:
  - If child is aged between 6 months to 59 months, MuAC is <11 cm or If child aged 0-5 years and weight for length/height is below -3 Z scores or
  - If a child aged more than 5 years and body-mass index (BMI) for age is below -3 Z scores.
- **MAM (Moderate acute malnutrition):** A child is defined under MAM if s/he falls under any of the criteria:
  - If child is aged between 6 months to 59 months, mid upper arm circumference (MuAC) is between 11 and < 12.5 cm or
  - If child aged 0-5 years and weight for length/height is between -2 Z scores and -3 Z score or
  - If child aged more than 5 years and BMI for age is between -2 Z scores and -3 Z scores.

Box 2: WHO Growth Monitoring criteria (2007)

Each month the QI team reviewed the progress of implementation of the systemic changes, the challenges encountered and the results obtained. This helped to develop the action for the following month. The QI work continued for 22 months from August 2009 to May 2011. Proposed changes were introduced in three main phases: 1) August 2009 to May 2010; 2) June to November 2010; and 3) December 2010 to May 2011. The bulk of changes were implemented during the first phase.

Phase One: August 2009 to May 2010

In the first phase, over 20 changes out of 27 listed were introduced (see Table 1). First, the necessary equipment for the pilot was procured. WAG...Chelsea procured the height stand, digital weighing machine and mid-upper arm circumference (MuAC) measuring tape; and supplied MuAC measuring tapes to GTB hospital.

WAG...Chelsea physician trained the project Social Workers (SW) on growth monitoring procedures, anthropometric measurements, identification of SAM and MAM. The data analyst was trained on body-mass index (BMI) calculation, interpretation and documentation.

Table 1: Changes Implemented in Phase One

Planned Changes - Phase One	Responsibility	Notes
Identification and registration of children	WAG…Chelsea	Done
Procurement of height stand, digital weight machine, MuAC measuring tape	WAG…Chelsea	Done
Procurement of infantometer, height stand and digital weight machine	GTB Hospital	Done
Training of social workers social workers on growth monitoring procedures, anthropometric measurements, identification of SAM and MAM	WAG…Chelsea	Done
Training of the data analyst on BMI calculation, interpretation and documentation	WAG…Chelsea	Done
Training of prevention of parent to child transmission (PPTCT) counselor, post-partum unit nurses, ART counselor, WAG…Chelsea counselor, and social workers on Nutrition Considerations, Growth measurement, and Infant feeding practices	GTB Hospital	Could not be completed due to limited resources
Strengthening the quality of counseling on infant feeding practices	WAG…Chelsea	Done
Strengthening of individual and family counseling	WAG…Chelsea and GTB Hospital	Conducted by WAG…Cheslea
Monthly healthy cooking methods and dishes with mothers and family members at the drop-in-center	WAG…Chelsea	Done
Monthly distribution of dry rations (wheat, soya-bean, lentil, rice and sugar) to children	WAG…Chelsea	Done
Conduct random checks of the measurements taken by the WAG...Chelsea social workers to assess accuracy	WAG…Chelsea and GTB Hospital	Done
Introduction of formal referral system between GTB Pediatric Department and WAG...Chelsea	WAG…Chelsea, GTB Hospital, and FHI 360	Done
Hold advocacy meetings between WAG…Chelsea and GTB Hospital	WAG…Chelsea	Done
Placement of nutritionist at the ART center in the GTB Hospital	GTB Hospital	Done
Placement of WAG...Chelsea social worker in GTB Hospital ART center	WAG…Chelsea	Done
Measurement of height, weight and MuAC (for children below 5 yrs.) once a month for all children from the ART center, WAG...Chelsea drop-in-center, WAG...Chelsea Community Care Center and from home visits	WAG…Chelsea	Done
Monthly analysis of QI project data	WAG...Chelsea and FHI 360	Done

(Continued to next page)

Planned Changes - Phase One	Responsibility	Notes
Collection of feedback on cooking demonstrations and infant feeding practices from randomly selected mothers and family members during home visits	WAG…Chelsea	Done
Focus Group Discussions on a monthly basis with parents and family members	WAG…Chelsea	Done
Admit six severe malnutrition cases (SAM) to GTB hospital	GTB Hospital	Could not be done
Initiation of ART for all the children and strict monitoring of ART adherence	GTB Hospital	Done
Development of a protocol on nutrition for children with SAM/MAM by a team of post-graduate students and dietician	GTB Hospital	Could not be done
Organization of a seminar on nutrition	GTB Hospital	Could not be done
Initiation of a diet demonstration session once a week by a dietician	GTB Hospital	Could not be done
Provide more space for pediatric ART clinic and introduce same day routine tests for Pediatric ART clinic through Emergency clinic	GTB Hospital	Same day routine tests introduced; more space could not be provided to pediatric ART clinic
Establish linkages with Swami Dayanand Hospital, Government Nutrition Rehabilitation center, for all SAM/MAM children	WAG…Chelsea	Could not be done, they were open to referral only from GTB Hospital (Government)
Procurement of readymade F-75 and F-100 WHO therapeutic formulations for SAM children	GTB Hospital	Could not be done, not available market

WAG...Chelsea placed one social worker at the GTB Hospital ART Centre, dedicated for taking the growth measures on Pediatric ART day (every Thursday, 2-4 PM).

WAG...Chelsea social workers measured height, weight and MuAC (for children below 5 yrs.) once a month for all children from the ART center, WAG...Chelsea drop-in-center, WAG...Chelsea Community Care Center (CCC) and from home visits and recorded the measurements in a pre-designed format. WAG...Chelsea plotted WHO growth charts for each child every quarter. A copy of the growth charts was shared with GTB Hospital for the doctor to explain to the parent/ guardian during the ART visit. The WAG...Chelsea doctor also explained the measurements and growth charts to parents/guardians of children not on ART.

Photo 1: Measurement of MuAc at the community level, within a household for a child under 5 years

WAG...Chelsea developed a formal referral card in consultation with GTB Hospital and FHI 360. A referral card was used by different WAG...Chelsea staff (doctor, social worker, counselor, and project manager) to refer children to GTB Hospital and proved to be very useful.

WAG...Chelsea held meetings with GTB Hospital to advocate for the improvement of services for HIV infected children. The following changes were advocated for: adequate space, equipment, human resources, clinic timing suitable to children and family (to decrease waiting time and multiple visits for consultation and investigation).

On a monthly basis, feedback on cooking demonstrations and infant feeding practices was collected from randomly selected mothers and family members during home visits by social workers through a pre-designed questionnaire developed by WAG...Chelsea in consultation with GTB Hospital and FHI 360. Focus Group Discussions were held on a monthly basis with parents and family members. Monthly review meetings were also held between WAG...Chelsea and FHI 360 to assess the progress of the study.

Photo 2: During a cooking demonstration at the drop in center for mothers, explaining quantities of ingredients

At the end of the month, the social workers provided data to the data operator for entry and analysis. After analysis, a monthly report was shared with FHI 360. Run charts were updated every month.

Phase Two: June 2010 to November 2010

During the second phase, previous activities were continued and additional interventions were introduced (see Table 2).

Table 2: Changes implemented in Phase Two

Planned Changes - Phase Two	Responsibility	Notes
Recruitment of a trained dietician to develop WHO F-75 and F-100 formulations for therapeutic purposes and provide nutritional services to children in need	WAG…Chelsea	Done
10-day nutrition rehabilitation for SAM/MAM at WAG…Chelsea drop-in center	WAG…Chelsea	Done
Training of WAG...Chelsea staff by dietician on nutritional assessment, meal planning, cooking demonstration, BMI calculation, weight for age and weight for height, immediate actions to take in the community for SAM/MAM	WAG…Chelsea	Done
Development of individualized nutrition plans for all children during home-visits, at the ART and drop-in center	WAG…Chelsea	Done
Collection of dietary history during home visits	WAG…Chelsea	Done
Addition of a counselor to the QI team	WAG…Chelsea	Done

Photo 3: Nutrition rehabilitation at the drop-in center

A trained dietician was recruited to develop WHO F-75 and F-100[4] formulations for therapeutic purposes, administration of the appropriate quantity, observation/ monitoring of children under day care, counseling to malnourished children, counseling to parents, training for service providers, skill and knowledge building of care givers (amongst family members), cooking demonstrations, hygiene and sanitation, monitoring and supervision, documentation and reporting.

Under the guidance of the dietician, a 10-day long nutrition rehabilitation was started at the WAG...Chelsea drop-in center. During the rehabilitation period, daily monitoring of height and weight for children with SAM/MAM was conducted. Cooked food was provided, based on the nutritional needs of children, which consisted of one major meal (lunch) and three small meals.

[4]The F-75 and F-100 WHO therapeutic formulations provide accurate proportions of micronutrients to SAM/MAM children. In the absence of readymade therapeutic formulations, a number of service providers in India prepare it by mixing milk, oil and sugar.

A dietician provided training to WAG…Chelsea staff on:

- Nutrition assessment including: calorie value calculation, calories in various food items, portion-wise calculation of food quantity and calories;
- Social workers and counselors were trained on BMI calculation, weight for age and weight for height, to take an immediate action in the community for SAM/MAM; and
- Meal planning and detailed steps for cooking demonstration.

Phase Three: December 2010 to May 2011

During the last phase, an additional eight changes were introduced (see Table 3).

Table 3: Changes implemented in Phase Three

Planned Changes - Phase Three	Responsibility	Notes
Recruitment of a pediatrician in place of dietician	WAG…Chelsea	Done
Nutrition assessment related to family income through interview of parents /care givers, and subsequent nutritional counseling (including diet plans)	WAG…Chelsea	Done
Monitoring of quantity and quality of food consumed by child, recording medical history, and identification of common infections during home visits	WAG…Chelsea	Done
Conduct cooking demonstrations in the community with inclusion of general population	WAG…Chelsea	Done
Provide training to mothers on water storage, food hygiene, personal hygiene and prevention of houseflies and mosquitoes using local methods	WAG…Chelsea	Done
Extension of 10-day nutrition rehabilitation at WAG…Chelsea drop-in center to 15-day nutritional rehabilitation program and provision of nutritional rehabilitation to children at home who could not attend the drop-in center	WAG…Chelsea	Done
Provision of counseling for mothers who were depressed and/or substance users	WAG…Chelsea	Done
Provision of counseling for child caregivers at homes who had misconceptions about HIV/AIDS	WAG…Chelsea	Done

A pediatrician was recruited by WAG…Chelsea with knowledge of locally available, low cost nutritious food, healthy methods of food preparation, and willing to guide cooking demonstrations at homes within the community. She provided hands-on training to WAG…Chelsea social worker on nutritional assessment and health screening of children (see Appendix 5 for details of training provided by the pediatrician). She emphasized the need to work towards preventing children with normal status becoming MAM/SAM. The pediatrician examined all the children registered with WAG…Chelsea. She counseled the parents/family members and explained the current nutritional status of the children through growth charts.

A nutrition assessment was conducted to understand family income through interviews of parents /care givers on certain parameters - approximate income of household, number of members in the household, and amount spent on food (total and per capita). Families were trained on how to purchase food products which were affordable and nutritious. The families were asked to purchase rations from an open market or through the public distribution system or both in case they had a below poverty line card. They were sensitized on buying seasonal vegetables and preserving green leafy vegetables for lean seasons. Each child's nutrition cost was decided on the basis of family income. (Rs. 500/-[5] per month was fixed for each child). Special meals were planned for those who were hospitalized for the treatment of severe opportunistic infections (see Appendix 6 for sample diet plans).

Photo 4: Water storage-Before counseling stored in plastic and dirty containers

Photo 5: Water Storage- Post counseling – stored in steel and traditional terracotta container

For comprehensive coverage, the WAG...Chelsea project area encompassed nine slums divided into seven clusters and a cooking demonstration was conducted in each cluster (see Appendix 7 for map). These clusters were designed based on the residence of HIV infected children. The cooking demonstration in the community was followed by consultation with caregivers/parents. A written consent was obtained from family members before conducting the cooking demonstration because some were apprehensive of home demonstrations as neighbors may wonder why the team was interested in their household. To combat issues of stigma and discrimination, the team decided to conduct cooking demonstrations in the community with inclusion of general population. This was done to mobilize the community and encourage mothers to interact and share especially for those who had children in the same age group. Each time, new and simple recipes were shared with focus on calories, proteins, total cost, cooking time, fuel efficiency, different taste etc. During each cooking demonstration, the age of the child was taken into consideration and food material available in the household or monthly ration provided by WAG...Chelsea was used.

[5]Approximately US$10

Although the food ingredients are very similar to the Integrated Child Development Scheme (ICDS) (government program for children below six years of age) feeds, WAG...Chelsea cooking demonstrations were appreciated more because these were organized at the doorstep in the community using low-cost food materials prepared taking less cooking-time, simple and were palatable. During community demonstrations, palatable recipes were prepared out of milk, bran, grains and jaggery.

The social workers also trained mothers on water storage, food hygiene, personal hygiene and prevention of houseflies and mosquitoes using local methods.

Additionally, the 10-day nutrition rehabilitation provided through WAG…Chelsea drop-in center in Phase 2 was extended to a 15-day nutritional rehabilitation program and children who could not attend the drop-in center, the nutritional rehabilitation was provided at their homes. Some parents were not ready to send their children for nutrition rehabilitation at the drop-in center for mobility and other reasons. Hence it was decided that these children will be treated at home but under daily supervision of social workers and counselors. The same meals (one major meal and three small meals) which children received at the WAG...Chelsea drop-in center were provided at homes. Counseling was done for mothers who were depressed and were substance users. Counseling sessions were also held for the child caregivers at home who had misconceptions about HIV/AIDS.

Studying changes

The run charts were updated monthly and reviewed by the QI team at regular intervals. Overall, results from Phase One did not demonstrate substantial improvements in the nutritional status of children enrolled in the pilot. However, upon introduction of new changes in Phase Two, modest improvements were observed. Phase Three, during which additional changes were incorporated, improvements were the most considerable – and seemingly stable.

In Phase One, no clear trend was observed for the proportion of children under follow-up that demonstrated a decrease in weight/MuAC/BMI according to age (see Figure 3). During the last phase, beginning in December 2010, large fluctuations seem to diminish, with proportions consistent across a 20-point range, between 11% and 31%.

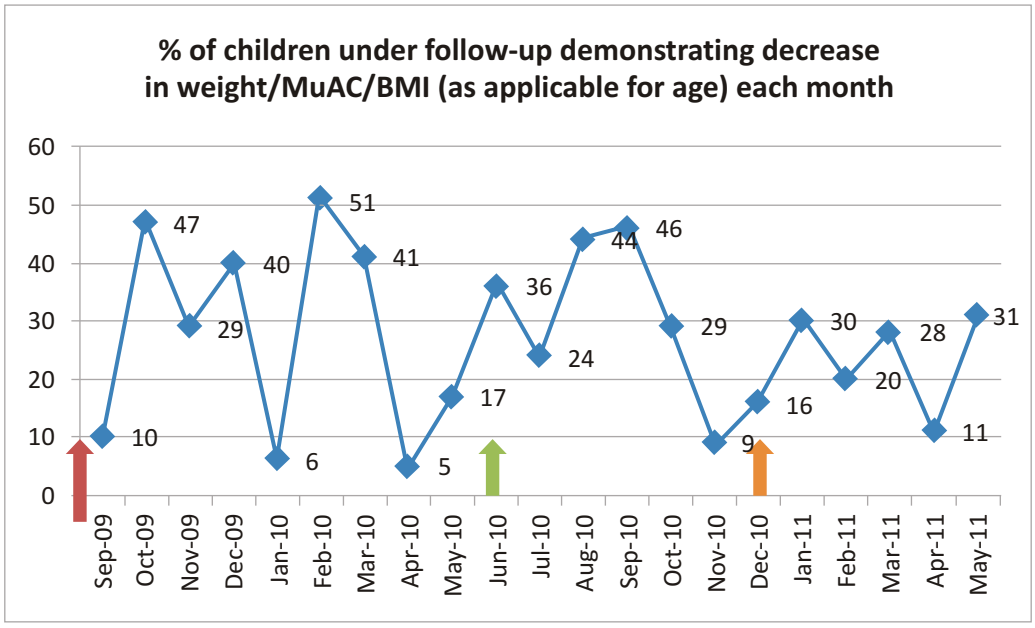


Figure 3 (the arrows indicate the three phases with different package of changes)

During Phase One, no significant decrease trend of the proportion of malnourished children demonstrating an increase in weight was found (see Figure 4). However, in Phase Two, the proportion of malnourished children with weight gain did improve. In June 2010, 25% of malnourished children demonstrated an increase in weight, which increased to a high of 88% in July 2010, and leveled off at around 50% for the remainder of Phase Two. This decreasing trend of malnutrition was sustained during Phase Three and by May 2011, 100% of the malnourished children demonstrated an increase in their anthropometric measurements.

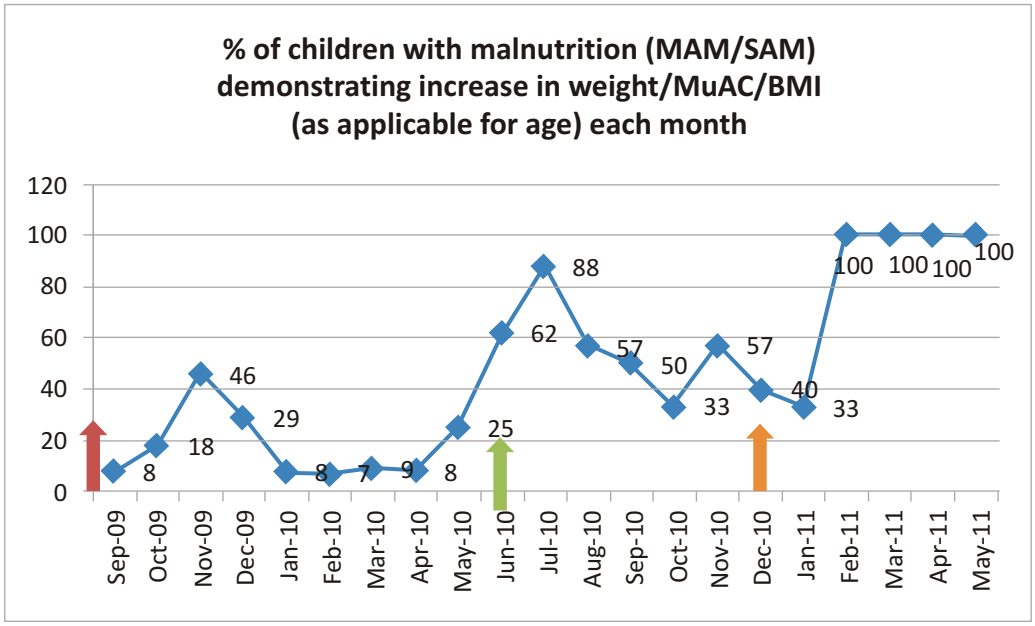


Figure 4 (the arrows indicate the three phases with different package of changes)

During Phase One, the proportion of children with severe acute malnutrition or moderate acute malnutrition remained somewhat consistent, ranging from 23 to 33% (see Figure 5). This proportion dropped considerably during Phase Two, from 27% in June 2010 to 15% in November 2010. The downward trend continued in Phase Three, which averaged just over 3% of children with severe or moderate acute malnutrition.

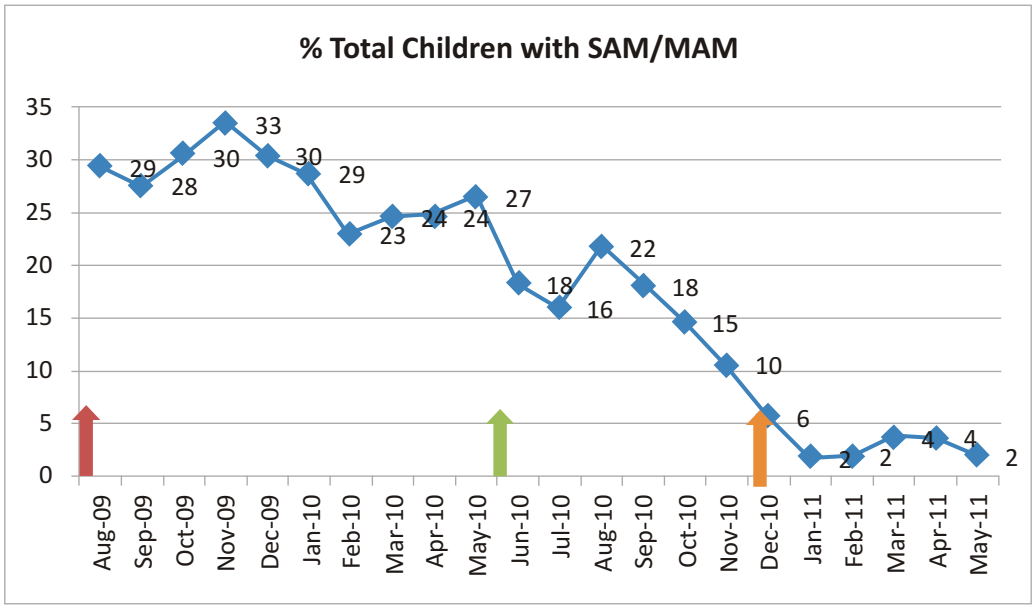


Figure 5 (the arrows indicate the three phases with different package of changes)

There were five deaths during the period. All of them seem to be unrelated to nutritional status. The five children died of different reasons: meningitis (died at GTB Hospital, was a MAM child, not on ART), cancer lung on chemotherapy (died at GTB hospital, was a MAM child, on ART), molluscum contagiosum (brought to home at the end stage from GTB Hospital, died, was a SAM child, not on ART), acute pain abdomen (consulted local doctor, died undiagnosed within one hour, normal nutrition status, on ART), one week high fever (died undiagnosed at GTB hospital, normal nutrition status, on ART); the deaths occurred in September 2009, November 2009, October 2010, February 2010 and May 2011 respectively.

Challenges

Over the course of implementation, the pilot encountered a host of challenges. These centered on health system gaps and difficulties in coordination of services.

First, throughout the pilot, readymade WHO F-75 and F-100 formulations could not be procured as planned because they were not available in the market. The team also felt that procurement of the F-75 and F-100 formulations was not sustainable for the long-term. As a result, a dietician was recruited to train the WAG…Chelsea social workers in preparing food similar to F-75 and F-100 formulation using locally available, low cost food. The dietician introduced individualized diet plans for children with SAM and MAM. Greater emphasis was placed on ensuring that children received adequate calories and micronutrients in their diets.

Due to human resource limitations and high patient load, GTB Hospital was not able to provide trainings on growth measurement, infant feeding practices and dietary needs specific to HIV infected children, preparation of nutrition and vitamin mix, and F-75 and F-100 formulations as initially planned. Initially, GTB hospital experienced difficulties in procuring one infantometer, height stand and digital weighing machine from their budget to be placed at the ART center; however this was realized in the third phase of the pilot project. The delay is an example of the multiple steps that are required for a government facility to procure new equipment.

A referral mechanism between WAG…Chelsea and Swami Dayanand Hospital (the Government designated nutritional rehabilitation center in the neighborhood) could not be established since the hospital was not able to accept direct referrals of HIV infected children from NGOs. As a result, all SAM/MAM children registered in the pilot QI project were treated for malnutrition in the community, mostly through WAG…Chelsea interventions. The few children who required hospitalization for OI treatment and/or were eligible and in need of ART were referred to GTB hospital.

From malnourishment to a normal nutritional status

Anil is 16 years old and belongs to a large family of five brothers and sisters. His father is a painter who has irregular work. In 2007, Anil was diagnosed with cancer and was admitted to hospital. He was in hospital for a long time and got HIV through a blood transfusion. He discovered his HIV status later. His health situation was further complicated with tuberculosis. He dropped out of school and came in contact with WAG…Chelsea in 2009. In August 2009, Anil's height was 141 cm and weight was 27 kgs. His BMI was 13.5 and he was diagnosed with severe acute malnutrition (SAM). He was on ART and cancer medication. Anil suffered with many opportunistic infections and lived in poor, unhygienic conditions. He was very selective about what he ate and was unable to digest food during his illness. WAG..Chelsea staff enrolled Anil into the nutrition rehabilitation program. His mother was given nutrition counseling. He was brought regularly to the drop-in-centre over a period of three months. He was provided with nutritious food – two major meals and three small meals. He was also provided with dry rations. He moved from SAM to MAM status, over a year after he started on the nutrition program. By January 2011, he attained normal nutritional status. His height was 149 cms, weight 36.5 kgs and BMI was 16.4. However, it was a challenge for the QI team to maintain his normal nutritional status. This was possible by continuous and rigorous follow up with Anil and his family. His mother also started attending cooking demonstrations and started taking interest in cooking more nutritious food at home.

During his sickness with pneumonia (Pneumocystis Carinii Pneumonia, PCP), a special meal was prepared by the paediatrician with additional 50% energy and 2 grams of protein requirement per Kg body weight. With close supervision and monitoring of his food intake, Anil was able to maintain his normal nutritional status. Anil has resumed attending school and is on four meals a day – three major and one small meal.

The hygienic conditions in his home have improved with the family learning about methods of water purification and storage from WAG...Chelsea. Anil feels healthier, goes to school regularly. His parents are also happy with the change in him.

BOX 3: A case study

Additionally, GTB hospital was able to introduce anthropometric measures in the ART OPD, place a dietician in the OPD, made changes in the OPD to enable same day lab testing, and provided preferred in-patient care for OIs to the children referred by the NGO.

Some children who were in SAM/MAM could not attend the nutrition rehabilitation program at the drop-in center due to limited mobility and family related challenges. In response, the pilot introduced

home-based nutritional rehabilitation during the third phase. Children were treated at home under daily supervision of social workers and counselors which included the provision of one major meal and three small meals.

Because the dietician was reluctant to visit homes and there was a need for early detection and management of medical problems in children, the QI team decided to hire a private pediatrician to monitor and provide treatment of malnutrition and general ailments at the community level.

Lastly, supplementary rations provided by WAG…Chelsea were used by the whole family and not by the child alone, a common occurrence among very poor families. Consequently, the children with SAM/MAM that are enrolled in the pilot do not obtain the necessary calories and vitamins required for good nutrition. In the future, additional changes should be considered in order to address this challenge.

Lessons Learned

This pilot is the first documented program for HIV infected children that utilized a quality improvement approach within the nutrition sphere in India. While initial results did not demonstrate immediate improvements, additional changes were made and in a few months significant changes were recorded. The staff also became increasingly familiar with the approach and benefited from the lessons learned about what worked and what did not.

Within resource constrained settings

The work demonstrated that it is possible to manage malnutrition among HIV-infected children in resource-constrained settings. Effective management can be accomplished in spite of limited funding, with the proper commitment of stakeholders, motivation of service providers, provision of training, and availability of counseling for parents and guardians. Issues surrounding household income, availability of nutritious and acceptable local foods, and healthy cooking methods must be addressed.

Through the QI study, I learnt about malnutrition. I also learnt that food helps in physical development and growth. I learnt about this through BMI, Height and weight – Mother of child who participated in nutrition program

Earlier, the children would prefer eating outside food. They did not like eating home food. But now after the cooking demonstration, I have learnt new recipes and my children prefer eating at home – Mother who participated in the program

Earlier, we would not take the height and weight measures. We did not realize their importance. After the QI was initiated, we started to take height and weight for children – ART center staff nurse

Box 4: Stakeholder perceptions of the QI Pilot

Managing malnutrition in public hospitals

The project highlighted that the overstretched public hospital found it difficult to bring in timely changes for effectively addressing management of malnutrition in HIV infected children in hospital. As a result the pilot increased the management of malnutrition at the community level.

Managing malnutrition at the community level

Malnutrition in HIV infected children was managed through a community based mechanism. Mobilizing local resources, including from faith-based agencies, supported the provision of rations to children from very poor households. Through customized diet plans, it was possible to provide adequate macro and micro-nutrients to children. Parents/and guardians were trained in preparing locally available, low cost meals for the child according to a customized diet plan. The project utilized trained staff that had a long association with the community; therefore staff was trusted by the community members in providing quality services to their children.

In the case of families with extreme poverty, results from the pilot suggest that food should be provided both for the child and the family. In case of orphans with non-supportive guardian or no guardian, management of malnutrition is a challenge. Other resources need to be mobilized for this group. The cluster mapping of malnutrition cases by WAG…Chelsea helped to more effectively target the intervention and extend services to the doorstep of households affected by HIV/AIDS. Community-based nutrition services are much more effective for HIV affected children than a hospital-based system. However, clear linkages must be established with the hospital for HIV infected children who may be in need of ART and treatment of OIs.

Importance of anthropometric measurement and analysis

The project highlighted the importance of recording and analysis of anthropometric measures regularly in children to detect, treat and prevent malnutrition in a timely manner. The project stresses the value of training local community workers on measurement, recording (in WHO growth charts) and analysis of anthropometric measures; feasible diet planning incorporating low cost nutritious food; and healthy cooking demonstrations. The project found that it is important to have a trained dietician and pediatrician (hired or linked) with knowledge of locally available, low cost nutritious food in order for proper advice and health screening.

Comprehensive approach to address malnutrition

The children targeted by the QI pilot were malnourished due to a variety of factors. On one hand children do not receive the right type and amount of food because of poverty their families simply cannot afford regular meals. Often parents/guardians are not aware of the quantity and types of food a child should be consuming, as well as methods of healthy cooking. On the other hand, common infections such as diarrhea and other water-borne diseases result into nutrient loss from the body of the children owing to drinking contaminated water and not practicing safe preventive health practices. An infection or sickness of a child also makes an additional drain on the scarce resources of caregivers. Given this reality, the project emphasized clean, safe drinking water, hygiene, OI prevention and treatment, diet maintenance in periods of illness, psychosocial support and counseling. The project had to focus on these other issues in order to be effective.

Quality improvement model

The QI initiative allowed the QI team to meet periodically, review interventions and results, and test new changes, resulting in success. The QI process helped the team to think of innovative sustainable changes in the absence of readymade WHO F-75 and F-100 formulations in the public health facility.

Recommendations

The quality improvement nutrition initiative suggests that government and non-government agencies need to develop policies which make nutrition counseling mandatory and therapy available through sustainable community and public health delivery systems.

The national and state level HIV/AIDS programs should train ART center and Community Care Center (CCC) staff to detect and manage malnutrition among HIV infected children. Currently, India's HIV/AIDS program emphasizes the treatment of OIs related to HIV and ART to HIV infected children through ART centers; and community follow-up through CCCs. Children on ART are expected to attend ART center clinics every month, which would be a good opportunity to address issues on nutrition among children, and identify and treat children with MAM and SAM.

Next, the Government of India's Integrated Child Development Services (ICDS) could strengthen their malnutrition management program to include HIV infected children. The ICDS staff should be trained on measurement, record and analysis of anthropometric measures, diet planning, recommendations of low cost nutritious foods and healthy cooking demonstrations. Nutrition advice to families should be based on what is feasible given their economic condition.

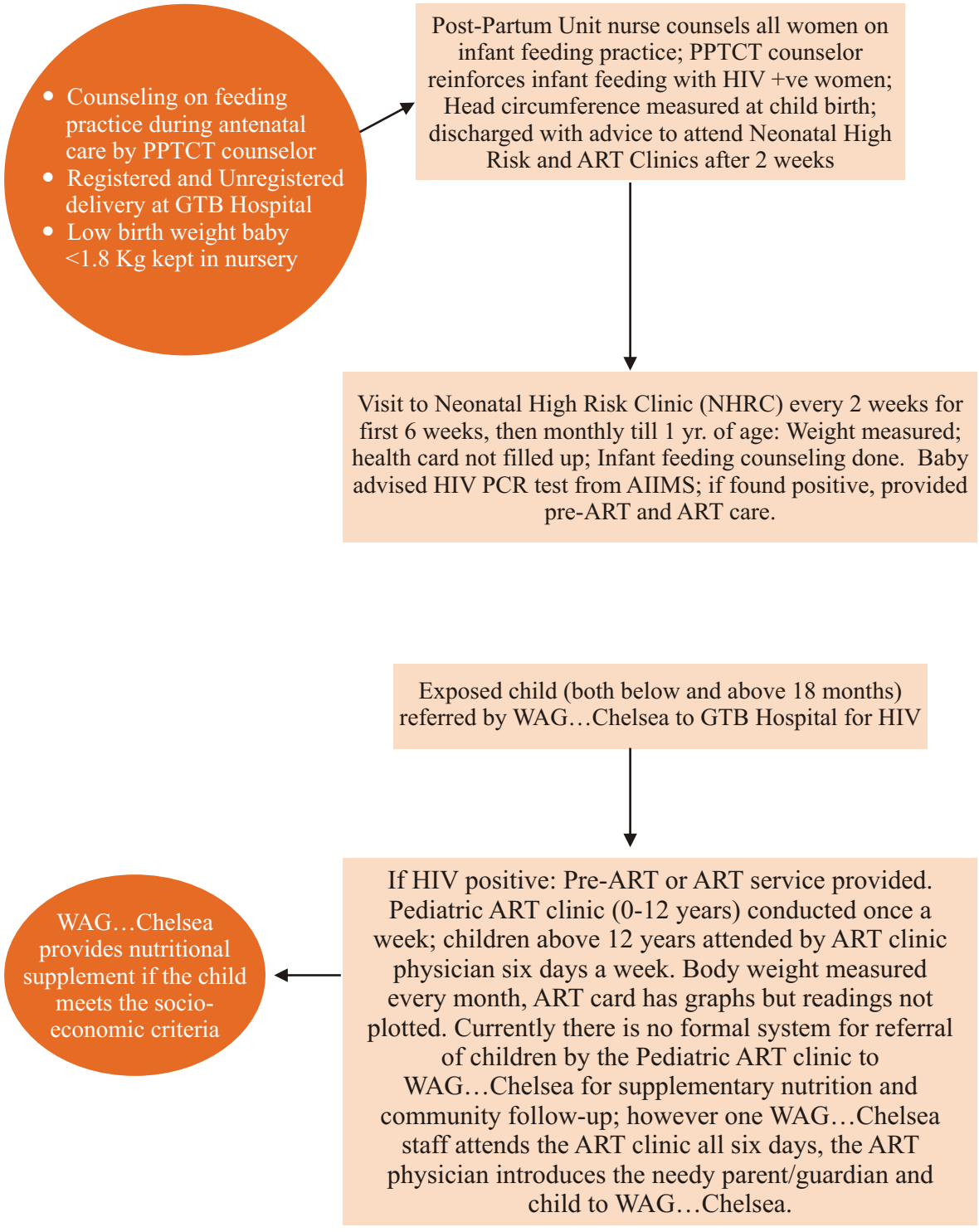
Finally, advocacy among a variety of stakeholders on the specific nutrition needs of children is crucial to scale up of quality child malnutrition programs. Initially advocacy efforts should be focused on the National Rural Health Mission (NRHM), the Government of India's large, flagship program on rural health and Ministry of Women and Child Development (MWCD), the focal government ministry for issues related to women and children.

Appendix 1: Quality Improvement Indicators

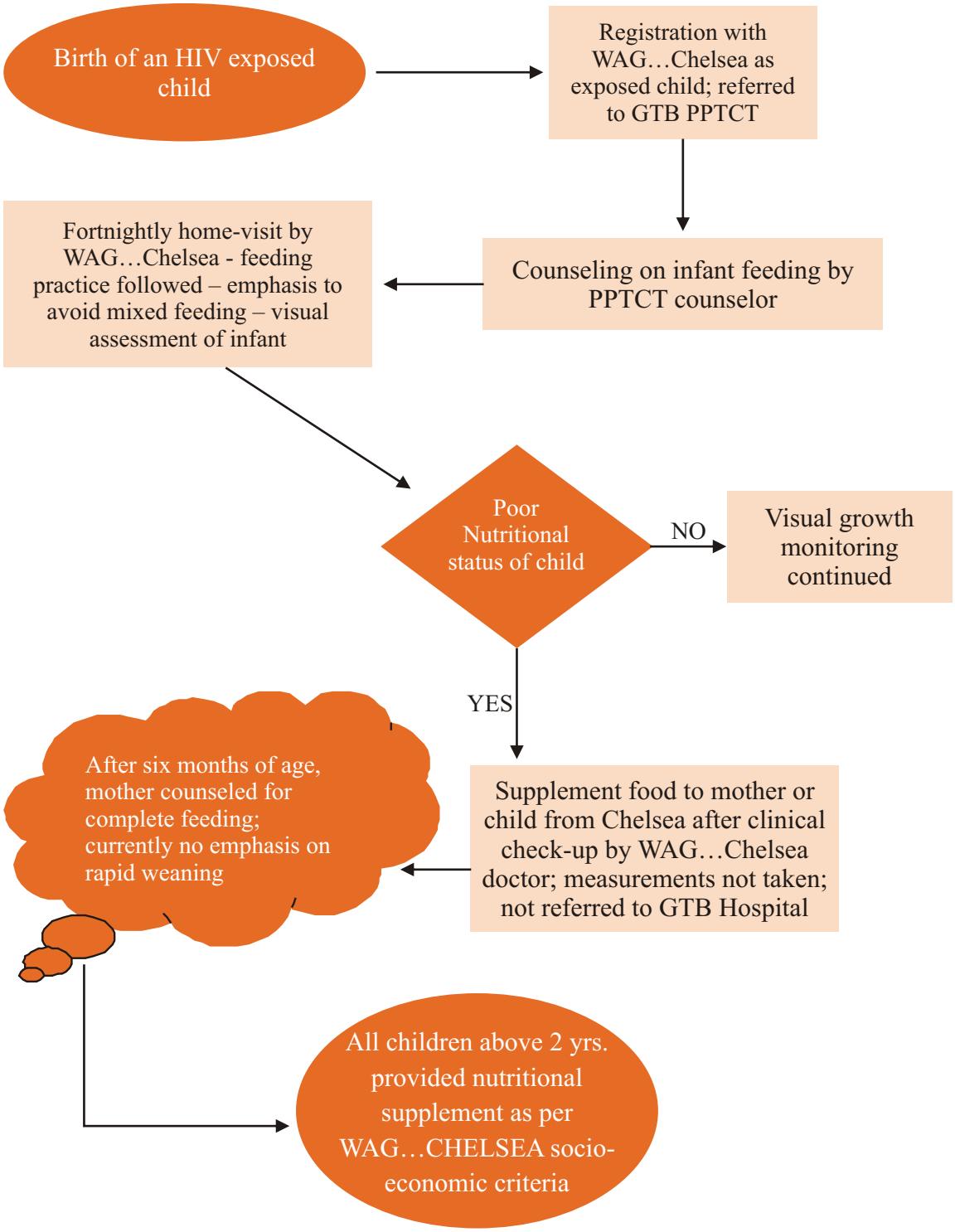
Type of Indicators
Input
1. GTB hospital sanctions budget for procurement of instruments
2. FHI360 sanctions budget for procurement of weighing machine by WAG...Chelsea
3. Number of trainings conducted by GTB and WAG...Chelsea
4. Number of demonstration sessions conducted each month
5. Number of formal meetings conducted between MS and ART HOD each month
6. Referral card developed by WAG...Chelsea
Output
1. The instruments are in place in GTB and WAG...Chelsea
2. Number of GTB and WAG...Chelsea staff trained in each topic
3. Number of mothers and/or family members attended the demonstration sessions each month
4. Type of issues discussed to improve the services of pediatric ART clinic (information collected from ART HOD each month)
5. Number and purpose of referrals made between WAG...Chelsea and GTB and vice versa each month
6. Number of specific cases of malnutrition discussed jointly by GTB and WAG...Chelsea each month
Outcome
1. GTB and WAG...Chelsea staff have the required instruments in working order to take measures
2. % of children whose growth charts is up to date each month
3. % of correct readings collected each month (determined by accuracy checks)
4. % of mothers and/or family members counseled on infant feeding practices (out of randomly selected sample each month)
5. % of mothers and/or family members provided information on nutritious food and hygiene (out of randomly selected sample each month)
6. Issues of inadequate space, equipment, manpower, clinic timing, waiting time and multiple visits addressed
7. % of malnutrition cases received focused attention by GTB and WAG...Chelsea each month
8. % of children under follow-up developing malnutrition (MAM/SAM) each month
9. % of children under follow-up demonstrating decrease in weight/MuAC/BMI (as applicable for age) each month
10. % of children with malnutrition (MAM/SAM) demonstrating increase in weight/MuAC/BMI (as applicable for age) each month
11. Time taken for a child to recover from SAM to MAM and MAM to normal (comparisons made every quarter)
Impact
% of HIV infected children (0-14) with malnutrition (MAM or SAM) disaggregated by age and sex

Appendix 2: Existing System for Providing Nutritional Support

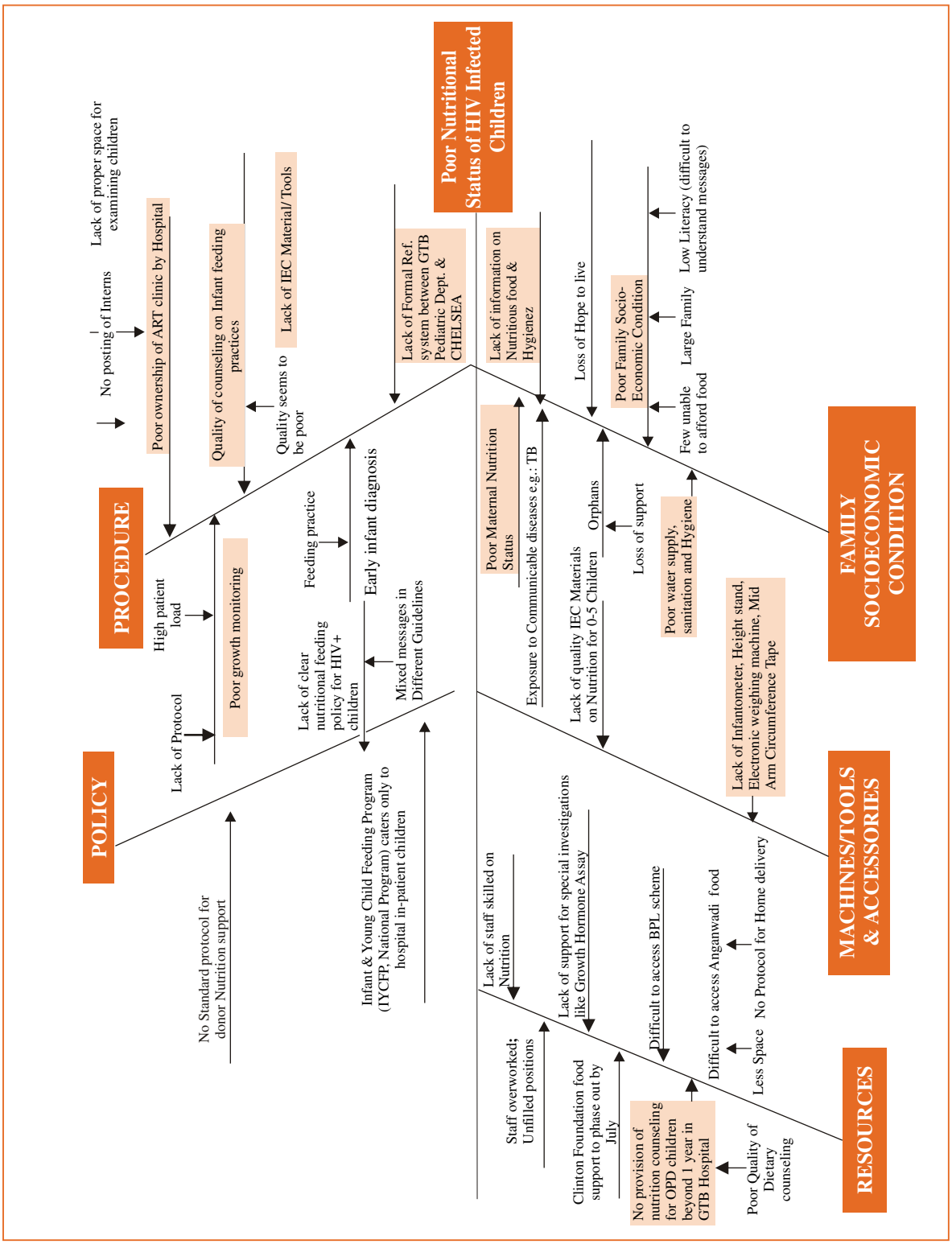
Receiving services primarily from GTB Hospital (March 2009)



Receiving services primarily from WAG...Chelsea (March 2009)



Appendix 3: Fishbone analysis



Appendix 4: Action Plan for system changes

Causes to be addressed	Actions to be taken by GTB Hospital	Actions to be taken by WAG…Chelsea
1. Lack of Infantometer, Height stand, Digital weighing machine, Mid-Arm Circumference (MuAC) Measuring Tape	■ GTB hospital will procure (from their budget) one infantometer, height stand and digital weighing machine specifically to be placed in the ART center. FHI 360 will supply MuAC measuring tape.	■ WAG…Chelsea to procure one digital weighing machine for its drop-in center
2. Poor Growth Monitoring	■ Dr Gomber to organize training of GTB staff involved in taking growth measurements of children in the hospital; WAG...Chelsea doctor would also participate as a trainer ■ GTB hospital to ensure growth measures are collected every month for all children attending the Pediatric ART center ■ GTB to initiate a process accuracy check of the measures	■ WAG…Chelsea doctor will train the project social workers (SW) on growth monitoring procedures and documentation; he/she will also conduct random checks of the measurements taken by them ■ WAG…Chelsea to place one social worker (SW) dedicated for taking the growth measures on Pediatric ART day (every Thursday, 2-4 PM) at GTB ART center ■ WAG…Chelsea SW to collect data in the pre-designed format (included below in the document) for QI project and required GTB documents; the SW will submit the format to WAG...Chelsea QI team for BMI calculation and interpretation ■ WAG…Chelsea will plot WHO growth charts for each child every quarter; copy of the growth charts will be shared with GTB Hospital for the doctor to explain to parent/ guardian during the visit for ART, WAG...Chelsea doctor will explain to parent/guardian of children not on ART ■ WAG…Chelsea will collect baseline measures for all 44 children in August and report them under normal, SAM & MAM categories.
3. Quality of counseling on Infant feeding practices	■ Dr Gomber to organize training of PPTCT counselor, post-partum unit nurses and ART counselor of GTB hospital on infant feeding practices; the training will provide the correct information on infant feeding and build skill on counseling	■ WAG...Chelsea counselors and social workers to attend the training conducted by GTB ■ WAG…Chelsea to collect feedback from randomly selected mothers and family members during home visits by social workers through a pre-designed questionnaire developed by WAG…Chelsea in consultation with GTB and FHI 360

Causes to be addressed	Actions to be taken by GTB Hospital	Actions to be taken by WAG… Chelsea
	techniques for communicating the information to mothers and her family members ■ Refresher training conducted every six months	
4. Lack of information on Nutritious food & Hygiene	■ GTB hospital dietician and Dr Gomber to train ART counselor, WAG…Chelsea Counselor and Social workers on dietary needs of HIV infected children, nutritious food & hygiene; locally available, low cost nutritious food; choice of menus; healthy methods of food preparation; preparation of diet chart; and monitoring of daily calorie input. ■ Refresher training conducted every six months	■ WAG…Chelsea counselors and social workers to attend the training conducted by GTB. ■ WAG…Chelsea will demonstrate healthy cooking methods and dishes, once in a month at its drop-in-center. ■ WAG…Chelsea to collect feedback from randomly selected mothers and family members during home visits by social workers through a pre-designed questionnaire developed by WAG…Chelsea in consultation with GTB and FHI
5. Poor ownership of ART clinic by Hospital	■ Medical Superintendent, GTB Hospital to discuss improvement of services for HIV infected children; adequate equipments, human resources, clinic timing suitable to children and families (to decrease waiting time and multiple visits for consultation and investigation)	■ To provide suggestions to Medical Superintendent (MS) for improving the services for HIV infected children
6. Lack of Formal Referral system between GTB Hospital Pediatric Dept. and WAG…Chelsea	■ Dr Gomber will introduce WAG…Chelsea to Pediatrics, Head of Department and other staff; the doctors and nurses will have contacts of WAG…Chelsea for referral	■ WAG…Chelsea to develop a formal referral card in consultation with GTB and FHI; the card will be used by different WAG…Chelsea staff (doctor, social worker, counselor, project manager) to refer children to GTB

Appendix 5: Training of WAG... Chelsea workers by pediatrician

1. Identifying training needs of workers: The workers were individually interviewed to understand their job responsibilities. Based on job responsibilities, nutrition experiences, problems faced, a training curriculum was designed.
2. The staff and workers were oriented on the importance of different macro and micronutrients. A different kind of approach had to be adopted with WAG…Chelsea workers as they had no academic degree in science or nutrition. Hence basic understanding of the triad between health, nutrition and HIV/AIDS was essential. The curriculum was converted into simple, non-scientific language, quoting examples from work experience of workers in the field (as described during their interviews). Practical problems related to nutrition and solutions, along with explanations built around them were used. Important issues like continuum of care and relation between it and chronic malnutrition were discussed.
3. Importance of weight and height, MuAC: Weight and height measurement and its importance as per the age of the child, stunting, wasting and underweight were explained. Individual weight and height of a child against standard height and weight as per reference provided by ICMR for particular age was discussed as this helped to detect chronic and acute malnutrition. BMI as an indicator and formula for BMI calculation along with charting on growth chart was explained.
4. Calculation of BMI
5. Diet Planning:
   - Diet History-Quality and Quantity of food consumed by family and child;
   - Diet Planning for normal child, during OI and convalescent phase; and
   - Diet planning with Calories and protein content adequacy for various age groups.
6. Counseling of parents on nutrition:
   - Demo diet planning of all enrolled children and interview parents and identify gaps in diet consumed and recorded by workers. This was more hands on and then implementation in the field was ongoing process;
   - Cooking menus and correlation with nutrition and budget spent on them to ensure sustainability; and
   - Interview of parents with workers on amount spent on food per capita and meal planning accordingly.
7. Counseling on:
   - Breast feeding, complementary feeding;
   - Nutrition for lean periods;
   - Water purification and storage methods;
   - Sanitation;
   - Personal, family and community hygiene;
   - Opportunistic infections and special nutrition needs; and
   - Correlation between poverty, socioeconomic status, water, sanitation, hygiene and malnutrition and role of frequent Inter personal communications (IPC) to amend it.

Appendix 6: Sample diet plans for children infected with HIV/AIDS

Sample diet plan of a child infected with HIV/ AIDS (without any ailments) 1-6 years

Name of the meal	Menu	Ingredients	Amount 2-3 years	Amount 4-6 years
Early Morning	Milk	Milk Sugar	1 Cup 200ml	1 Cup 200ml
Breakfast	Missi Roti with Jaggery **OR** Bread pakora **OR** Besan cheela with jaggery	Wheat flour Besan Jaggery Oil/ghee	1	1 ½ -2
Mid-morning	Seasonal fruit **OR** Peanut murmura	Fruit Peanut murmura	1 20g	1 30g
Lunch	Any Dal Rice Curd/raita	Dal Oil/ghee Rice Curd	¾ katori *consistency should not be watery* 1 tsp. 1 ½ ladles ½ katori	1 katori *consistency should not be watery* 2 ladles ½ katori
Evening tea	Banana/cheeku mashed in milk with Jaggery **OR** Bread-Gur with tea	Milk 100 ml Bread Jaggery	1 katori ½ Fruit ½ slice	1 katori 1 fruit 1 slice
Dinner	Seasonal vegetable/ green leafy vegetable Roti	Variable Wheat flour + soya bean flour	¾ katori 10 g each	1 katori 20 g each
Bed Time	Milk	Milk Sugar/jaggery	100 ml 7-10 g	100 ml 7-10 g

Sample Diet plan of children (6-12 years) infected with HIV/AIDS

Name of the meal	Menu	Ingredients
Early Morning	Milk	Milk Sugar
Breakfast	Missi Roti with Jaggery **OR** Bread pakora **OR** Besan cheela with jaggery **OR** Daliya with vegetables and curd	Wheat flour Besan Jaggery Oil/ghee
Mid-morning	Seasonal fruit **OR** Peanut murmura	Fruit Peanut murmura
Lunch	Any Dal Rice Curd/raita	Dal Oil/ghee Rice Curd
Evening tea	Vegetable Bonda OR Bread OR Suji Toast with Seasonal fruit and tea	Variable
Dinner	Seasonal vegetable/ green leafy vegetable Roti	Variable Wheat flour + soya bean flour
Bed Time	Milk **OR** Rice/Vermicelli Kheer with peanuts **OR**	Milk Sugar/jaggery

Appendix 7: Area-wise Clustering for QI Intervention-community based approach