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Evaluation of an Integrated Nurturing Care Activity to Improve Early Childhood Outcomes in Mozambique

Evaluation Baseline Report

DECEMBER 2023

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Acronyms

APE	*agente polivante elementare* (community health worker)
ASQ-3	Ages and Stages Questionnaire
CHC	Community Health Committee
CREDI	Caregiver Reported Early Childhood Development Instrument
DAZ	development-for-age z-score
DHS	Demographic and Health Survey
ECD	early childhood development
GAIN	Global Alliance for Improved Nutrition
GAMLSS	Generalized Additive Model for Location, Scale, and Shape
GSED	Global Scales for Early Development
IYCF	infant and young child feeding
MDAT	Malawi Developmental Assessment Tool
MICS	Multiple Indicator Cluster Survey
MISAU	Ministério da Saúde (Ministry of Health)
PHQ	Patient Health Questionnaire
SH	sanitation and hygiene
TN	Transform Nutrition
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
WHO	World Health Organization

Executive Summary

Background

Healthy development in a child's early years provides the foundation for educational achievement, economic productivity, lifelong health, strong communities, and successful parenting of the next generation (Black et al. 2022). As described in the Nurturing Care Framework, there is growing momentum for integrated programming across multiple sectors to improve child development outcomes, including health and nutrition, given the clear evidence base for nurturing care and the movement toward holistic rather than siloed services (WHO, UNICEF, and the World Bank 2018). The World Health Organization (WHO) guidelines for improving early childhood development (ECD) specifically recommend integrating nutrition and caregiving interventions based on the evidence of improved outcomes when using integrated approaches (WHO 2020).

In Mozambique, 72 percent of young children are at risk of poor development based on a composite indicator of stunting in children under 5 and exposure to extreme childhood poverty (Lu, Black, and Richter 2016). Building on the Government of Mozambique's work to integrate nurturing care for ECD into health and nutrition services, USAID Advancing Nutrition is supporting the local consortium, Transform Nutrition (TN), to improve ECD through integration of responsive care and early learning in community-based nutrition services in Nampula province and to support the enabling environment for those services. This report describes the baseline data collection activities and the baseline findings for the integrated nurturing care activity to improve early childhood outcomes implemented by TN with technical assistance from USAID Advancing Nutrition. The objectives of this evaluation are to:

- Understand the baseline care practices and developmental status of children ages 0 to 23 months whose caregivers are enrolled in TN community nutrition groups, and
- Collect data for the validation of the GSED for measuring overall child development in Mozambique.

TN has been implementing nutrition programming since 2021. Immediately after baseline data collection, the program began integrating additional content to support ECD into its programming in all study communities. Endline data will be collected one year after the baseline evaluation.

Methods

USAID Advancing Nutrition contracted data collection firm Maraxis to conduct the evaluation in Mozambique. The baseline evaluation, which included children 0 to 23 months of age, was quasi-experimental (non-equivalent comparison group) and combined a validation element for the GSED. Measures collected include socio-demographic characteristics of the caregiver and the child, socioeconomic status assessed using a wealth index, overall child development, early learning in the home, infant and young child feeding practices, child nutritional status, and the caregiver's mental health.

Baseline data collection through household surveys took place from February to March 2022 in 12 districts covering 97 communities in Nampula province. ECD interventions in the sampled districts

started after baseline data collection. Based on TN's programmatic considerations, the intervention and comparison districts were non-randomly assigned as follows:

- Six intervention districts: Nacala Porto, Larde, Lalaua, Rapale, Mossuril, and Meconta where caregivers will receive the integrated nurturing care package to improve ECD, which includes the standard nutrition and sanitation and hygiene (SH) package with additional content on responsive care, early learning, and child development
- Six comparison districts: Mecuburi, Memba, Murrupula, Mongicual, Angoche, and Mogovolas where caregivers will receive the standard nutrition and SH package.

This study aims to answer the following questions:

1. Does the integration of responsive care and early learning have a greater effect on ECD outcomes as compared to the nutrition/SH intervention alone?
2. What is the feasibility, acceptability, and implementation experience of integrating responsive caregiving and early learning messaging into a nutrition and SH platform by a local partner?
3. What was the experience of community actors and caregivers with identifying and referring children with developmental difficulties for additional services?
4. What is the concurrent validity of the GSED with the Ages and Stages Questionnaire (ASQ-3) in Mozambique?

This report summarizes the baseline findings related to research questions one and four. We did not collect data related to research questions two and three at baseline because they both examine experiences related to implementing new interventions and processes introduced as part of the intervention and, therefore, had not been implemented at the time of baseline data collection. Research questions two and three will be included in endline data collection.

Measures for research question one included children's overall development (ASQ-3), caregiving practices in the home (Multiple Indicator Cluster Surveys [MICS] Family Care Indicators and Nurturing Care Framework Early Learning Tool), infant and young child feeding (24-hour dietary recall), caregiver mental health (Patient Health Questionnaire [PHQ-9]), anthropometrics, and socio-demographic variables. Data was analyzed in Excel (descriptive statistics) and SPSS (inferential statistics) for the first research question. The chi-square test (or Fisher's exact test when assumptions of chi-square were not met) was used to determine any association between two categorical variables while the independent t-test or Kruskal-Wallis test was used to establish any statistically significant difference between means of continuous variables. Data analysis for the concurrent validity of the GSED was completed in R. GSED development scores or "D-scores" (Weber et al. 2019) were calculated using the latest GSED model, and a Generalized Additive Model for Location, Scale, and Shape (GAMLSS) was fitted to extract the effect of age resulting in a development-for-age z-score (DAZ) (outliers removed). To answer research question four, Pearson's correlations were calculated for correlation of the GSED DAZ with the ASQ-3.

Findings

A total of 961 caregiver-child dyads participated in household surveys in the study. Out of 961 caregiver-child dyads, 943 caregiver-child dyads were available to complete the full GSED. Findings from

key indicators are presented in annex 1, disaggregated by intervention and comparison group. Overall, 75.9 percent of children in the study were at risk for poor development in one or more domains of the ASQ-3,[1] with significant differences between the intervention (71.5 percent) and comparison (80.1 percent) groups. Regarding home environment support for children's learning, 1.6 percent of children in the sample had access to three or more books and approximately half (53.9 percent) of children had access to two or more types of playthings, such as homemade toys, household objects, or manufactured toys. In addition, 28.2 percent of children in the intervention group and 41.5 percent of children in the comparison group had been left alone or with a child younger than ten for at least an hour in the previous week. The study also found that almost one-quarter (23.4 percent) of caregivers had elevated symptoms of depression. Regarding feeding and nutrition, the study found significantly higher rates of wasting (23.7 percent vs. 18.3 percent), stunting (45.6 percent vs. 33.4 percent), and underweight (32.8 percent vs. 20 percent) in the comparison group than in the intervention group. The comparison group had a higher percentage of children 6-23 months who achieved minimum dietary diversity (10.9 percent) than the intervention group (4.2 percent), while a higher percentage of children in the intervention group (21.3 percent) achieved minimum meal frequency than the comparison group (11.1 percent). Overall, the proportion of children achieving a minimum acceptable diet was low (1.2 percent).

The GSED DAZ was significantly correlated with the ASQ-3 total sum scores ($r=0.53$, $p<0.001$), as well as each individual domain of the ASQ-3: communication ($r=0.34$, $p<0.001$), gross motor ($r=0.48$, $p<0.001$), fine motor ($r=0.22$, $p<0.001$), problem solving ($r=0.37$, $p<0.001$), and social skills ($r=0.32$, $p<0.001$).

Conclusions

The baseline study shows high rates of children who are at risk of developmental delay—nearly three in every four children. In addition, most home environments are not optimal for supporting young children's development as a result of high rates of depressive symptoms among the primary caregivers, limited engagement of adults in opportunities to support a child's early learning, and sub-optimal diets. Notably, there are significant differences in several key indicators across the intervention and comparison sites which will need to be addressed in the endline analysis. The concurrent validity results suggest the GSED is a valid measure of children's development.

[1] The five ASQ-3 domains are communication, gross motor, fine motor, problem solving, and personal-social.

Background

The U. S. Agency for International Development (USAID) recognizes early childhood as a critical stage of human development. The early experiences of infants and children directly affect their physical, cognitive, emotional, and social development, with lasting impact on later success in school and life (USAID et al. nd). The first 1,000 days from pregnancy through a child's second birthday are a critical period of rapid brain development. Good maternal and child nutrition, in addition to quality caregiver engagement and early learning, are critical to optimize brain development during this period (Black et al. 2017). Nearly 1,000 neural connections are formed every second in the first 1,000 days, a pace not matched during any other period in life (Georgieff, Ramel, and Cusick 2018). Children develop best in a nurturing environment that includes safe and secure surroundings, responsive parenting/caregiving, adequate health care and nutrition, and opportunities for stimulation and early learning (Britto et al. 2017).

There is growing momentum for integrated programming across multiple sectors to improve child development outcomes, including health and nutrition, given the clear evidence base for nurturing care, movement toward holistic rather than siloed services, and strong touchpoints of the health and nutrition sectors with pregnant women and young children during the first 1,000 days. The 2016 Lancet Early Childhood Development Series calls for existing maternal and child health services to include interventions on nurturing care to support families and reach young children. The 2020 World Health Organization (WHO) guidelines for improving early childhood development (ECD) also focus on the critical importance of integrating nutrition and caregiving interventions (WHO 2020). Compared to early childhood services implemented by a single sector, integrated interventions promoting positive parenting behaviors, responsive care, and early learning result in better outcomes for children and their families (Jeong, Franchett, and Yousafzai 2018). Evidence from low- and middle-income countries indicates that combined caregiving and nutrition interventions are effective in improving children's cognitive, language, and motor development, compared with care or nutrition interventions alone (Jeong et al. 2021).

Seventy-two percent of young children in Mozambique are at risk of poor development based on a composite indicator of stunting in children under 5 and exposure to extreme household poverty (Lu, Black, and Richter 2016). Global research shows that physical stunting is associated with poor cognitive development (Black et al. 2017). Further, the Nurturing Care Country Profile data for Mozambique indicates that less than half (41 percent) of infants under 6 months of age exclusively breastfeed, only 11 percent of children have a minimum acceptable diet, 33 percent are engaged in activities to promote early learning, and only 3 percent have playthings at home (UNICEF 2019). These results demonstrate a need to support parents and caregivers in Mozambique to provide nurturing care for young children, particularly around adequate nutrition, responsive care, and early learning. A small pilot of the International Child Development Program in Maputo included a parenting program that showed promise in strengthening positive caregiver and parenting practices, parenting self-efficacy, and well-being, as well as improving child behavior for preschool age children (3–4 years) (Skar et al. 2014). In addition, the scale-up of community *escolinhas* (community-based preschools targeting children ages 3–5 years) improved children's development outcomes—including cognitive ability, problem-solving ability, fine motor skills, socio-emotional development, and behavioral outcomes—as well as school readiness and

enrollment into primary schools (Martinez, Naudeau, and Pereira 2012). However, programming in the first 1,000 days to improve ECD is nascent in Mozambique.

Following the endorsement of the Nurturing Care Framework for promoting optimal ECD outcomes by the World Health Assembly in 2018, WHO issued global evidence-based guidelines for improving ECD. One of the four recommendations is for countries to promote integration of caregiving interventions, namely those focused on responsive care and early learning, into nutritional programming (WHO 2020). The promotion of holistic nurturing care is gaining momentum in Mozambique, with efforts at the national and provincial levels to integrate responsive care and early learning into health and nutrition programs. With support from PATH and the United Nations Children's Fund (UNICEF), the government has integrated light touch responsive care messaging into the community-based Nutrition Interventions Package (*Pacote de Intervenções de Nutrição*) and the *agentes polivalentes elementares* (APEs or community health workers) training package at the community level. The responsive care content covers brief communications messaging for caregivers on responding to children's needs and is included in the communications materials provided to APEs; however, the content is not covered in training. At the facility level, nurturing care and child development has been integrated into the well-child and the sick-child consultation registers, the infant and young child feeding (IYCF) strategy, and the inpatient protocols and tools within the national Nutrition Rehabilitation Program (*Programa de Reabilitação Nutricional*). The Ministry of Health (MISAU) created an inter-sectoral ECD technical working group in early 2020 to define the agenda for promoting optimal ECD outcomes, including nutritional programming. In addition, PATH, UNICEF, and other organizations conducted a pilot intervention in Monapo District in Nampula Province to test integration of nurturing care activities at the health facility and community levels while engaging in advocacy and promotion at the provincial level. The pilot demonstrated the feasibility of integrating support for ECD into health systems (Jeong et al. 2022).

Building on the government's momentum in integrating nurturing care for ECD into health and nutrition services, USAID Advancing Nutrition provides technical assistance to the local consortium Transform Nutrition (TN), to improve ECD through integrating responsive care and early learning into community-based nutrition services and to support the enabling environment for those services. This support includes ensuring high-quality service delivery at the community level with an intensified package to promote nurturing care through a structured parent group model using evidence-based approaches. USAID Advancing Nutrition also provides technical assistance to the maternal and child health project Alcançar to support the monitoring children's development and counseling through child health services at health facilities. In addition, USAID Advancing Nutrition works closely with the government to conduct advocacy at provincial and national levels to advance the promotion of holistic nurturing care for young children to improve ECD outcomes.

Study Objectives

The study's objectives are (1) to understand the effect of integrating responsive care and early learning into a nutrition and sanitation and hygiene (SH) platform on early childhood development outcomes; (2) to document the feasibility, acceptability, and implementation experience of integrating a responsive care and early learning intervention into a community-based nutrition and SH delivery platform; and (3) to contribute to global learning on a standard tool for monitoring ECD for children ages 0–3. The study

findings will be used by USAID Mozambique and other stakeholders who are considering integrated approaches to improve children's development outcomes and contribute to the global evidence base on nurturing care.

Evaluation and Research Questions

This study aims to answer the following questions:

1. Does the integration of responsive care and early learning have a greater effect on ECD outcomes compared to the nutrition/SH intervention alone?
2. What is the feasibility, acceptability, and implementation experience of integrating responsive caregiving and early learning messaging into a nutrition and SH platform by a local partner?
3. What was the experience of community actors and caregivers with identifying and referring children with developmental difficulties for additional services?
4. What is the concurrent validity of the Global Scale of Early Development (GSED) with the Ages and Stages Questionnaire (ASQ-3) in Mozambique?

This report summarizes the baseline findings related to research questions one and four. Data on research questions two and three were not collected at baseline because they both examine experiences related to the new interventions and processes introduced as part of the intervention and had not been implemented at the time of baseline data collection. We will collect data related to questions two and three during the endline assessment.

Methods

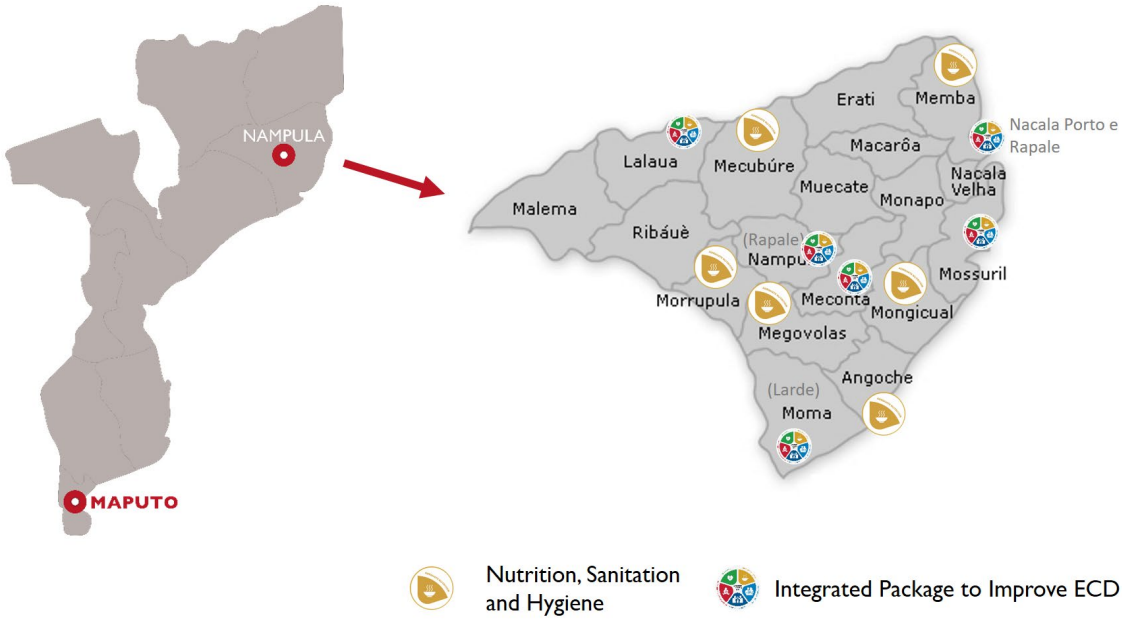
Study Design

This quantitative study was a quasi-experimental (non-equivalent comparison group) household survey and combined a validation element for the GSED.

Setting

The study took place in Nampula Province in northern Mozambique across the 12 districts supported by TN. The 12 districts are divided into two groups of six: one group will receive the additional components to improve ECD and the other will receive the standard nutrition and SH package from TN. TN assigned the districts to either the integrated intervention or standard package groups (non-random assignment). TN selected smaller districts for the expanded interventions based on feasibility and alignment of complementary support from the Global Alliance for Improved Nutrition (GAIN) and USAID Advancing Nutrition. The six intervention districts for the integrated package are Nacala Porto, Larde, Lalaua, Rapale, Mossuril, and Meconta (see figure 1). The six comparison districts receiving the standard nutrition and SH program are Mecubure, Memba, Murrupula, Mongicual, Angoche, and Megovlas. Data for this baseline study was collected from 97 communities randomly selected across the 12 districts.

Figure 1. Study Districts



Intervention Description

Programmatic Approach in All Districts

At the community level, TN implements a multi-pronged approach with several interventions delivered concurrently to the same populations of pregnant women, caregivers of children from 0–23 months, and community influencers. TN began implementing community-based nutrition, sanitation, and hygiene activities in all communities in 2021 and included ECD in non-study communities in the ECD districts. In study communities within the ECD districts, TN started implementing the ECD community-level activities immediately after the baseline data collection. The project works with the government's Community Health Committees (CHCs) and Co-Management Committees to mobilize communities, promote health and nutrition, and improve links with community health workers and health facilities. Front-line community-based staff—APEs, TN-supported health promoters (working in areas where APEs are not available), and TN-supported volunteer nutrition group leaders—also mobilize community members, deliver nutrition services, and promote social and behavior change interventions. For the nutrition groups, each APE and/or health promoter mobilizes 10 volunteers who become the nutrition group leaders; they, in turn, mobilize the nutrition groups made up of pregnant and lactating women and other influential community members. Using a manual appropriate for caregiver group interventions, the nutrition groups learn and exchange knowledge and skills while following a structured program facilitated by the nutrition group leaders. The nutrition group leaders also conduct home visits to follow-up with caregivers participating in the community group, focusing on those who need additional support. Community radio and video messaging is used to complement these activities. TN used this programmatic approach across both the intervention and comparison districts.

Integrated Package to Improve ECD

The activities to improve ECD are embedded into the TN activities in the six intervention districts (figure 2), including promoting responsive care, early learning and development monitoring through the community nutrition groups, home visits, and radio/video spots. Annex 2 summarizes the topics covered in the community nutrition groups. District-level community radio services broadcast programming using existing radio materials previously developed for Nampula by PATH. In addition, the CHCs received training on responsive care, early learning, and child development to integrate into their community mobilization roles. To improve identification of children with developmental difficulties, USAID Advancing Nutrition is promoting the use of the Child Health Card. The card includes developmental milestones by age within nutrition groups to help caregivers monitor their child's development. APEs will be trained to refer children who are not meeting the developmental milestones for their age to the health facility for additional support. USAID Advancing Nutrition is partnering with USAID-funded bilateral Alcançar to strengthen health facility support for child development.

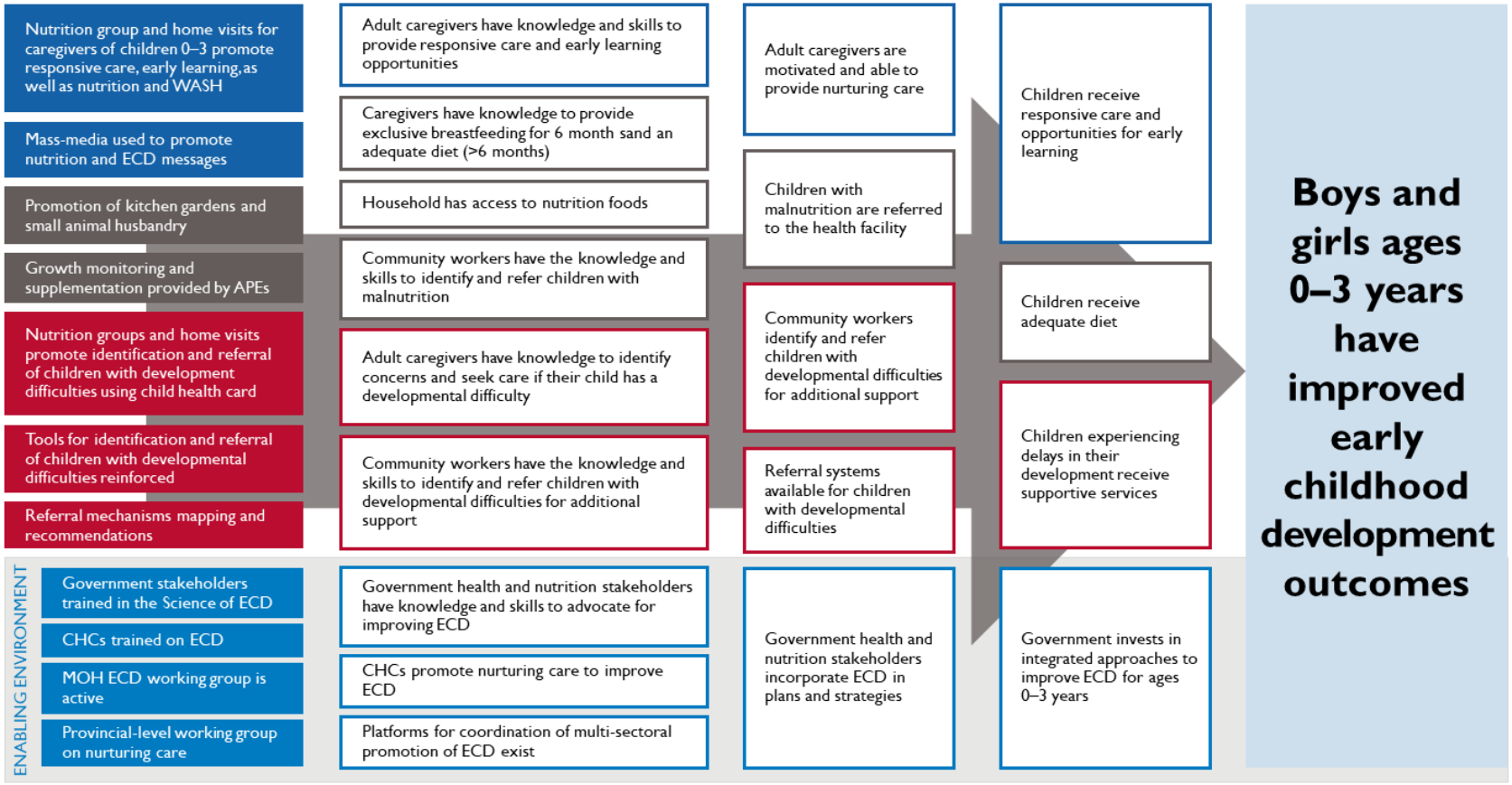
In addition to community-level activities, to promote integration of evidence-based approaches to improve ECD in the first 1,000 days into routine services, USAID Advancing Nutrition also specifically supports the enabling environment for improving ECD through collaboration with government and key stakeholders at the national and sub-national levels. USAID Advancing Nutrition's support at the sub-national level is focused on the provincial government, which oversees all districts in Nampula. USAID

Advancing Nutrition also supports the district governments in the six intervention districts. Support to the provincial and district government includes coordination meetings and engagement in supportive supervision. In addition, USAID Advancing Nutrition works to strengthen the linkages between TN's community-based activities and health facility services by partnering with Alcançar to strengthen support for ECD at health facilities. This support leverages a health facility package to improve ECD developed by the MISAU which uses the Malawi Developmental Assessment Tool (MDAT) abbreviated for clinical encounters to identify children with developmental delays.

Sampling

Sampling involved a two-stage process for enrolling a cohort of caregivers with children 0–2 years of age (<24 months at baseline) who were enrolled in community nutrition groups at the time of data collection. The same children will be assessed at endline. First, communities were randomly sampled from the 12 target districts (more communities were selected in larger districts with more communities) and then caregiver-child dyads were randomly sampled from those communities. The target child age strata was in ranges from 0–2 months, 3–5 months, 6–8 months, 9–11 months, 12–17 months, and 18–23 months of age at baseline. At endline, which will occur around one year after baseline, children's ages will range from approximately 12 to 35 months. A target total of 931 caregiver-child dyads surveys were needed, with 465 each in the intervention and comparison groups. This sample size assumes an effect size of 0.3 on overall child development, based on a medium effect size from several systematic reviews of parenting interventions (Jeong et al. 2021; Prado et al. 2019) and a design effect of two to anticipate clustering by the nutrition groups (i.e., some of the caregiver-child dyads will come from the same nutrition groups), as well as a 25 percent loss to follow-up between the baseline and endline assessments. This assumes the maximum design effect based on a random sample of

Figure 2. Theory of Change for Integrated Package to Improve ECD



Source: USAID Advancing Nutrition 2021

caregivers from any group. The sample size will allow for comparison of impact on child development outcomes for all children combined, but not for disaggregated impact of the program by age strata. Age will still be controlled and adjusted for in the calculation of child development outcomes.

Sampling Study Communities

The number of randomly sampled communities in each district depended on the total number of communities in that district, meaning that each community had the same chance of being sampled across all districts. A total of 931 caregiver-child dyads were to be covered in the 12 districts for an average of 78 caregiver-child dyads per district. With ten caregiver-child dyads sampled per community, this translates to an average of 7.8 communities per district. Due to differences in the number of communities per district, ranging from 83 to 300, the number of communities sampled per district ranged from 4 to 11. To guarantee that the baseline was not biased by implementation prior to data collection, only communities in the intervention districts where the ECD training for volunteers had not started were selected. A random selection of communities per district was completed using a web-based random number generator. Cyclone Gombe hit Nampula in March 2022 and caused flooding and infrastructure damage that made several of the initially sampled communities inaccessible. These communities were replaced by back-up communities from the randomly sampled community list.

Sampling Caregiver-Child Dyads

Following random selection of the communities, USAID Advancing Nutrition worked with TN to provide lists of eligible caregivers and their children from those communities. TN staff, primarily nutrition group leads and APEs working in the communities, developed the lists. Ten caregiver-child dyads were sampled in each community, with the aim of having an equal distribution of children across six age brackets at baseline for the total sample (0-2 months, 3-5 months, 6-8 months, 9-11 months, 12-17 months, and 18-23 months). The stratified sampling approach aimed to have a distribution of children across the full age range in the final sample.

The caregiver-child dyads recruited had to fulfill the following eligibility criteria:

- The caregiver should be enrolled in a community nutrition group.
- The caregiver is the primary caregiver of the child (i.e., the one who provides daily care) and is not necessarily the biological mother/father of the child.
- The caregiver is 18 years or older and provided consent to participate.
- The child is less than 24 months old and in the correct age bracket (ages were verified using the child inoculation card if available)

The caregiver-child dyads lists in each community were randomized to include many different age groups of children represented in the top 20 to have children spanning the full age range from 0 to 23 months in the sample. After randomization, each caregiver-child dyad received a sequence number starting from 1 to n. The enumerators used the sequential order of the randomized list to find the caregiver-child dyad, starting at the top with number one and working their way down to the list until ten caregiver-child dyads participated in each community.

Measures

The primary outcome of interest is children's overall development, which was measured using the ASQ-3 (Squires, Bricker, and Twombly 2009). The ASQ-3 assesses children's overall development through a caregiver report and has been used previously in Mozambique (Martinez, Naudeau, and Pereira 2012). The research team selected the ASQ-3 as the gold standard measurement for children's development based on its prior use in the Mozambican context, feasibility of completing the caregiver report measure alongside the direct GSED direct assessment measure, and feasibility for use to validate the GSED (e.g., the comparison measure could not be one of the three tools used to inform the GSED [McCray et al. 2023]). The five domains of development measured on the ASQ-3 are fine motor, gross motor, communication, problem-solving, and personal-social skills. Each caregiver is asked 30 questions from an age-specific form based on their child's age in months and days. In this study, we used 12 different ASQ-3 forms at baseline (2-month, 4-month, 6-month, 8-month, 10-month, 12-month, 14-month, 16-month, 18-month, 20-month, 22-month, and 24-month forms).

In addition, we used the GSED long form, short form, and psychosocial form as a secondary measure of children's overall development as part of the validation of the GSED. The WHO is currently completing validation of the GSED in six countries (Bangladesh, Brazil, Ivory Coast, Pakistan, Tanzania, and the Netherlands). This study is testing the GSED through the WHO's Opportunistic Testing program to assess the use of the GSED in an intervention evaluation. The GSED combines direct observation (long form), caregiver reports on developmental milestones (short form), and child behaviors (psychosocial form) and is a global tool for measuring children's developmental outcomes for ages 0–3 years (GSED Team 2019). It provides a holistic measure of childhood development and assesses cognitive, socio-emotional, language, and motor skills to calculate a developmental score (D-score) that is reported at the population level. This D-score can be monitored over time and across groups of children. Each GSED form has one tool, and questions asked or observations made will vary based on the child's age and the responses to GSED questions or observations. The GSED is based on existing validated tools, including the Caregiver Reported Child Development Index (CREDI), MDAT, and the infant and young child development indicators (McCoy et al. 2018; Gladstone et al. 2010; and Lancaster et al. 2018).

In addition to our primary outcome of interest, secondary outcomes include the child's nutritional status, which was measured using standard anthropometric procedures to assess weight-for-age (underweight), weight-for-length (wasting), and length-for-age (stunting) according to WHO Growth Standards.[2] Z-scores were calculated using WHO software and according to WHO guidance. Important intermediate outcomes focus on early learning in the home environment, child supervision, caregiver mental health, and IYCF. Child feeding was measured using a 24-hour dietary recall (UNICEF et al. 2018). Early learning was measured with both the Family Care Indicators (Kariger et al. 2012) and a new measure of early learning focused on children ages 0 to 3 years (Hentschel, Yousafzai, and Aboud 2020). Inadequate supervision was measured using the UNICEF MICS tool (UNICEF et al. 2018). See table 1 for additional information on each measure.

[2] The study protocol called for length measurements for all children in the study, according to WHO protocol. Some children were measured standing (height) and corrections were made in the analysis.

Using the Demographic and Health Survey (DHS) questionnaires, demographic covariates were measured using child age, child sex, caregiver age, caregiver level of education, relationship of the caregiver to the child, and socio-economic status. In addition, the study measured caregiver capabilities (Matare et al. 2015), such as caregiver mental health, using the Patient Health Questionnaire-9 Mozambique (PHQ-9-MZ) (Cumbe et al. 2020).

Table 1: Study Measures Conducted for Each Caregiver-Child Dyad

Outcome	Measure	Scoring
Overall child development	Primary Measure: ASQ-3	Continuous sum score of all items and by each of the five domains (fine motor, gross motor, personal-social, problem solving, and communication) as well as categorical (on track or at risk of developmental delay) based on standardized cut points for each domain on each ASQ-3 form (e.g. 2 months, 4 months, etc.)[3] (Squires, Bricker, and Potter 2009).
	Secondary Measure: GSED	"D-score" adjusted for age z-scores (DAZ)
Child growth	Wasting (Weight-for-length/height z-scores <-2 standard deviations)	Continuous z-scores based on WHO growth standards and binary (yes/no)
	Stunting (length/height-for-age z-scores <-2 standard deviations)	Continuous z-scores based on WHO growth standards and binary (yes/no)
	Underweight (weight-for-age z-scores <-2 standard deviations)	Continuous z-scores based on WHO growth standards and binary (yes/no)
Early learning in the home environment	Support for learning	Binary (yes/no) for adult engagement in four or more activities to support the child's learning in the three days prior to the survey
	Availability of children's books and playthings	Binary (yes/no) for the availability of three or more children's books and binary (yes/no) for having two or more playthings in the home
	Nurturing Care Framework Early Learning Tool	Continuous sum score of the number of items marked as yes that support children's learning (past 24 hours)

[3] To assess changes over time, we will convert ASQ-3 scores to within sample z-scores at endline.

Outcome	Measure	Scoring
Inadequate supervision	UNICEF MICS	Binary (yes/no) for being left alone or in the care of a child under 10 years for one hour or more in the prior week
Infant and young child feeding	24-hour dietary recall	Binary (yes/no) for exclusive breastfeeding <6 months and binary (yes/no) for minimum acceptable diet
Caregiver mental health (depression)	PHQ-9-MZ	Continuous sum score and binary cutoff validated in Mozambique (>=9)

Data Collection Processes

All enumerators received training on the data collection tool, ethics, and data collection processes using KoboCollect and the GSED long form application on tablets prior to data collection. Details on preparing the enumerators to use the GSED are included in annex 3. Enumerators were organized into six teams including a supervisor and two assessors. Each supervisor was responsible for introducing the team to the district authorities before starting data collection in the selected community. For each community, the team followed a consistent process for informing the APE/volunteer(s) in the community, selecting households from the sampling list, and seeking consent at the household prior to conducting the interviews and assessments. The child was only required to be present for the GSED long form. The other questionnaires were administered without the presence of the child. The assessment teams administered all tools (with the exception of GSED long form including the informed consent note) on the first day of data collection in the household, which took an average of one hour. Participants were randomly assigned to go through the GSED short form or ASQ-3 first so about half of participants received the GSED short form before the ASQ-3 and about half after the ASQ-3. The GSED long form was completed on a second day of data collection (ideally the next day, but always within three days of the first day of data collection in the household) and took an average of 25 minutes, though times varied depending on the age of the child.

The data collection teams implemented COVID-19 risk prevention measures as follows: interviews were conducted outside whenever a private location was possible; all team members were checked daily for symptoms; interviewers kept a physical distance of two meters from participants; interviewers used face masks and provided them for the respondents; and interviewers used hand sanitizers before and after all interviews. For travel within the areas, teams used a dedicated car with a private driver. The driver and team members were instructed to wear masks in the car and to use hand sanitizer before and after travel. The team members ensured proper cleaning and disinfecting of study tools used during assessments, including toys, scales, height boards, and any other materials, before using them in the next household.

The conditions for data collection posed a significant challenge. When data collection started, Nampula had recently been hit by tropical storm Ana in January 2022, and roads were not in good condition. Some were very muddy, some areas were risky to pass, and certain areas were only accessible by boat every three days. Cyclone Gombe hit in March 2022, causing extensive infrastructure damage and limiting access to some of the sampled communities. As a result, the research team was required to select alternative communities. This situation did not affect or change the sampling approach, and the communities that could not be accessed were replaced using the same random sampling methods. The tropical storm and cyclone did not cause long-term interruptions to intervention delivery. However, these events are likely to have affected family livelihoods and well-being and to have contributed to displacement, all of which can affect children's development.

Analysis

Indicators were calculated according to standard indicator definitions (annex 4). Frequencies and means of the different indicators were calculated in Excel and disaggregated based on the child's sex, socioeconomic status, caregiver education, and study group (intervention/comparison). Inferential statistics were calculated in SPSS. The chi-square test (or Fisher's exact test when assumptions of chi-square were not met) was used to determine any association between two categorical variables while the independent t-test or Kruskal-Walli test was used to establish any statistically significant difference between means of continuous variables. A principal component analysis was used to calculate the relative wealth following standard processes for constructing a wealth index (Rutstein and Johnston 2004).

GSED development scores or "D-scores" (Weber et al. 2019) were calculated using the latest GSED model. The GSED model (294_0) will not be the final model used for GSED analysis; however, this is the current model developed based on Phase 1 data from the GSED valuation across three countries with a sample of more than 4,000 children. Then, a GAMLSS was fitted to extract the effect of age resulting in DAZ. Outliers, or children whose values were outside the 95 percent quantiles, were removed, and the GAMLSS model was refitted. To answer research question two, Pearson's correlations were used for analyzing concurrent validity of the GSED with the ASQ-3.

Ethics

All caregivers provided written informed consent for themselves and their child to participate in the study. The JSI institutional review board reviewed the study and deemed it exempt. Both the UniLurio institutional review board in Mozambique and the WHO institutional review board (GSED validation component only) approved the study.

Results

Study Participants

A total of 961 caregiver-child dyads participated in the study. The average age of participating children was 11.7 months and 53.4 percent (n=513) were female (table 2). The majority of participating primary caregivers were female (97.0 percent, n=932), and 96.5 percent (n=927) of primary caregiver participants were the child's biological mother. Only 3 percent of primary caregivers across both study groups were male. The average age of the child's mother was 27.1 years, and on average 5.3 people were living in each household. Overall, 37.3 percent (n=358) of caregivers had completed no formal education, and 24.0 percent (n=231) were able to read and write. The majority of the children's fathers were living in the home (75.2 percent, n=723), and most primary caregivers were currently married (65.7 percent, n=631) or living together (20.2 percent, n=194).

There were a few significant differences between the intervention and comparison groups. The intervention group had a higher percentage of literate caregivers (29.6 percent vs. 18.6 percent) and fewer caregivers who had completed no formal education (26.0 percent vs. 40.8 percent). The comparison group had a higher proportion of female index children (47.5 percent vs. 59.2 percent). There also were significant differences in the mean age of children in the intervention and comparison groups (11.1 months vs. 12.2 months) and the mean age of mothers (27.7 years vs. 26.5 years). Annex 5 provides disaggregation of children's age groups by study district, which did not vary significantly across districts (p=0.399).

Table 2. Participant Demographic Characteristics

	Comparison		Intervention		Total	
	N	%	N	%	N	%
Total	485	100	476	100	961	100
Child's sex*						
Female	287	59.2	226	47.5	513	53.4
Male	198	40.8	250	52.5	448	46.6
Child's age in months*						
<6 months	84	17.3	96	20.2	180	18.7
6-11 months	144	29.7	165	34.7	309	32.2
12-17 months	142	29.3	129	27.1	271	28.2
18-23 months	115	23.7	86	18.1	201	20.9
Child's age in months (mean, SD)*	12.2 (mean)	6.19 (SD)	11.1 (mean)	5.97 (SD)	11.7 (mean)	6.10 (SD)
Primary caregiver's sex						

	Comparison		Intervention		Total	
	N	%	N	%	N	%
Female	468	96.5	464	97.5	932	97
Male	17	3.5	12	2.5	29	3.0
Primary caregiver's relationship to child*						
Biological mother	468	96.5	459	96.4	927	96.5
Biological father	17	3.5	10	2.1	27	2.8
Other	0	0	7	1.5	7	0.7
Current marital status of the primary caregiver						
Not in union	70	14.4	66	13.9	136	14.2
Living with partner	103	21.2	91	19.1	194	20.2
Married	312	64.3	319	67	631	65.7
Highest level of education completed for the primary caregiver*						
None	214	44.1	144	30.3	358	37.3
Primary	251	51.8	286	60.1	537	55.9
Secondary or higher	20	4.1	46	9.7	66	6.9
Primary caregiver is able to read/write*						
No	395	81.4	335	70.4	730	76
Yes	90	18.6	141	29.6	231	24
Child's father is living in the home						
No	126	26	112	23.5	238	24.8
Yes	359	74	364	76.5	723	75.2
Child's father's highest level of education completed*						
None	129	27.6	76	16.4	205	22
Primary	137	29.3	156	33.6	293	31.4
Secondary or higher	45	9.6	81	17.5	126	13.5
Unknown	157	33.5	151	32.5	308	33
Child's father is able to read and write*						
No	174	37.2	128	27.6	302	32.4

	Comparison		Intervention		Total	
	N	%	N	%	N	%
Yes	226	48.3	254	54.7	480	51.5
Don't know	68	14.5	82	17.7	150	16.1
Age of the child's mother in years*	27.6 (mean)	7.7 (SD)	26.6 (mean)	7.3 (SD)	27.1 (mean)	7.5 (SD)
Number of people living in the household*	5.2 (mean)	1.7 (SD)	5.4 (mean)	1.9 (SD)	5.3 (mean)	1.8 (SD)

*p<0.05

Child Development Outcomes

The primary outcome of overall child development was measured using the ASQ-3 and reported as a total sum score (table 3), as well as a percentage of children at potential risk of developmental delay in terms of overall development (table 4) and five domains: gross motor, fine motor, communication, problem solving, and personal social skills.[4] The mean sum score on the ASQ-3 was 168.0 (out of a maximum of 300). There were significant differences in the ASQ-3 sum score overall in the intervention (mean=175.9) and comparison groups (mean=160.3) and significantly higher scores in the intervention group in the domains of gross motor (37.9 vs. 32.9), fine motor (37.4 vs. 32.2), and communication (34.9 vs. 31.2). There were no significant differences in problem solving (33.5 intervention vs. 32.5 comparison) and personal social (32.3 intervention vs. 31.6 comparison) domains.

[4] Children are categorized as at risk for potential developmental delay on the ASQ-3 if their score falls below ASQ-3 standardized cut-points for their age in any one of the five domains. Cut-points are published in the ASQ-3 User Guide.

Table 3. Sum Scores on the ASQ-3

	Total ASQ		Communication		Fine Motor		Gross Motor		Problem Solving		Personal Social	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Overall	168.0	64.0	33.0	17.8	34.8	18.2	35.4	18.3	33.0	18.0	31.9	16.7
Child's sex												
Female	166.8	63.7	32.6	17.6	34.1	18.0	35.3	18.6	32.8	18.0	32.0	16.9
Male	169.5	64.4	33.4	18.1	35.5	18.4	35.5	18.1	33.2	18.0	31.9	16.6
Highest level of education completed for the primary caregiver												
None	165.3	65.5	32.2	17.8	33.4	18.7	35.3	18.4	33.3	17.8	31.1	16.0
Primary	168.2	64.1	33.4	17.9	35.4	18.1	35.0	18.5	32.4	18.1	32.0	17.6
Secondary or higher	182.1	52.7	34.1	17.4	36.9	16.1	39.3	15.8	35.7	17.8	36.1	13.2
Wealth quintile												
Lowest	154.5*	64.2	30.1*	18.8	31.6*	19.0	33.2*	19.0	30.1*	18.2	29.6*	17.0
Second	160.5*	67.1	31.6*	17.9	32.9*	18.1	33.1*	18.3	32.4*	18.4	30.5*	17.3
Middle	172.1*	66.0	35.8*	17.6	35.4*	17.5	35.4*	18.2	33.0*	18.7	32.7*	16.8
Fourth	168.5*	59.1	33.2*	16.8	36.4*	18.2	34.2*	17.8	32.8*	16.7	32.0*	16.0
Highest	184.6*	59.6	34.3*	17.6	37.6*	17.8	41.1*	17.2	36.6*	17.4	35.0*	16.1
Study group												
Comparison	160.3*	63.1	31.2*	17.8	32.2*	17.6	32.9*	18.4	32.5	17.6	31.6	16.9
Intervention	175.9*	64.1	34.9*	17.7	37.4*	18.5	37.9*	17.9	33.5	18.4	32.3	16.6

*$p<0.05$

Overall, 24.1 percent of children were on track across all five domains of development on the ASQ-3 (table 4), with 73.1 percent on track in the communication domain, 56.4 percent in fine motor, 59.9 percent in gross motor, 60.6 percent in problem solving, and 58.3 percent in the personal social domain. The overall proportion of children on-track was significantly higher in the intervention group compared to the comparison group (31.2 percent vs. 22.4 percent), with domain specific proportions significantly higher in the intervention group for gross motor (65.8 percent vs. 54.0 percent) and fine motor skills (62.4 percent vs 50.5 percent). There was a statistically significant difference across wealth quintiles in the percent of children developmentally on track.

Table 4. Percent of Children Developmentally On-Track on the ASQ-3

	Communi-cation		Fine Motor		Gross Motor		Problem Solving		Personal Social		On Track in All 5 Domains	
	N	%	N	%	N	%	N	%	N	%	N	%
Overall	697	73.1	538	56.4	571	59.9	578	60.6	556	58.3	230	24.1
Child's sex												
Female	370	72.7	284	55.8	306	60.1	304	59.7	294	57.8	122	24.0
Male	327	73.5	254	57.1	265	59.6	274	61.6	262	58.9	108	24.3
Highest level of education completed for the primary caregiver												
None	250	70.4	191	53.8	214	60.3	217	61.1	198	55.8*	81	22.8
Primary	396	74.2	305	57.1	314	58.8	317	59.4	309	57.9*	129	24.2
Secondary or higher	51	78.5	42	64.6	43	66.2	44	67.7	49	75.4*	20	30.8
Wealth quintile												
Lowest	131	68.9	95	50.0	105	55.3*	97	51.1*	101	53.2	31	16.3*
Second	133	68.6	103	53.1	107	55.2*	120	61.9*	106	54.6	44	22.7*
Middle	147	77.4	106	55.8	116	61.1*	116	61.1*	112	58.9	54	28.4*
Fourth	143	75.7	115	60.8	107	56.6*	112	59.3*	111	58.7	42	22.2*
Highest	143	74.9	119	62.3	136	71.2*	133	69.6*	126	66.0	59	30.9*
Study group												
Comparison	340	70.4	244	50.5*	261	54.0*	281	58.2	276	57.1	96	19.9*
Intervention	357	75.8	294	62.4*	310	65.8*	297	63.1	280	59.4	134	28.5*

Secondary Outcomes

Early learning

Children's books are not widely available across Nampula, as seen in the data with only 1.6 percent (n=15) of children overall having access to three or more children's books (table 5). The comparison group had a lower percentage of children with three or more books at 0.4 percent (n=2) as compared to the intervention group with 2.7 percent (n=13). The availability of playthings in the home included homemade toys, household objects used for play, and manufactured toys. About half of children (53.9 percent, n=518) had access to two or more types of playthings, which was similar across the intervention and comparison groups. The availability of playthings increased significantly as the primary caregiver's education level increased. The most commonly available items in the home for play were household objects (82.1 percent). Homemade toys (53.5 percent) and manufactured toys (21.4 percent) were less common (figure 3).

Children's engagement with an adult in four or more different activities to support learning (reading books, stories, songs, going outside, playing, or naming/counting/drawing) was low (4.2 percent, n=40), and it was significantly lower in the intervention (2.5 percent) than the comparison (5.8 percent) group.

Figure 3. Availability of Different Playthings in the Home

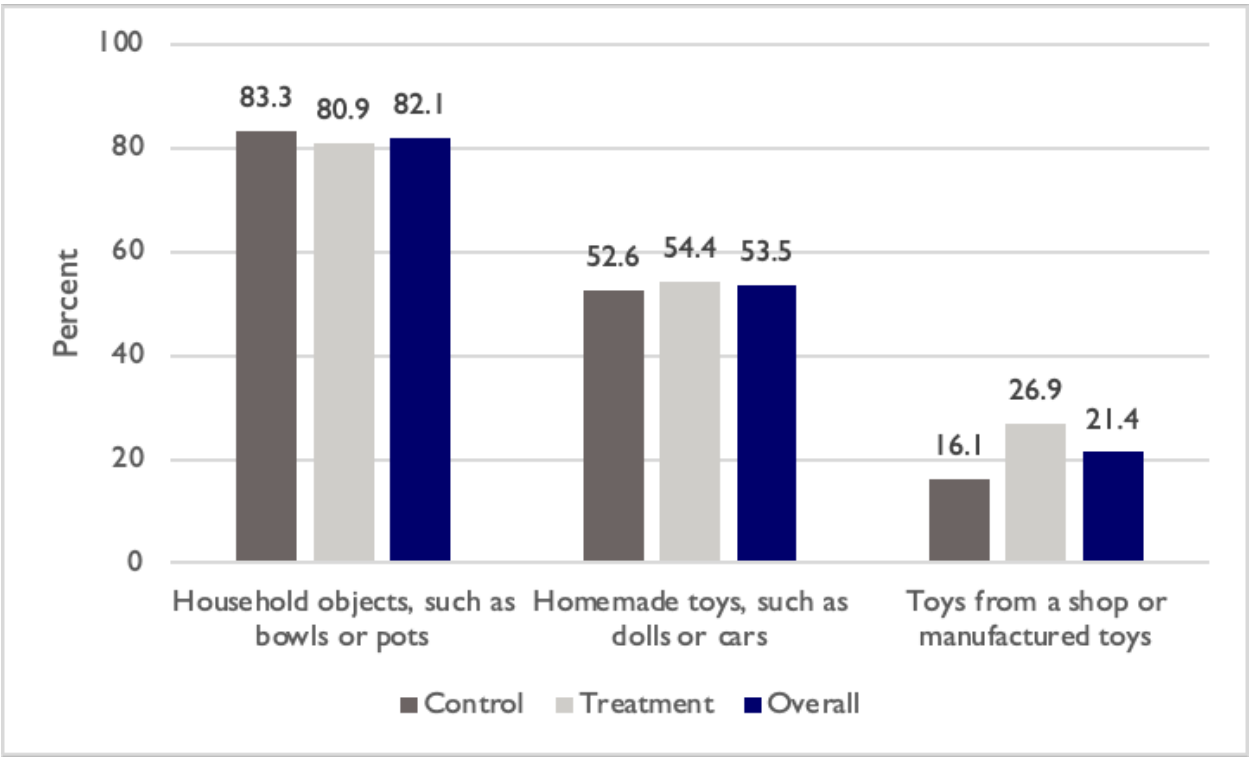


Table 5. Home Environment Support for Children's Learning

	Child has three or more children's books		Child plays with two or more types of playthings		Adult caregiver has engaged in four or more activities to support learning in the past three days	
	N	%	N	%	N	%
Overall	15	1.6	518	53.9	40	4.2
Child's sex						
Female	7	1.4	275	53.6	25	4.9
Male	8	1.8	243	54.2	15	3.3
Highest level of education completed for the primary caregiver						
None	2	0.6	164	45.8*	11	3.1
Primary	13	2.4	312	58.1*	25	4.7
Secondary or higher	0	0.0	42	63.6*	4	6.1
Wealth quintile						
Lowest	2	1.0	103	53.6	8	4.2
Second	2	1.0	106	54.6	6	3.1
Middle	2	1.0	104	54.5	7	3.7
Fourth	6	3.1	98	51.0	6	3.1
Highest	3	1.6	107	55.7	13	6.8
Study group						
Comparison	2	0.4*	258	53.2	28	5.8*
Intervention	13	2.7*	260	54.6	12	2.5*

*p<0.05

Child nutritional status

The study found very high rates of undernutrition in the study sample among children 0–23 months (table 6), with 39.5 percent (n=381) of children stunted (low length-for-age), 21.0 percent wasted (low weight-for-length), and 26.4 percent underweight (low weight-for-age) with significantly higher rates of all three forms of undernutrition among the comparison group compared to the intervention group. The mean age of children who were wasted (10.9 months and SD 6.0) was lower than children who were not wasted (11.9 months and SD 6.1, p=0.03); however, the mean age of children who were stunted

(13.6 months and SD 5.7) and underweight (12.5 months, SD 5.5) was higher than children who were not stunted (10.4 months and SD 6.0, p<0.001) or underweight (11.4 months and SD 5.5, p=0.01). There are no recent DHS data for children 0–23 months in Nampula; however, the 2011 DHS found that among children under five in Nampula, 55 percent were stunted, 16 percent were underweight and the wasting prevalence was 7 percent (MISAU 2011). The 2021 TN baseline survey, conducted in March 2021 among children 0–23 months in the six Nampula study districts, found a higher underweight prevalence (31.5 percent) and lower wasting prevalence (11 percent) than this baseline study (Mozambique Monitoring and Evaluation Mechanism and Services 2021).

Table 6. Child Nutritional Status[5]

	Stunting		Wasting		Underweight	
	N	%	N	%	N	%
Overall	380	39.5	202	21.0	254	26.4
Child's sex						
Female	278	54.2*	119	23.2	183	35.7*
Male	102	22.8*	83	18.5	71	15.8*
Highest level of education completed for the primary caregiver						
None	167	46.6*	67	18.7	102	28.5
Primary	187	34.8*	119	22.2	137	25.5
Secondary or higher	26	39.4*	16	24.2	15	22.7
Wealth quintile						
Lowest	82	42.7	43	22.4	53	27.6
Second	76	39.2	37	19.1	56	28.9
Middle	74	38.7	40	20.9	54	28.3
Fourth	78	40.6	44	22.9	53	27.6
Highest	70	36.5	38	19.8	38	19.8
Study group						
Comparison	221	45.6*	115	23.7*	159	32.8*
Intervention	159	33.4*	87	18.3*	95	20.0*

*p<0.05

Infant and young child feeding

Around two-thirds of children ages 0–5 months were exclusively breastfed (68.6 percent, n=120/175), which was similar across intervention and comparison groups (table 7). This is lower than what was found in the TN baseline (77.4 percent) (Mozambique Monitoring and Evaluation Mechanism and Services 2021) and higher than the national level rates from the last DHS (2011), which showed only 40.0 percent of children 0–5 months in Mozambique were exclusively breastfed (MISAU 2011).

[5] USAID Advancing Nutrition and Maraxis teams are further reviewing anthropometric data over data quality concerns to inform improvements at endline. A number of unusual trends in nutritional status were observed in the baseline study findings that warrant additional attention.

Adequate complementary feeding was less common, with only 7.7 percent (n=60) of children ages 6–23 months meeting expected minimum dietary diversity and 14.6 percent (n=114) meeting minimum meal frequency. Overall, only 1.2 percent (n=9) of children 6–23 months received a minimum acceptable diet. The 2021 TN baseline found a similar proportion of children receiving a minimum acceptable diet (1.1 percent), but reported a lower percentage of children receiving minimum dietary diversity (2.6 percent) and a higher proportion meeting the minimum meal frequency (29.3 percent). (Mozambique Monitoring and Evaluation Mechanism and Services 2021). Diet varied significantly between the intervention and comparison groups with a higher percentage of children ages 6–23 months in the intervention group meeting the minimum meal frequency cut-off (19.5 percent vs. 10.0 percent) but a lower percentage of children achieving minimum dietary diversity (4.2 percent vs. 10.9 percent) than the comparison group. Overall, 2 percent of children in the intervention group met the cutoff for minimum acceptable diet, compared to 0.3 percent of the comparison group, a significant difference.

Table 7. Infant and Young Child Feeding Indicators

	Infants 0–5 months who are exclusively breastfeed			Children 6–23 months with minimum dietary diversity			Children 6–23 months with minimum meal frequency		Children 6–23 months with minimum acceptable diet	
	Number of infants 0–5 months	N	%	Number of children 6–23 months	N	%	N	%	N	%
Overall	175	120	68.6	781	60	7.7	114	14.6	9	1.2
Child's sex										
Female	85	56	65.9	421	32	7.6	60	14.2	8	1.9*
Male	90	64	71.1	360	28	7.8	54	15.1	1	0.3*
Highest level of education completed for the primary caregiver										
None	62	36	58.1	298	21	7.0*	28	9.5*	2	0.7
Primary	101	76	75.2	432	30	6.9*	78	18.1*	6	1.4
Secondary or higher	12	8	66.7	51	9	17.6*	8	14.8*	1	1.9
Wealth quintile										
Lowest	34	28	82.4	159	9	5.7	19	12.1	0	0.0
Second	32	22	68.8	155	12	7.7	25	15.5	3	1.9
Middle	34	23	67.6	154	15	9.7	19	12.1	0	0.0

	Infants 0–5 months who are exclusively breastfeed			Children 6–23 months with minimum dietary diversity			Children 6–23 months with minimum meal frequency		Children 6–23 months with minimum acceptable diet	
	Number of infants 0–5 months	N	%	Number of children 6–23 months	N	%	N	%	N	%
Fourth	36	23	63.9	157	10	6.4	25	16.2	2	1.3
Highest	39	24	61.5	156	14	9.0	26	17.1	4	2.6
Study group										
Comparison	82	58	70.7	402	44	10.9*	40	10.0*	8	2.0*
Intervention	93	62	66.7	379	16	4.2*	74	19.5*	1	0.3*

*p<0.05

Supervision

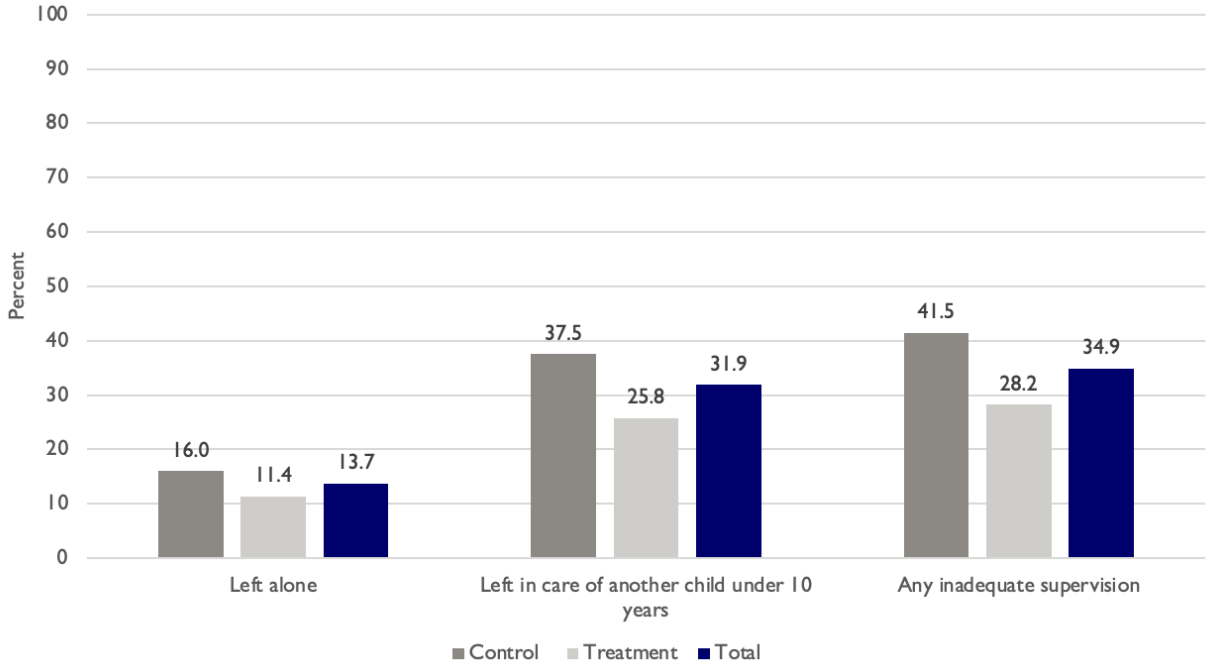
Inadequate supervision is defined as a child under the age of five years being left alone or in the care of another child under 10 years for one hour or more on at least one day in the week prior to the survey (UNICEF 2018). There was a statistically significant difference between the comparison and intervention groups (table 8), with significantly more children in the comparison group exposed to inadequate supervision (41.5 percent, n=201) compared to the intervention group (28.2 percent, n=134). Inadequate supervision was significantly associated with lower levels of the primary caregiver's education and there were significant differences across wealth quintiles.

Table 8. Percentage of Children Exposed to Inadequate Supervision in the Past Week

	Children left alone or in the care of a child under 10 years for an hour or more in the past week (N=960)	
	N	%
Overall	335	34.9
Child's sex		
Female	191	37.2
Male	144	32.2
Highest level of education completed for the primary caregiver*		
None	145	40.5
Primary	166	31.0
Secondary or higher	24	36.4
Wealth quintile*		
Lowest	54	28.1
Second	65	33.5
Middle	80	42.1
Fourth	63	32.8
Highest	73	38.0
Study group*		
Comparison	201	41.5
Intervention	134	28.2

*p<0.05

Figure 4. Type of Inadequate Supervision by Study Group



Caregiver's mental health

Depression among primary caregivers was measured using the PHQ-9, which has been validated in Mozambique (Cumbe 2020). Scores above the cut point indicated elevated symptoms of depression that would warrant further professional assessment for diagnosis. Overall, 23.4 percent of primary caregivers reported elevated symptoms of depression (table 9), which was consistent across the intervention and comparison groups. The percent of caregivers with elevated symptoms of depression was significantly associated with education and wealth, with lowest levels of depression symptoms among caregivers who had completed primary school and generally increasing levels of depression in higher wealth quintiles.

Table 9. Primary Caregiver Mental Health

	Primary caregivers with elevated symptoms of depression		Sum Score on PHQ-9	
	N	%	Mean	SD
Overall	225	23.4	5.4	4.4
Child's sex				
Female	124	24.2	5.4	4.4
Male	101	22.5	5.4	4.4
Highest level of education completed for the primary caregiver				
None	110	30.7*	6.3	4.7*

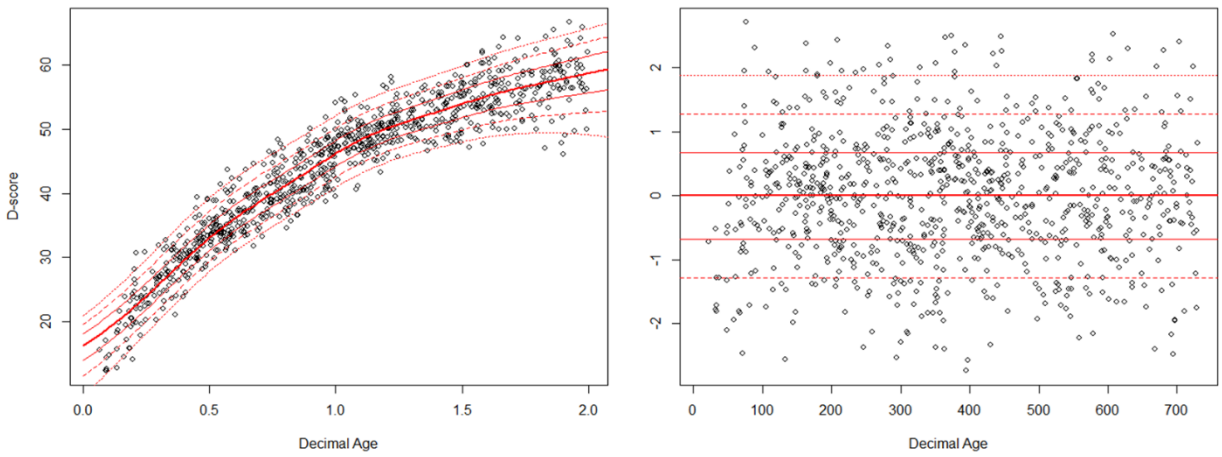
	Primary caregivers with elevated symptoms of depression		Sum Score on PHQ-9	
	N	%	Mean	SD
Primary	96	17.9*	4.7	4.1*
Secondary or higher	19	28.8*	5.5	4.5*
Wealth quintile				
Lowest	34	17.7*	5.0	4.3*
Second	34	17.5*	4.4	3.8*
Middle	55	28.8*	6.3	4.4*
Fourth	49	25.5*	5.5	4.7*
Highest	53	27.6*	5.7	4.4*
Study group				
Comparison	109	22.5	5.6	4.0*
Intervention	116	24.4	5.1	4.8*

*p<0.05

GSED Validation

Only 943 caregiver-child dyads, out of the sample of 961, completed the GSED long form. The GSED long form was completed the day after the other measures at a time agreed upon by the enumerator and caregiver on the first day of data collection. However, 18 of the caregivers were not available the following day due to various reasons (e.g., child was sick, other emergencies, prohibited by the husband, emergency travel, among others). The GSED was analyzed using GAMLSS models, and 52 outliers were removed for the purpose of validation analysis. The age-adjusted d-scores follow expected patterns for age (figure 5, left), and development-for-age z-scores (right) show good distribution.

Figure 5. Plotting Age-Adjusted D-Scores on the GSED



Note: Age in the left figure is plotted in years and in the right figure in days.

We assessed concurrent validity of the GSED by comparing the GSED DAZ with the ASQ-3 (table 10). The GSED DAZ was significantly correlated with the ASQ-3 total sum scores (r=0.53, p<0.001), as well as each individual domain of the ASQ-3: communication (r=0.34, p<0.001), gross motor (r=0.48, p<0.001), fine motor (r=0.22, p<0.001), problem solving (r=0.37, p<0.001), and social skills (r=0.32, p<0.001).

Table 10. Concurrent Validity with the ASQ-3

ASQ-3 Component	Pearson's correlation (r)	Effect size (D)
Total sum scores	0.052***	0.91***
Sum scores on the communication domain	0.34***	0.74***
Sum scores on the gross motor domain	0.48***	0.89***
Sum scores on the fine motor domain	0.33***	0.64***
Sum scores on the problem solving domain	0.37***	0.68***
Sum scores on the personal social domain	0.32***	0.55***

*p<0.05, **p<0.01, ***p<0.001

Discussion

The baseline findings of this study highlight the importance of integrated support for young children's growth and development in Nampula, Mozambique, given high rates of children at risk of developmental delays and undernutrition. The high proportion of children at risk for potential developmental delays shown in this study (75.9 percent) is consistent with estimates that 72 percent of children are at risk for poor development in Mozambique due to stunting and extreme poverty (Lu et al. 2016). While the high malnutrition rates were the impetus for the Multisectoral Action Plan for the Reduction of Chronic Undernutrition in Mozambique, efforts to address children's development are in the early phases. These findings highlight the urgent need to better support children's overall development.

This study also provides new insights into the caregiving practices for young children in Nampula Province for which there is limited data. One positive outcome observed was that at least half of the children surveyed had access to two or more playthings, with nearly all children playing with household objects. However, nurturing care practices to support early learning through increased caregiver-child interactions and improved infant and young child feeding require strengthening. The intervention plans are well aligned with these gaps identified at baseline, given that the primary focus of the community nutrition groups is to promote optimal infant and young child feeding practices, and responsive care and early learning have been integrated into the groups in the intervention districts.

One notable finding is the high proportion of the primary caregivers with elevated symptoms of depression—nearly one in four caregivers studied. The planned intervention does not have a specific component focused on addressing depression. A small pilot is ongoing in Mozambique to strengthen identification of maternal depression (PATH 2021), and the government has committed to integrating mental health services into primary health care (dos Santos et al. 2016). However, additional efforts are needed to improve caregiver well-being.

The study contributes to global efforts to provide valid measures for children's development. The baseline findings show concurrent validity between the GSED and the ASQ-3. The endline study will further contribute to learning about the use of the GSED for assessing program impact.

Limitations

This study has some limitations. Due to heavy rains (cyclone Gombe) during data collection, some of the communities that had been randomly selected were inaccessible and had to be replaced by the back-up communities. The evaluation is not a randomized study, and districts were assigned to the intervention group by TN based on convenience. We found significant baseline differences between the intervention and comparison groups on key demographic and outcome variables. For example, related to our primary outcome of children's development, the intervention group had a higher proportion of children on track in all five domains. A difference-in-differences approach will be applied for endline analysis, but the non-equal intervention and comparison groups is a limitation. Another limitation is the lack of a validated measure for child development outcomes in Mozambique. However, this study will contribute to a global effort to validate the GSED across multiple countries, and the GSED itself was designed based on tools that had been validated in settings similar to Mozambique. An additional limitation is that,

due to time and available resources, the study used the ASQ-3, which relies on caregiver recall rather than direct observation. Furthermore, the measurement of nurturing care relies on available measurement tools based on Western measures, which may not fully capture the diversity of ways that caregivers in Nampula province work to support their children's development (Scheidecker et al. 2022). However, these tools do provide helpful insight into the caregiving practices in Nampula province and are widely used in national surveys. Lastly, we found higher than expected rates of children underweight and with wasting, which may be a result of our specific sample of participants not being representative of the general population of Mozambique and facing higher vulnerabilities leading to malnutrition or because of issues with the anthropometric measurements. Additional attention will be given to this issue at endline, and additional local trainers have been engaged to improve the validation processes for endline anthropometrics along with several additional data quality indicators.

Conclusion

The study found a high proportion of children at risk for developmental delay and with undernutrition, suboptimal support for early learning, and inadequate diets among the sample in Nampula. Furthermore, caregivers in the sample reported a high degree of symptoms of depression indicating an urgent need to better support caregivers for their own wellbeing and for that of their children. The concurrent validity results suggest the GSED is a valid measure of children's development. Endline data will be collected in 2023 and will contribute to the evidence base showing integrated approaches to improving nurturing care practices support optimal child development outcomes, as well as to evidence on the use of the GSED in programmatic evaluations.

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Annex 1: Summary of Key Study Indicators

Significant differences ($p<0.05$) between the intervention and comparison group are indicated with an asterisk.

Indicator	Intervention	Comparison	Total
Child Development Outcomes			
Total sum score on all five ASQ-3 domains[6]*	175.9	160.3	168.0
Percent of children at risk for poor development[7] in one or more domains of the ASQ-3*	71.5%	80.1%	75.9%
Home Environment Indicators			
Mean number of activities to support learning with any adult household members (out of maximum of six)	1.5	1.5	1.5
Percent of children whose caregiver engaged in four or more activities to support learning*	2.5%	5.8%	4.2%
Percent of children who have three or more children's books*	2.7%	0.4%	1.6%
Percent children who play with two or more types of playthings	54.6%	53.2%	53.9%
Mean number of stimulating engagement activities by a caregiver (out of maximum of 14)	4.7	4.9	4.8
Percent of children experiencing inadequate supervision*	28.2%	41.5%	34.9%
Feeding and Nutrition Indicators			
Percent children (0–23 months) who fall below–2SD weight-for-length (wasting)*	18.3%	23.7%	21.0%
Percent children (0–23 months) who fall below–2SD length-for-age (stunting)*	33.4%	45.6%	39.5%
Percent children (0–23 months) who fall below–2SD weight-for-age (underweight)*	20.0%	32.8%	26.4%

[6] Each of the five ASQ-3 domains (communication, gross motor, fine motor, problem solving, and personal-social) has a maximum score of 60 and the maximum ASQ-3 sum score is 300.
[7] Defined as a child falling below an age-specific cut-point on one of the five ASQ-3 domains.

Indicator	Intervention	Comparison	Total
Percent of children ages 6–23 months with minimum dietary diversity*	4.2%	10.9%	7.7%
Percent of children ages 6–23 months with minimum meal frequency*	21.3%	11.1%	16.0%
Percent of children ages 6–23 months with minimum acceptable diet*	0.3%	2.0%	1.2%
Percent of children ages 0–5 months that are exclusively breastfeed	66.7%	70.7%	68.6%
Caregiver Mental Health			
Percent of caregivers with elevated symptoms of depression on the PHQ-9	24.4%	22.5%	23.4%

Annex 2: Nutrition Group Sessions

Focus Area	Session Topics
Introduction to the nutrition groups	• The importance of the first 1,000 days
Maternal health and nutrition in pregnancy	• Planning childbirth (attending antenatal care, facility delivery, and postpartum care) • Diversified diet for pregnant and lactating women • Increased nutritional needs during pregnancy • Supporting pregnant and lactating women in the home
Breastfeeding	• Colostrum and breastfeeding within 1 hour • Maintaining exclusive breastfeeding for 6 months • Breastfeeding positions and techniques • Continuing breastfeeding when it seems there is not enough milk
Responsive care and early learning	• Understanding our child's signals and responding well • Talking to our children from pregnancy
Complementary feeding	• Food frequency • A diverse diet for children from their own plate • Feeding children colorful foods • Feeding iron-rich foods
Supporting and monitoring child development	• Playing with our children in our daily work • Attending to our child's development and monitoring milestones using the Child Health Card
Nutrition in special situations	• Feeding the sick child • Feeding a child who is recuperating • Care for children with diarrhea
Family harmony	• Joint decision-making in the family
Hygiene	• Handwashing with soap • Treating drinking water • Hygiene of food • Use of the latrine

Note: Sessions in blue will only be delivered in the districts receiving the integrated package.

Annex 3: GSED Preparations

Assembling GSED Kits

The data collectors needed a complete set of data collection materials, including two GSED kits per team for six teams. The Maraxis team locally sourced the GSED kit, and the USAID Advancing Nutrition team approved it. The table below describes the items in the GSED kit. All items were washable and stored in a container that was easy to carry and protected the kit against weather elements such as rain and dust.

GSED-KIT Item Descriptions

#	Description of the item
1	1 floor mat sized 1–2 by 1.5 meters
2	1 digital timer
3	1 rattle or shaker toy (rattle head should be 10–12 cm in length by 3–4 cm in width and have a handle that is 1–2 cm in width)
4	12 small colored wooden square blocks (2.5 cm by 2.5 cm) with at least six of the same color and at least two of different colors
5	2 large colored wooden square blocks (3.5 cm by 3.5 cm) in the same two different colors as the small blocks
6	Four plastic or other non-breakable material cups, one small (6-8 cm in height) and one large (10-12 cm in height) each in two different colors
7	1 chalk or crayon in a dark color (blue or black) at least 4–6 cm in length and 1 cm wide
8	2 tennis balls or other brightly colored balls sized 6.5–6.8 cm in diameter
9	1 plastic spoon (10 cm in length and spoon width of 3 cm)
10	1 metal spoon (10 cm in length and spoon width of 3 cm)
11	1 clean plastic water bottle without a top (500 ml or 16-20 cm tall and 6-8 cm wide)
12	1 thick cloth of any color (30 cm by 30 cm)
13	1 typical child's shoe for a small child (i.e., for a child of about 2 years)
14	1 toy car (10 cm in length and 5 cm in width)
15	1 colored plastic or metal plate (15–20 cm in diameter)
16	1 plastic comb (5–10 cm in length)
17	1 jar with a screw-on lid (about 12–14 cm in height by 5 cm lid)
18	1 shoelace (40–50 cm long and about 0.5 cm wide or less)

19	1 meter white or black string that can be laid flat
20	2 wooden sticks (one 10 cm and one 12 cm in length)
21	Blank A4 size papers
22	Wooden shape board with three cut-out shape blocks painted (board should be 20 cm wide by 15 cm high by 1–1.5 cm thick with a cut-out circle 5 cm in diameter, cut-out triangle 5 cm at the bottom side, and cut-out square that is 5x5 cm)
23	1 wooden peg board with 8 pegs (board should be 15 cm long by 10 cm wide by 1–1.5 cm thick with 8 holes that are cut to 1 cm diameter to fit a 1 cm diameter peg with eight 1 cm wooden downs cut into pegs)
24	1 squeeze toy or clean packet of crisps filled with cloth that makes a noise when squeezed (8 cm x 6 cm x 3–4 cm in thickness)
25	1 square cloth sack filled with beans or rice (8 cm by 8 cm)
26	rice puff or raisin
27	1 container to store all of the above materials

Training on the GSED

Training of GSED Trainers

Five members of the USAID Advancing Nutrition team (three based in Mozambique and two based in the United States) were trained on the GSED as part of a GSED Training of Trainers led by the WHO. The training of trainers was conducted virtually and was facilitated by the GSED team, including sessions by Melissa Gladstone, Patricia Kariger, and Katelyn Hepworth. The virtual training took place over 10 days including videotaped practice sessions. All GSED trainers were required to be validated on the GSED long form by Melissa Gladstone prior to being able to train others.

Training of GSED Enumerators

The enumerators' training took place in Nampula with the following objectives:

- To familiarize the data collectors with the research context and objectives.
- To introduce the research protocol and acquaint the data collectors with the data collection process and procedures and present the data collection tools.
- To experiment with the existing research tools within a classroom setting as well as implementing the pilot in real life settings.
- To certify Maraxis GSED long form master trainers who would certify other GSED long form assessors (as part of the assessors' cohort dedicated to conducting LF observations in the field).

The enumerators' training lasted two weeks. The first week (February 15-20, 2022) introduced the study and general ECD terms and context; addressed ethics in research, interview and survey tips, and

the informed consent process; introduced survey tools, aside from the GSED long form, and using tablets to collect data; and provided classroom simulations. The second week was dedicated to the WHO GSED long form including piloting, certifying four additional master trainers from Maraxis, and certifying assessors who collected data using the WHO GSED Long Form app.

Pilot implementation emulated the processes followed in a real data collection scenario (obtaining informed consent, using the tablets, and sending information in real time). Three pilot sites were organized in Nampula City: 25 de Setembro and Muhala Expansão health facilities (two teams, each allocated a health facility for the pilot exercise) and one community within the city of Nampula (Namutequeliua). During the training, the Portuguese informed consent form and key terms in all the tools were translated into Makua, a local language spoken in Nampula. During the practice sessions, the enumerators used both Portuguese and Makua.

There were four quizzes administered using tablets: GSED general; long form; short form; psychosocial form; and the final GSED training test that was programmed using the KoboToolbox application. Each enumerator had to score 90 percent or above to pass. Enumerators had three chances to retry each test to get a passing score, and they were allowed to consult learning materials while taking the quizzes. During the first attempt that involved a quiz on GSED in general, all participants scored less than 90 percent. The second attempt gave the enumerators a chance to improve, and the averages improved as the training continued. A few of the enumerators received perfect scores. All quizzes including the final GSED end of training were repeated until everybody achieved a score of 90 percent or more. Those who did not receive 90 percent on their first or second attempts did so on their third and final attempts.

A cascading model was used for the certification process of the GSED long form, as was agreed upon by the USAID Advancing Nutrition and WHO teams. Master trainers from USAID Advancing Nutrition first certified four Maraxis master trainers, who then certified Maraxis assessors (under the supervision of the USAID Advancing Nutrition master trainers), who were then authorized to collect data using the GSED long form. This extensive process required patience, especially for the practical exercises at the health facilities and at the community levels. An important phase of the training was for participants to learn how to play with the children, observe the children's capabilities based on age, and simultaneously rate/score these observations using the WHO app.

Annex 4: Indicator Definitions

Construct	Indicator Definition	Survey Tool	Overview of How to Calculate
Primary Outcome			
Child Development	Total sum score on gross motor domain	Ages and Stages Questionnaire (ASQ-3)	A total sum score for the 6 gross motor items from the child's age-specific form is calculated by adding the individual points across all 6 items.
	Total sum score on fine motor domain	ASQ-3	A total sum score for the 6 fine motor items from the child's age-specific form is calculated by adding the individual points across all 6 items.
	Total sum score on communication domain	ASQ-3	A total sum score for the 6 communication items from the child's age-specific form is calculated by adding the individual points across all 6 items.
	Total sum score on problem solving domain	ASQ-3	A total sum score for the 6 problem solving items from the child's age-specific form is calculated by adding the individual points across all 6 items.
	Total sum score on personal social domain	ASQ-3	A total sum score for the 6 personal social items from the child's age-specific form is calculated by adding the individual points across all 6 items.
	Total sum score on all five domains	ASQ-3	A total sum score for the five domains from the child's age-specific form is calculated by adding the sum scores for each domain.
	Child is below the age-specific cut point in the gross motor domain	ASQ-3	Binary (yes/no) for child fell below the age-specific cut-point in the gross motor domain
	Child is below the age-specific cut point in the fine motor domain	ASQ-3	Binary (yes/no) for child fell below the age-specific cut-point in the fine motor domain
	Child is below the age-specific cut point in the communication domain	ASQ-3	Binary (yes/no) for child fell below the age-specific cut-point in the communication domain
	Child is below the age-specific cut point in the problem solving domain	ASQ-3	Binary (yes/no) for child fell below the age-specific cut-point in the problem solving domain
	Child is below the age-specific cut point in the	ASQ-3	Binary (yes/no) for child fell below the age-specific cut-point in the personal

Construct	Indicator Definition	Survey Tool	Overview of How to Calculate
	personal social domain		social domain
	Child is below the age-specific cut point in one or more domains	ASQ-3	Binary (yes/no) for child fell below the age-specific cut-point in any one domain
Additional Measures			
Early Learning	Mean number of activities with adult household members	Family Care Indicators	For each child, sum of the number of activities marked "yes"
	Percentage of children engaged in four or more activities to provide early stimulation and responsive care in the last 3 days with (a) Any adult household member (b) Father (c) Mother	Family Care Indicators	Binary (yes/no) for parent engagement in four or more activities to support learning in the three days prior to the survey
	Percentage of children under age 2 who have three or more children's books	Family Care Indicators	Binary (yes/no) for availability of children's books in the child's home
	Percentage of children under age 5 who play with two or more types of playthings	Family Care Indicators	Binary (yes/no) for availability of playthings in the child's home
	Number of stimulating engagement activities by a caregiver with a child from 0-23 months with objects (e.g., playthings) and/or people (adults and peers) [*non-standard language as this is a global indicator under development*]	Nurturing Care Framework Early Learning Tool	Continuous sum score of the number of items marked as "yes" of 14 total questions
Child growth	Weight-for-length/height z-scores	Anthropometrics	Continuous z-scores based on WHO growth standards and binary (yes/no)

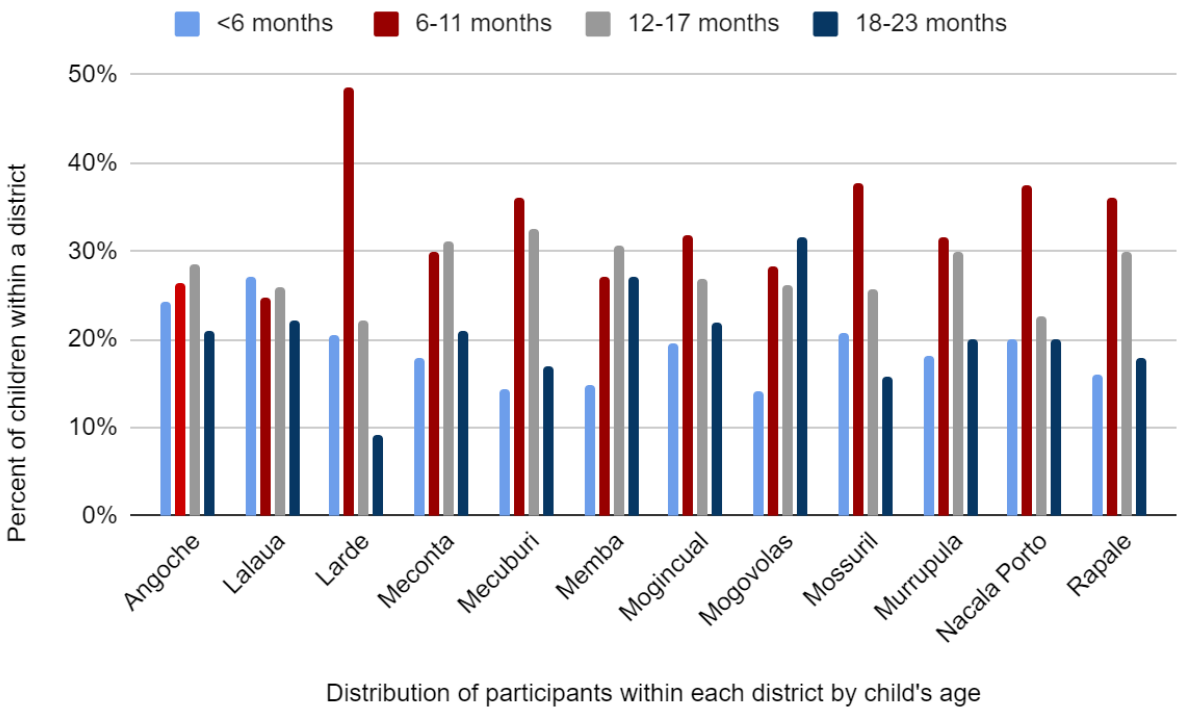
Construct	Indicator Definition	Survey Tool	Overview of How to Calculate
	Percentage of children under age 2 who fall below (a) minus two standard deviations (moderate and severe) (b) minus three standard deviations (severe) of the median weight for height of the WHO standard	Anthropometrics	Categorical wasting (normal, moderate, severe)
	Length/height-for-age z-scores	Anthropometrics	Continuous z-scores based on WHO growth standards and binary (yes/no)
	Percentage of children under age 2 who fall below (a) minus two standard deviations (moderate and severe) (b) below minus three standard deviations (severe) of the median height for age of the WHO standard	Anthropometrics	Categorical stunting (normal, moderate, severe)
	Weight-for-age z-scores	Anthropometrics	Continuous z-scores based on WHO growth standards
	Percentage of children under age 25 who fall below (a) minus two standard deviations (moderate and severe) (b) minus three standard deviations (severe) of the median weight for age of the WHO standard	Anthropometrics	Categorical underweight (normal, moderate, severe)

Construct	Indicator Definition	Survey Tool	Overview of How to Calculate
Minimum dietary diversity 6–23 months	Percentage of children 6–23 months of age who consumed foods and beverages from at least five out of eight defined food groups during the previous day	24-hour dietary recall	Mark as yes for an individual if child 6–23 months of age who consumed foods and beverages from at least five out of eight defined food groups during the previous day. The eight food groups used for tabulation of this indicator are: 1. breast milk; 2. grains, roots, tubers and plantains; 3. pulses (beans, peas, lentils), nuts and seeds; 4. dairy products (milk, infant formula, yogurt, cheese); 5. flesh foods (meat, fish, poultry, organ meats); 6. eggs; 7. vitamin-A rich fruits and vegetables; and 8. other fruits and vegetables.
Minimum meal frequency 6–23 months	Percentage of children 6–23 months of age who consumed solid, semi-solid or soft foods (but also including milk feeds for non-breastfed children) the minimum number of times or more during the previous day	24-hour dietary recall	Mark as yes for an individual if child 6–23 months of age consumed solid, semi-solid or soft foods at least the minimum number of times during the previous day. The minimum number of times is defined as: • two feedings of solid, semi-solid or soft foods for breastfed infants aged 6–8 months; • three feedings of solid, semi-solid or soft foods for breastfed children aged 9–23 months; and • four feedings of solid, semi-solid or soft foods or milk feeds for non-breastfed children aged 6–23 months whereby at least one of the four feeds must be a solid, semi-solid or soft feed.

Construct	Indicator Definition	Survey Tool	Overview of How to Calculate
Minimum Acceptable Diet	Percentage of children 6–23 months of age who consumed a minimum acceptable diet during the previous day	24-hour dietary recall	Binary (yes/no) for Minimum Acceptable Diet (composite of minimum meal frequency and minimum dietary diversity) Mark as yes for an individual if child 6–23 months of age who consumed a minimum acceptable diet during the previous day. The minimum acceptable diet is defined as: • for breastfed children: receiving at least the minimum dietary diversity and minimum meal frequency for their age during the previous day; • for non-breastfed children: receiving at least the minimum dietary diversity and minimum meal frequency for their age during the previous day as well as at least two milk feeds.
Exclusive Breastfeeding	Percentage of infants 0–5 months of age who were fed exclusively with breast milk during the previous day	24-hour dietary recall	Binary (yes/no) for exclusive breastfeeding <6 months
Inadequate supervision	Percentage of children under age 2 left alone or under the supervision of another child younger than 10 years of age for more than one hour at least once in the last week	Family Care Indicators	Binary (yes/no) for children exposed to inadequate supervision
Caregiver Mental Health	Percentage of caregivers with elevated symptoms of depression (>=9)	Patient Health Questionnaire (PHQ-9)	Binary (yes/no) for having a score of greater than or equal to 9 across all PHQ-9 items

Annex 5: Child Age Disaggregated by District

Child Age Disaggregated by District



Child Age Disaggregated by District

	<6 months		6–11 months		12–17 months		18–23 months		Total	
District	n	%	n	%	n	%	n	%	n	%
Angoche	23	24.2%	25	26.3%	27	28.4%	20	21.1%	95	9.9%
Lalaua	22	27.2%	20	24.7%	21	25.9%	18	22.2%	81	8.4%
Larde	11	20.4%	26	48.1%	12	22.2%	5	9.3%	54	5.6%
Meconta	18	18.0%	30	30.0%	31	31.0%	21	21.0%	100	10.4%
Mecuburi	12	14.5%	30	36.1%	27	32.5%	14	16.9%	83	8.6%
Memba	17	14.9%	31	27.2%	35	30.7%	31	27.2%	114	11.9%
Mogincual	8	19.5%	13	31.7%	11	26.8%	9	22.0%	41	4.3%
Mogovolas	13	14.1%	26	28.3%	24	26.1%	29	31.5%	92	9.6%
Mossuril	21	20.8%	38	37.6%	26	25.7%	16	15.8%	101	10.5%
Murrupula	11	18.3%	19	31.7%	18	30.0%	12	20.0%	60	6.2%
Nacala Porto	8	20.0%	15	37.5%	9	22.5%	8	20.0%	40	4.2%

	<6 months		6–11 months		12–17 months		18–23 months		Total	
Rapale	16	16.0%	36	36.0%	30	30.0%	18	18.0%	100	10.4%
Total	**180**	**18.7%**	**309**	**32.2%**	**271**	**28.2%**	**201**	**20.9%**	**961**	**100.0%**

USAID ADVANCING NUTRITION

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