Implementing care for vulnerable infants under 6 months of age and their mothers

‘Learning by doing’ case study series: **South Sudan**

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Keywords

Infant health; mother child health; continuity of care; infants at risk of poor growth and development; small vulnerable infants

Further information

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To find more about the South Sudan case and to discuss how this work can be taken forward, please contact Marlene Traore-Hebie at MHebie@momentumihr.org or Angelina Nasira Boi at ANasira@momentumihr.org

Mothers waiting to attend services at the health centre.

Abstract

Background

Many infants are born vulnerable, or become so in the first six months of life, and thus are at an increased risk of poor growth and development, ill health and mortality. To mitigate risks and safeguard future health, comprehensive continuity of person-centred care for at-risk mother–infant pairs is needed, but it remains challenging to deliver this at the required level of quality and at scale. This case study investigates the process of implementing, adapting, normalising and embedding an integrated care pathway approach for the management of small and nutritionally at-risk infants under six months (u6m) and their mothers (the MAMI Care Pathway) in the South Sudan context, to inform sustainable scalability.

Method

In the South Sudan case, an implementation study by the MOMENTUM Integrated Health Resilience (MIHR) project introduced the MAMI Care Pathway approach in maternal and child health services in five primary care urban and rural sites in four states. Mixed methods were used to provide a detailed description of the planning and implementation processes, to explore influences on the adoption of the approach, and to appraise the potential scalability and sustainability of care. Different lenses were used to examine health workers' experiences of applying and implementing the MAMI Care Pathway. The consultative process we engaged in doing so enhanced mutual capacities through 'learning by doing'. Reflective discussions unearthed further knowledge to inform implementation evolution in this setting, and transferable insights for other settings.

The case study did not paint an exhaustive or exclusive picture of the implementation of the MAMI Care Pathway approach. For example, it did not seek the perspectives of mothers, as service users or decliners, and involved only a few clinical health workers. Nor did it evaluate the cost effectiveness, acceptability or feasibility of the Care Pathway approach or compare it to alternative approaches.

Results

While South Sudan has strong national policies covering health and nutrition for infants u6m and their mothers, irregular support from financial and technical partners compromised their implementation. Introduction of the MAMI Care Pathway approach in this context aimed to address gaps in providing comprehensive continuity of care for vulnerable mother–infant pairs.

The MAMI Care Pathway approach was implemented in five sites, each consisting of a Ministry of Health- (MOH-) run primary healthcare centre (PHCC), the communities in its health catchment area, the referral hospital, and the County Health Department (CHD) for oversight. Planning for implementation took substantial time to obtain research approval and involve key stakeholders of the national MOH. The adaptation process to align the MAMI Care Pathway with existing services and the participatory and integrated approach required ongoing coaching to aid contextualisation and ensure sustained quality of care.

The adaptation process helped health workers understand, comply with the agreed implementation modality and engage in quality improvement of the MAMI Care Pathway approach. However, because implementation occurred within a research context, the MAMI Care Pathway was not fully accommodated as a routine service. Health workers were not incentivised or their job descriptions were not adjusted to accommodate new demands, which constrained their motivation (where there was will, there was not an easy way). The conceptual shift from disease-focused to person-centred care was new and did not manifest into tangible benefits – such as streamlined care or improved teamwork – and was difficult to achieve in the prevailing vertical programme-driven health system.

Challenges relating to readiness to scale up the initiative indicated the need to adapt policies and practices to support the shift towards comprehensive continuity of care of the vulnerable mother–infant pair. Key challenges were refocusing care on person-centred vulnerabilities (rather than conditions), securing buy-in to the MAMI Care Pathway approach from policymakers to practitioners, poorly appreciated common ground between existing health and nutrition policies and services and generating support from institutions and donors. Suggestions for improvement included embedding the MAMI Care Pathway approach in existing services while aligning and simplifying the provision of comprehensive care, and sensitising and empowering communities to adopt healthy behaviours.

Conclusion

Guided by different frameworks, the case study painted a rich, nuanced picture of the planning, implementation and adoption of the MAMI Care Pathway approach in the South Sudan implementation. It considered the sustainable scalability of the approach, shared collective learning and made suggestions for strengthening the potential for future scale-up.

From the start, implementation of this pilot intended to follow an integrated approach, building upon existing health services. It has generated valuable learning to inform integration but proved difficult to realise in practice due to the limitations of a research study to effect the necessary system changes. Transformative changes in policies and practices led by national authorities would be needed to successfully embed and sustain an integrated approach to care for vulnerable infants and their mothers in South Sudan.

Mother's MUAC taken at the health centre.

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Abbreviations

BHI	Boma Health Initiative
BHW	Boma health worker
CHD	County Health Department
CLO	County Liaison Officer
CMAM	Community-based management of acute malnutrition
ENN	Emergency Nutrition Network
EPI	Expanded Programme on Immunization
IYCF	Infant and young child feeding
IMNCI	Integrated management of neonatal and childhood illness
LBW	Low birthweight
M&E	Monitoring and evaluation
MERL	Monitoring, evaluation, research and learning
MAMI	Management of small and nutritionally at-risk infants under six months and their mothers
MIHR	MOMENTUM Integrated Health Resilience
MIYCN	Maternal, infant and young child nutrition
MNCH	Maternal neonatal and child health
MOH	Ministry of Health
MUAC	Mid-upper arm circumference
NGO	Non-governmental organisation
OPD	Outpatient department
PHCC	Primary health care centre
u6m	Under six months of age
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WAZ	Weight-for-age z-score
WHO	World Health Organization

1. Addressing care gaps for vulnerable at-risk infants and their mothers

Infant vulnerability

Many infants are born vulnerable, or become so in the first six months of life. These infants are at increased risk of poor growth and development, immediate and long-term ill health, and increased mortality (1). Each year, an estimated 8.9 million infants (14.6%) are born with low birthweight (LBW) (2), carrying short- and long-term health risks, especially for those born premature (1). In low- and middle-income countries, an estimated 9.2 million (15.5%) infants under six months of age (u6m) are wasted, 10.3 million (17.4%) are underweight and 11.8 million (19.9%) are stunted (3). An episode of wasting, particularly in the first three months of life, increases the risk of subsequent and persistent wasting, and concurrent wasting and stunting, as children age (4, 5). This poor start to life contributes to the global burden of 45 million children under five years of age who are wasted and 149 million who are stunted (6), affecting health outcomes in current and future generations and compromising individual and community potential (4, 7).

Gap in evidence to practice

Vulnerable or at-risk infants u6m may be described or present to services in many ways (8). They include newborns with LBW, especially those born preterm or small for gestational age; infants identified with wasting or acute malnutrition, stunting or underweight; infants who are nutritionally at-risk, or with acute or chronic illness, disability or other growth and development concerns; and infants whose mothers have nutrition, physical or mental health or social challenges. Many services are provided for these infants, and sometimes their mothers, across health and nutrition services, including for reproductive health (e.g., for LBW, small and sick newborns), nutrition (wasting prevention and treatment), paediatric health (integrated management of neonatal and childhood illness (IMNCI); integrated community case management) and maternal health. However, continuity of comprehensive, quality care centred on at-risk mother–infant pairs is needed to mitigate immediate risks and safeguard future health (9), and this is challenging to deliver at scale (10). Care is therefore complex at both the individual level and service delivery level.

Connecting within and across services is ideal but elusive in practice. One critical barrier is a lack of evidence on how to do this in different contexts. The 2013 World Health Organization (WHO) guideline update on wasting recommended outpatient care for stable and “uncomplicated” severely wasted infants u6m (11). However, uptake in national policy and practice has been low and slow, with most countries still recommending inpatient treatment. In 2023, WHO updated the guideline (12) to cover infants u6m at risk of poor growth and development. Knowing how to deliver such care in different settings is critical for national policy-makers and those who support their efforts. National decision-makers need contextualised evidence on what works, where, how and for whom in different settings, to enable informed policy and service development within cost and capacity. Without addressing the ‘how’, realising adequate care will remain elusive.

Commitment to country-led learning on 'how'

To help put the WHO 2013 guidelines into practice, the Emergency Nutrition Network (ENN) coordinated the development of the Management of Small and Nutritionally At-Risk Infants Under Six Months and their Mothers (MAMI) Care Pathway in 2015 through a global collaboration of experts and practitioners. Version 3 was released in 2021. The provisions are consistent with the 2023 WHO guideline update's extended scope (12). The MAMI Care Pathway applies, and expands on, updated health and nutrition guidance, including IMNCI and United Nations Children's Fund (UNICEF)/ WHO breastfeeding counselling materials and frameworks, as well as integrated continuity of care for at-risk infants u6m and their mothers across health and nutrition services. It has been applied in pilot studies, small-scale programmes and, increasingly, government services to help navigate and plan care in multiple settings.

Evidence is needed to show that an intervention is effective, but also to assess the conditions under which it is implemented, to maximise the potential for replicability and sustainable delivery at scale. Learning from small-scale implementation is essential before expanding, which requires active planning from the outset. As a collective, the MAMI Global Network is an active forum that practitioners around the world use to collaborate, exchange experience and support each other in caring for at-risk infants and mothers through policy, research and practice. Activities are guided by a five-year strategy (9) that aims to achieve sustainable, scaled care by supporting country leadership, priorities and action to help mothers and their infants to survive and thrive. The MAMI Global Network is committed to supporting learning to capture and appraise experiences of the MAMI Care Pathway and examine implementation models and delivery systems in different contexts.

Mother and baby walking to the health centre.

2. Case study series

Three in-depth case studies were carried to explore different implementation modalities of the MAMI Care Pathway approach in three different small-scale settings: in **Pakistan**, **South Sudan** and **Yemen**.

Objectives

The overall objective of the case studies was to explore, capture and generate learning from the application of the MAMI Care Pathway approach in different contexts to inform approaches for sustainable scalability of care.

Specific objectives

1. Describe and learn about what was done, and how and why, in each context.
2. Describe and learn about what worked (or not), for whom, and under what circumstances, to bring about routine practices.
3. Examine the spread, scale-up and sustainability of the approach within and across settings.
4. Provide suggestions on how to improve practice and ensure sustainability at scale.

Methods

We applied a mixed-methods approach within and across the three case study settings, including the following elements:

- Developing *a Planning and Implementation Process Framework for the MAMI Care Pathway Approach* to describe in detail the planning and implementation process in each context.
- Exploring the sequential steps of 'normalisation' (adoption) of care, spread, scalability and sustainability in sequential steps by applying the *Normalisation Process Theory (NPT)* (13-15); the *Non-adoption, Abandonment, Scale-up, Spread and Sustainability (NASSS) Framework* (16); and the *Checklist for Assessing the Potential Scalability of Pilot Projects or Research* (17, 18).
- Using these methods to apply different lenses to examine experiences in each context and to generate insights that may be transferable to other settings (19).
- Using a participatory and reflective approach of 'learning by doing, together' to deepen the understanding and build the capacity of all participants.

The South Sudan case was selected as an example of introducing the MAMI Care Pathway approach in maternal and child health services in urban and rural sites as implementation research embedded in the five-year MOMENTUM Integrated Health Resilience project (MIHR) managed by IMA World Health South Sudan, an affiliate of Corus International, funded by the United States Agency for International Development's (USAID). The **country health context** **(section 3)** described the implementation environment for our phased investigation:

- First, we described the process of **planning and implementing** the MAMI Care Pathway approach to understand what was done, and how and why **(section 4)**.
- Second, we explored factors that influenced the process of **normalisation and adoption** of the approach and explored perceptions about what worked, for whom and under what circumstances **(section 5)**.
- Third, we triangulated and synthesised data on descriptions and perceptions to appraise the **potential scalability and sustainability** of the approach **(section 6)**.
- Finally, we synthesised **insights** generated through the **collective learning** process into suggestions for policy, research and practice to strengthen the potential for future scale **(section 7)**.

Annex 1 provides an overview of the MAMI Care Pathway approach (who, what, where). Annex 2 lists working definitions. Annex 3 details the methods applied in the three case studies, and their limitations. Annex 4 is a set of generic questionnaires, and Annexes 5 and 6 provide more detailed information on the materials used for implementation and training. Annexes 7 and 8 present the detailed findings from the appraisal of the adoption process, and readiness for scale .

What we did not do. The case study did not paint an exhaustive or exclusive picture of the implementation of the MAMI Care Pathway approach. For example, it did not seek the perspectives of mothers, as service users or decliners, and involved only a few clinical health workers. Nor did it evaluate the cost effectiveness, acceptability or feasibility of the Care Pathway approach or compare it to alternative approaches.

Screening of mother and infant at the health centre.

3. Country health context

South Sudan is a low-income country that has faced protracted conflict both before and since it gained independence in 2011. Of the 13 million people living in South Sudan in 2021, more than eight million required humanitarian assistance because of conflict and violence, major flooding and the coronavirus disease (COVID-19). Government funding for health is limited to less than 2% of the national budget, and households' out-of-pocket spending accounts for about 54% of total health expenditure, posing catastrophic health costs for many South Sudanese people. In 2017, 96% of the population lived in rural areas and 56% were unable to access health services (20).

According to the latest available data (2010) (21), only 19% of deliveries in South Sudan are assisted by skilled birth attendants. In 2018, approximately 74% of infants were exclusively breastfed, and 13% of children 6–59 months of age experienced wasting (Table 1). While data on the burden of at-risk infants u6m are not available, these figures suggest that there are likely to be high numbers of infants at risk of, or experiencing, poor growth and development, and whose mothers need additional care and support.

Table 1: Key health and nutrition indicators, South Sudan

Total population (million)	14.2 (2020) (22)
Fertility (births per woman)	4.5 (2021) (23)
Live birth (births per 1,000 people)	29 (2021) (23)
Neonatal mortality (neonatal deaths per 1,000 live births)	40 (2021) (23)
Infant mortality (infant deaths per 1,000 live births)	64 (2021) (23)
Skilled birth attendance	19% (2010) (21)
Exclusive breastfeeding	74% (2018) (24)
Wasting (children 6–59 months)	13% (2018) (25)
Stunting (children 6–59 months)	17% (2018) (25)
Severe wasting and nutritional oedema (children 6–59 months)	4% (2019) (26)

National policies currently recommend that infants u6m with severe wasting or nutritional oedema are referred to hospital for inpatient care. This recommendation is impractical because these infants are either not detected and referred, or live far from services and are unlikely to be taken to care facilities. Even if they were, hospitals would not have the capacity to deliver the necessary services to all those in need. While numerous non-governmental organisations (NGOs) support the local health system, funding is limited and for a specific period, so support for service delivery is unstable.

The MAMI Care Pathway approach was introduced in South Sudan through a 15-month implementation study as part of the MIHR project. The study was embedded in existing primary care services in five selected Ministry of Health-(MOH-) run primary healthcare centres (PHCCs), providing an opportunity to explore how the approach was introduced through the lens of sustainable, scalable care. Additional resources for support staff, training, supportive supervision and monitoring and evaluation (M&E) supported implementation during the study period, likely influencing whether and how well the MAMI Care Pathway approach was implemented. This study provides insights into what is needed for this approach to be adopted within routine care.

Specific objectives of the implementation study were the following:

1. Adapt the MAMI Care Pathway approach to the South Sudanese context in participation with the MOH and its key health and nutrition partners.
2. Appraise the effectiveness of the activities of the MAMI Care Pathway approach (sensitisation, screening, assessment, enrolment for care and support, monitoring of risks and progress and evaluation of outcomes).
3. Document and disseminate lessons from implementing the MAMI Care Pathway approach as part of maternal, newborn and child health (MNCH) services in selected health facilities and communities in South Sudan.
4. Generate learning to improve implementation of the MAMI Care Pathway approach and the quality of MNCH services (including maternal mental health) more broadly to prepare for scale-up and to inform the process of adapting policies and developing practice guidelines.

The MAMI Care Pathway approach was implemented in five sites, each consisting of an MOH-run PHCC, the communities in its health catchment area, a referral hospital, and the County Health Department (CHD) for oversight (Figure 1 and Table 2).

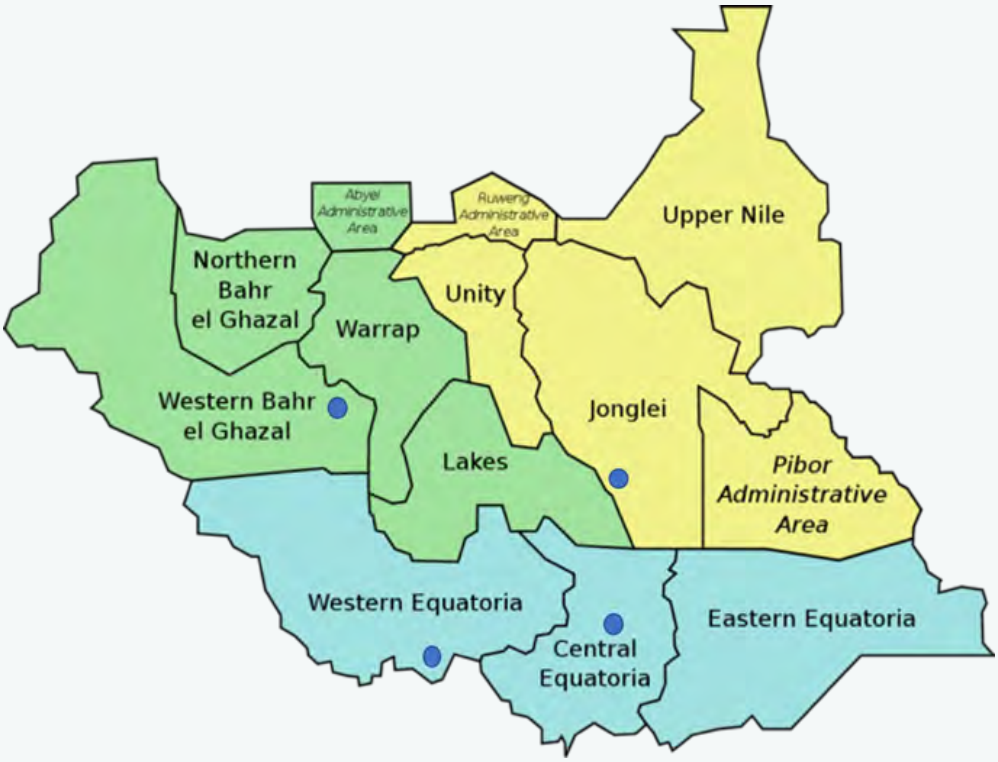

Figure 1. MAMI implementation sites in South Sudan (blue dots), 2021–2023

Table 2: Implementation sites in South Sudan, 2021–2023

State	County health department (CHD)	Primary health care centre (PHCC)	Referral hospital
Central Equatoria	Juba CHD	Gurei PHCC Nyakuron PHCC	El Sabah Children's Hospital and Juba Teaching Hospital
Jonglei	Bor CHD	Pariak PHCC	Bor State Hospital
Western Equatoria	Yambio CHD	Yambio PHCC	Yambio State Hospital
Western Bahr el-Ghazal	Wau CHD	Hai Dinka PHCC	Wau State Hospital

Enrolment of mother–infant pairs started in October 2022 and ended in June 2023, with pairs remaining in care until mid-December 2023 (when infants reached six months of age). The study screened 7,418 mother–infant pairs in the communities and health facilities and assessed 521 pairs as at moderate risk and enrolled them in care and support.

4. Planning and implementation

This section describes the inquiry into the planning and implementation of the MAMI Care Pathway in the South Sudan case that included the following steps:

1. Understanding the health system.
2. Planning for service delivery: who, what and how.
3. Implementating services: steps taken to implement the MAMI Care Pathway approach.
4. Monitoring, improving quality and collaborative learning.
5. Making suggestions for improving planning and implementation.

4.1. Understanding the health system

Key information

- South Sudan has strong national policies covering health and nutrition for infants u6m and their mothers, but erratic support from financial and technical partners had compromised their implementation.
- Guidance on providing comprehensive continuity of care for vulnerable infants u6m outside of hospital settings was limited.
- Capacity assessments confirmed the availability of skilled clinical MOH staff at the sites, but there were gaps in implementing the IMNCI and infant and young child feeding (IYCF) approaches.
- MIHR South Sudan recruited one MAMI coordinator and five MAMI assistants, who were supported by the MIHR senior nutrition advisor from headquarters and an international MAMI expert consultant.
- Stakeholder analysis ensured that key health and nutrition actors, representatives from the MOH, United Nations organisations, the Health and Nutrition Clusters, and NGOs were involved in adapting the MAMI Care Pathway approach to the context.

Burden and perceived health priority. In South Sudan, health policy-makers and clinicians were aware of the vulnerability of infants u6m. However, a lack of data on the burden of risk limited their understanding of the need to integrate care across existing services for infants and their mothers to ensure continuity of care. The MOH targets infants u6m in the community for promotive and preventive health actions through the Boma (community) Health Initiative (BHI) and the Maternal, Infant and Young Child Nutrition (MIYCN) programme, both of which include health and nutrition counselling. Infants u6m identified with illness are referred for investigation in the IMNCI approach and in the case of severe malnutrition are referred for inpatient care at stabilisation centres in the state or national hospitals. The MIHR project oriented the MOH on the MAMI Care Pathway approach and explored how to build on and strengthen existing health and nutrition services in South Sudan. Following the initial orientation meeting, senior health actors in the country confirmed their support for the MAMI study and their intention to use the findings to inform updates of the national nutrition strategy.

Policy context. A policy analysis conducted as part of planning for implementing the MAMI Care Pathway approach showed that South Sudan's health and nutrition policies (e.g., the 2017–2025 MIYCN Strategy, the 2017 IMNCI Guidelines, the 2018 Guidelines for Inpatient Management of Severe Acute Malnutrition, and the 2019 BHI) covered infants u6m and their mothers to varying degrees. However, their implementation was fragmented because it depended on support from financial and technical partners and erratic funding. Clear guidance on how to operationalise comprehensive care for the u6m age group outside of the hospital and continuity across services and time were lacking.

Local health system capacities. MIHR assessed the capacities of the proposed sites between December 2021 and March 2022 and again between June and August 2022 before starting implementation. The assessments explored the readiness of the local health system to embed the MAMI Care Pathway approach, including the availability of quality and well-equipped health and nutrition services for children and adequately skilled clinicians.

NGOs supported essential health and nutrition services in the health facilities and communities in the implementation sites. Services especially relevant to the MAMI Care Pathway approach at the PHCCs included child consultations in accordance with the IMNCI approach, and IYCF at breastfeeding corners, while community-based management of acute malnutrition (CMAM) in outpatient care targeted children aged 6–59 months with acute malnutrition. A gap identified in IMNCI implementation was a lack of continued mentorship to ensure adherence to the sick child guidelines, including the use of the IMNCI records and supportive supervision tool. The capacities of the referral hospitals were also assessed, with a focus on paediatric wards, stabilisation centres and mental health services.

The knowledge and skills of health workers helped identify needs for implementation and support (training skills and quality improvement). A MIHR MAMI team consisting of a MAMI coordinator, five MAMI assistants, the maternal and newborn health advisors, and the senior nutrition advisor from headquarters, supported by one international MAMI expert, supported local MOH staff and BHWs in the five implementation sites.

Stakeholders. Stakeholder analysis before and during a two-day MAMI orientation meeting held in Juba in mid-July 2022 ensured that key stakeholders were involved in preliminary discussions. Participants in the stakeholder orientation included the directors of key MOH departments for primary care (i.e., child health, nutrition, and community health), representatives from hospital services and research institutions, representatives of United Nations organisations, members of the Health and Nutrition Clusters, health and nutrition implementing partners, and senior paediatricians of the referral hospitals. Table 3 lists stakeholders identified by MIHR and their potential roles in supporting implementation of the MAMI Care Pathway approach in South Sudan.

Two representatives from the national MOH were identified as champions for the MAMI Care Pathway approach because they were well-oriented in the approach, participated in developing the study protocol and showed great interest in the potential of the approach to strengthen health services for at-risk infants u6m and their mothers.

Table 3. Key stakeholders identified by MIHR for involvement in implementing the MAMI Care Pathway approach in South Sudan

Stakeholder name	Potential role in implementing the MAMI Care Pathway
Ministry of Health	Supporting implementation and monitoring progress
Other ministries	Not available (n/a)
United States Agency for International Development	Donor supporting the study, monitoring progress of the MAMI Care Pathway implementation
Non-governmental organizations (i.e., the Health Pooled Fund coalition, Save the Children, World Vision, Action contre la faim, Samaritan's Purse)	Supporting implementation in the health facilities
Community-based organisations	n/a
UNICEF	Technical support/provision of equipment
World Health Organization	Technical support
World Food Programme	n/a
Academic and training institutions	Supporting implementation
Professional associations	Supporting implementation
Religious leaders	n/a
Media	n/a
Private sector	n/a

4.2. Planning for service delivery

Key information

- Early engagement with the MOH in South Sudan helped secure buy-in and involved it in conceptualising, co-creating and adapting the study protocol.
- Five implementation sites were selected, covering four states with high vulnerability. Each site consisted of a PHCC, the communities in its health catchment area, the referral hospital, and the CHD for oversight.
- A combination of MAMI Care Pathway Package materials, existing materials (e.g., from BHI, and relating to IMNCI) and newly developed materials were adapted to the local context and aligned, in consultation with the MOH, United Nations organisations and implementing partners.
- MOH staff (clinical health workers and Boma health workers (BHWs)) were trained to implement the MAMI Care Pathway approach, according to their level of care. The MAMI coordinator and MAMI assistants provided ongoing mentorship and support for providing quality care.
- A monitoring and learning system solved problems daily via WhatsApp messaging and reviewed quality of care to carry out quality improvement at regular intervals (first weekly, later monthly).

Agency preparedness, stakeholder engagement and approval. As a strong proponent of the MAMI Care Pathway approach, USAID requested that MIHR champion implementation, first in South Sudan and then in a francophone sub-Saharan MIHR-supported country. South Sudan was selected because MIHR was supporting MNCH services but not nutrition activities at the time and it was seen as an opportunity to understand whether and how to integrate the MAMI Care Pathway approach into MIHR's broader MNCH support.

MIHR engaged with MOH in South Sudan in December 2021 to discuss a potential collaboration to integrate the MAMI Care Pathway approach into the existing health system. MOH requested that MIHR submit a study protocol to ensure that evidence on implementing the integrated MAMI Care Pathway approach could be presented at a national meeting in which an MOH-led MAMI committee would decide the next steps for MAMI implementation in South Sudan.

An international MAMI expert (Doctor of Public Health) was contracted to support the introduction of the MAMI Care Pathway approach as an implementation study. The consultant's role included supporting the expanded MAMI team (the MAMI team plus MOH decision-makers and other experts and implementers) in developing and implementing the MAMI study protocol and materials and strengthening capacities as needed. The protocol (available on request) received IRB approval in March 2022.

Fifty-one participants attended the two-day MAMI orientation meeting in July 2022. They included representatives of the national and state MOH, along with county health officials, and representatives from USAID, WHO, UNICEF, MIHR and other implementing partners engaged in child health and nutrition. The objectives of the orientation were to introduce stakeholders to the MAMI Care Pathway approach, secure their buy-in, discuss the study protocol and make any necessary adaptations prior to implementation.

Defining the target population. The study protocol outlined criteria for enrolment in care, and key partners were given an opportunity to provide input. Further discussion and adaptation took place during the orientation meeting to reach consensus on the final criteria to be used during the rapid screening and in-depth assessment (Box 1). Infant-specific mid-upper arm circumference (MUAC) tapes developed by UNICEF for research purposes under the MAMI Global Network were used in the MAMI study (the multi-MUAC trial report is available on request).

Box 1. Criteria used to identify small and nutritionally at-risk infants u6m and their mothers during screening and assessment in the South Sudan case, 2022–2023

Criteria used to identify at-risk infants u6m and their mothers during rapid screening in the community or in any contact with health services, for referral for in-depth assessment

Infant u6m:

- Clinically unwell, current illness
- Difficulties in feeding
- Not breastfed
- Recent weight loss or failure to grow
- Small or low birthweight as a newborn
- MUAC <125 mm

Mother of infant u6m:

- Clinically unwell or with severe disease
- Absent or dead
- Adolescent mother < 19 years
- Feeling unwell, behaving badly, putting infant at risk
- Another health, wellbeing, or social concern
- MUAC <230 mm

Criteria used to identify high-risk infants u6m and their mothers during in-depth assessment for referral to inpatient care

Infant u6m:

- IMNCI general danger signs or signs and symptoms of severe disease, including nutritional oedema

Mother of infant u6m:

- Severe problem related to mother's physical or mental health

Note: High-risk mother–infant pairs are referred to hospital. After their problems are resolved, they return to the outpatient department (OPD) for enrolment in the MAMI Care Pathway and continue to be supported until the infants reach six months of age.

Criteria used to identify moderate-risk infants u6m and their mothers during in-depth assessment for enrolment in outpatient care

Infant u6m:

- MUAC <110 mm (infant <7 weeks) and <115 mm (≥7 weeks)
- Weight-for-age z-score (WAZ) <–2
- (If known) born preterm <37 weeks
- (If known) low birthweight <2,500 g
- Recent weight loss, no weight gain, poor growth
- Difficulty feeding
- Not breastfed
- Excessive crying, sleep problems
- Other health concern or disability

Mother of infant u6m:

- Absent or dead
- MUAC <230 mm
- First child
- Multiple births
- Adolescent mother < 19 years
- Difficult breastfeeding conditions
- Confirmed or suspected HIV, TB
- (If known) enrolment in prevention of mother-to-child transmission of HIV
- Disability impairing feeding and/or care
- Impaired mental wellbeing
- Other health or social concern

Selecting implementation sites. Five MIHR-supported MOH-led PHCCs were selected based on high MNCH attendance, active NGO-supported MNCH services (including CMAM) and combined coverage of at least four counties across four states in South Sudan. The MOH requested that the sites include a rural area and areas with high vulnerability, and agreed on the final five sites.

Designing the implementation modus. The *capacity assessment tool* was used to inform discussions on tailoring implementation materials to the local context and capacities, and determining the 'who', 'what', 'where' and 'how' of implementing the MAMI Care Pathway components. The proposed implementation matrix was further refined during training in all sites. A simple continuous quality improvement system was put in place, including daily WhatsApp messaging, for instant problem solving. The monitoring and learning system reviewed quality of care, first weekly then bi-weekly and monthly, to adapt and improve the organisation of care as needed.

Adapting, aligning, simplifying, testing and using materials. Generic MAMI Care Pathway materials (27) were simplified and aligned with MOH BHI and IMNCI materials. For example, the MAMI Risk Form, MAMI Maternal Health Form and MAMI Feeding Form were combined, and repetitive questions were removed, and MOH IMNCI forms were added. New materials were also developed (Annex 5).

Revision of materials started during the orientation meeting, in consultation with senior health and nutrition actors from the MOH, United Nations agencies and implementing partners. Adaptation and simplification continued during the clinical health worker training, which included initial field testing, and later during implementation upon request from practitioners. Every change was discussed with the expanded MAMI team through face-to-face or remote meetings or in WhatsApp discussions. To guide implementation, the MAMI team in South Sudan developed MAMI implementation guidance and job aids for health workers.

No written materials were translated. MAMI team members communicated in local languages, including Arabic, Dinka and Pazande, during screening and consultations with mothers.

Training for implementation. Training was held from October to December 2022 for health workers (nurses, nutritionist, vaccinators, BHWs, CNVs and supervisors) in the five sites. The national MOH was not involved, but representatives from the CHD and staff in charge of the health facilities did attend. Prerequisites for MAMI training and implementation were IMNCI and counselling skills. As discussed, MIHR assessed the knowledge and skills of the MOH health workers to tailor training as needed. The training aimed to equip a) health workers with the knowledge and skills to implement the MAMI Care Pathway approach according to their levels of care, and b) the MAMI Team to mentor, support and improve quality of care. National training materials were developed, and training was facilitated by the MAMI coordinator, child health advisor, and County Liaison Officer (CLO) of MIHR. Annex 6 describes

4.3. Implementing services

Key information:

- The implementation study was implemented from October 2022 to December 2023.
- Services were free of charge at all facilities, but some ad hoc fees were charged to mother–infant pairs (e.g., for registration at the health facility, transport costs, inpatient care). These charges were not approved by MOH.
- Discussions with senior health and nutrition actors helped inform context-specific embedding of care into existing health services and facilitated adoption of the implementation modality.
- Understaffing at the PHCCs and hospitals meant that MOH staff often had a heavy workload, and some expected incentives for covering MAMI care as part of their regular work.
- Motivating mothers was a key challenge to retaining mother–infant pairs in care. The time and cost required to attend follow-up visits was not always seen as beneficial or worth it.
- Opportunities to improve mothers' commitment to remain in care included stronger counselling messages, beneficial services (e.g., relaxation) and links to other services (e.g., vaccination or family planning).

Access: availability, geographic accessibility, affordability and acceptability. The MAMI Care Pathway approach was implemented between October 2022 and December 2023 in all five implementation sites. Services were free of charge, but the PHCCSs routinely charged fees for some of the services received by mother–infant pairs. For example, because there was no patient record form or digitalised recording system, mothers were asked to purchase a small notebook to record their infants' details and follow-up visits, or to pay fees for registration or for vaccination cards. Amounts varied across PHCCs. These top-up fees were not approved by MOH.

The OPDs of the PHCCs facilitated referrals of mother–infant pairs to the hospital. While the PHCCs were responsible for providing transport, patients had to pay transport costs when there was no ambulance available. Admission to inpatient care was free, but mothers had to pay some costs; e.g., for food. Again, such charges were not aligned with national health policies.

Organisation of care. The MAMI Care Pathway approach was designed to be embedded into existing child health services and therefore to strengthen services and add new elements of the MAMI Care Pathway as appropriate. Therefore, during participatory discussions during meetings and at various implementation levels, the implementation and organisation of MAMI Care Pathway activities were discussed in detail. During the national orientation meeting, senior health and nutrition actors discussed which activities of the MAMI Care Pathway approach should be carried out, where and by whom. The *MAMI Care Pathway "who does what where" matrix* (Annex 1) was used to discuss and refine activities during training.

Table 4 lists the components of the adapted MAMI Care Pathway across health actors at the community and PHCC levels, with minimal variation by site. Discussing and field testing the matrix helped actors visualise and understand the MAMI Care Pathway approach and adapt the implementation modality to their local context.

Table 4. MAMI Care Pathway components unpacked for integration into health services by care level in the South Sudan case, 2022–2023

Activity	Detailed activities	What	Where	Who
Community				
Sensitisation	Community sensitisation and participation	Sensitise and discuss risks of poor growth and development of infant, risks related to the mother, and the MAMI Care Pathway with community members through, for example, community activities, mother groups, household visits.	Community	Boma health workers (BHWs), supported by their supervisors
Screening	Community screening	Discuss with mothers to verify key indicators, and referral to health centres in case of identified risk.		
Follow-up	Community monitoring and counselling of at-risk pairs	Follow up and counsel at-risk pairs through household visits; find pairs that default or miss follow-up.		
Health facility				
Screening	Mother and child health services screening of all infant–mother pairs	Ask mothers questions to verify key indicators and measure MUAC of infants and mothers.	Expanded Programme on Immunization (EPI), maternity, antenatal care/postnatal care, nutrition or family planning units and under-five clinic	Health workers of the respective services, supported by their supervisors
Assessment	Anthropometric assessment of pairs at risk	Measure anthropometry of infant–mother pairs at risk: weight, length, MUAC in mm and classification, WAZ classification, oedema check.	Registration and waiting area, nutrition unit or outpatient department (OPD) of the PHCC	Trained health worker
	IMNCI and MAMI risk assessment	Conduct a comprehensive IMNCI and MAMI risk assessment.	OPD or under-five consultation (clinic) *	Clinical officer at under-five clinic
	Classification of risk	Classify risk and decide on enrolment or referral.		
Outpatient care	Enrolment	Register and copy information from the assessment as baseline.	Registration and waiting area, nutrition unit or outpatient department (OPD) of the PHCC	Trained health worker
	Initial targeted counselling	Counsel on identified problems related to exclusive breastfeeding, early childhood development and maternal physical and mental wellbeing.	OPD or under-five consultation	Clinical officer at under-five clinic
	Follow-up (monitoring)	Repeat assessment, monitor progress and refer if needed.		
	Follow-up (targeted counselling)	Counsel on previous or newly identified problems related to exclusive breastfeeding, early childhood development and maternal physical and mental wellbeing.		
	Health and nutrition education	Provide general health and nutrition education on essential family practices and prepare for quality complementary feeding.		
	End of care when infant reaches six months of age	Review outcome and decide on referral to follow-on services.		

* Gurei, Hai Dinka, Pariak and Yambio PHCCs have child clinics for consultations for children under five years of age.

In the community, the BHI provided sensitisation, health and nutrition promotion, screening, and referral and home-based follow-up for the MAMI Care Pathway approach. For example, BHWs and mothers of absent pairs received individual reminders on their mobile phones for follow-up. MIHR supported nine BHWs per site (supported through the CLO and MAMI assistant) for individual- or family-based outreach. Sensitisation and active screening were not done in the entire health catchment area because of limited coverage of BHWs, as the BHI is still being rolled out, and while MIHR supported MAMI Care Pathway screening to some extent, it was unable to fully fund and facilitate the rollout of BHWs in the entire catchment areas of the implementation sites.

In the health facility, in theory, various essential health and nutrition services were available for vulnerable infants u6m and their mothers under the nationally elaborated MNCHN, IMNCI or CMAM guidelines. In reality, poor coordination and organisation and limited resources meant that care for vulnerable infants was limited to addressing illness and referring malnourished infants to the hospital for stabilisation. For example, PHCCs were supposed to have breastfeeding corners that provided IYCF counselling as part of their nutrition units, but the units only cared for infants from six months of age and did not accept younger infants and their mothers. Mothers attending antenatal care and maternity care received breastfeeding advice but nothing thereafter. Thus, when the MAMI Care Pathway approach was introduced, rapid screening, in-depth assessment, care and referral were provided across the PHCCs, creating opportunities to connect services and offer comprehensive continuity of care for vulnerable infants and their mothers.

Although all PHCCs were required to refer high-risk patients to specialised care, ambulances were often unavailable, so transport of high-risk mother–infant pairs who were referred was usually left to mothers to arrange. The same was true for mothers discharged from hospital who were supposed to return to PHCCs to continue care. Referring mothers for mental health care proved particularly challenging because only two referral hospitals (Juba Teaching Hospital and Bor State Hospital) had designated mental health units. Therefore, minimal psychological support was provided to mothers during counselling.

Infants who reached six months of age and had recovered (with no remaining risk factors) exited care and were referred for continued community support from the BHWs. Those who had not recovered (i.e., showed some risk factors and needed to continue specialised care) were referred for follow-up services (e.g., CMAM services for treatment according to the national protocol).

Organisation of staff. Skilled health workers were available at the PHCCs and referral hospitals, but they often had heavy workloads due to understaffing or they expected incentives for adding MAMI activities to their existing work. MIHR did not incentivise MOH staff, although some implementing partners in the same health facilities did, which created unresolvable expectations and affected motivation.

The WHO IMNCI Supervisory Checklist and a specifically developed MAMI supportive supervision checklist were used for supportive supervision. MOH staff were mentored by the MAMI assistants positioned at the sites, and the MAMI assistants were mentored by the expanded MAMI team through daily WhatsApp group discussions and (bi)weekly and monthly scheduled and ad hoc meetings.

Participation. Caregivers were involved in the MAMI Care Pathway through rapid screening, in-depth assessments, care, and support through counselling and sensitisation activities. Information on caregiver satisfaction was obtained through supportive supervision inquiries and exit interviews.

It was a challenge to motivate mothers to remain in care with their infants. While most mothers were positive about their experience, some raised concerns about the duration of consultations. Also, they felt that they were repeatedly asked the same questions, particularly questions related to the feeding or the growth of their children. Therefore, it was not always seen as beneficial to continue in the MAMI Care Pathway, in light of the time and opportunity cost. Some mothers had high expectations regarding receiving food supplements or soap at the facilities when they attended follow-up visits and were disappointed when they did not. Opportunities to increase their interest and commitment were identified (e.g., increasing knowledge, providing quality targeted counselling, offering relaxation exercises), especially having improved access to consultations and other services, such as vaccination or family planning.

Partnerships. The initial stakeholder analysis found that the national health system in South Sudan relies heavily on international NGOs, supported by United Nations agencies (UNICEF, World Food Programme, WHO). Emergency and development donors played a decisive role in implementing strategies and site coverage. As such, a complicated web of irregularly funded initia-

tives and collaborative partnerships covered one or more strategies in health facilities and communities.

Each PHCC had a local MAMI coordination team, including for quality improvement, which met monthly. At the community level, the Boma health committee oversaw and supervised all activities in the community.

The strong national coordination system was not always evident at the distal locations, resulting in a challenging collaborative working environment. For example, when MIHR requested the involvement of other implementing partners that supported the implementation sites, they received no response. At the orientation meeting, it was proposed to establish a MAMI Country Chapter[1], following the example of the India MAMI Country Chapter, to coordinate actions and learning, but this did not materialise. However, a MAMI study advisory board was established and included senior health and nutrition actors of MOH.

4.4. Monitoring, improving quality and collaborative learning

Key information:

- A monitoring, evaluation, reporting and learning (MERL) system was developed and put in place to record monthly monitoring and individual data. All study data will be analysed and reported on by September 2024.
- Virtual platforms (e.g., WhatsApp, virtual meetings and emails) were used to share successes and challenges, solve problems and improve quality.
- An in-depth qualitative study on implementing the MAMI Care Pathway approach as part of the MAMI implementation study protocol gathered perceptions of health workers and mother to understand *how well they accepted and adhered to the recommendations*.
- MIHR remained accountable to MOH in South Sudan in regard to sharing learning and guidance on the integration of the MAMI Care Pathway approach into the health system. Findings from the study will be presented in a final debriefing meeting with stakeholders of MOH, United Nations organisations and implementing partners to inform discussion on next steps.

Monitoring and reporting. Monitoring data were collected using paper-based tools and then collated and consolidated monthly, both within and across facilities. Table 5 shows the number of mother–infant pairs screened, identified as at risk, and assessed over a 12-month period. Digitised tools were used for monthly monitoring (in Excel) and for individual data recording (in Kobo). The monitoring data were reviewed during monthly meetings to evaluate progress and discuss improvements of the Care Pathway implementation. Individual qualitative data collected on the care forms will also be analysed and synthesised. By July 2024, all the study results will be finalised.

1 A MAMI Country Chapter is a network that may be formed at national or sub-national level to enhance capacity, bridge disciplines, highlight evidence gaps or champion the MAMI Care Pathway approach according to local needs and demand.

Table 5. Screening, assessment, enrolment, and outcomes of mother–infant pairs, 12-month period (October 2022–September 2023), South Sudan

Key indicators:	
Pairs screened	4,813
Pairs screened identified at risk	1,971
Pairs assessed	1,971
Pairs assessed identified at moderate risk (% of pairs assessed)	529 (26.8%)
Pairs assessed identified at high risk (% of pairs assessed)	94 (4.7%)
Pairs assessed boy/girl ratio	1.03
Key reasons infants' moderate risk	LBW, low MUAC, feeding difficulties
Key reasons mothers' moderate risk	Adolescent motherhood
Pairs enrolled in care	521
Pairs recovered at infant aged 6 months (% pairs attending care until infant aged 6 months)	183 (83.6%)
Pairs not recovered at infant aged 6 months (% of pairs attending care until infant aged 6 months)	36 (16.4%)
Pairs missed before or at infant aged 6 months (died, absented, did not return, lost to follow-up) (% of pairs enrolled)	302 (58.0%)

LBW= low birth weight; MUAC= mid-upper arm circumference.

Improving quality and disseminating information and learning. Virtual platforms, including a MAMI WhatsApp group, virtual meetings and email, were used for timely problem solving, discussion and sharing of successes and challenges. Weekly/biweekly/monthly meetings (per site and across sites) were held to review the findings from monitoring reports and suggested actions for quality improvement, focusing on weaknesses, strengths (lessons) and ways to improve, and to give feedback and make corrections when needed. The database dashboards automatically summarised key indicators and presented key data in graphic form. They were used to interpret progress and trends and explore reasons for variations in implementation quality.

Intermediate findings were presented at regular intervals in-country, as well as in international learning events. The final results will be presented at a debriefing of key stakeholders of MOH, United Nations agencies and implementing partners to discuss next steps.

An in-depth qualitative study of the MAMI Care Pathway approach, including key informant interviews with participating mothers and health workers, took place in February–March 2024 in Gurei and Pariak PHCCs and health catchment areas, as part of the implementation study. This study explored perceptions of service providers (clinical and community health workers and MAMI assistants) and mothers on the acceptability of and adherence to the Care Pathway.

The implementation study initially intended to create a national learning and information sharing mechanism, but as there are no plans for further implementation, this was not pursued. Nonetheless, MIHR remains accountable to MOH in regard to sharing learning and guidance on integrating the MAMI Care Pathway approach into the South Sudan health system and is interested in contributing to any emerging fora to this end.

4.5. Making suggestions for improving planning and implementation

Key information:

- Integrating the MAMI Care Pathway approach into routine services would help streamline and simplify care for at-risk infants u6m and their mothers but should avoid creating unintended challenges for both routine and the new activities.
- Decision-makers, implementing partners and donors need to better understand how the MAMI Care Pathway approach builds on and strengthens existing services to encourage future buy-in and technical and financial commitment.
- Appropriate MOH staff need to be trained to provide quality services for at-risk mother–infant pairs as part of their routine work, instead of employing external staff to cover the tasks.
- More resources need to be available to not compromise continuity of care, for, e.g., transport for referral, specialised mental health care.
- Integrating the MAMI Care Pathway approach into routine services and adapting job descriptions to include the care pathway activities would motivate staff and improve quality care.

From their experience implementing the MAMI Care Pathway approach, case study participants made several suggestions on ways to improve care. One was to integrate activities into routine services for infants u6m to streamline and simplify care for mother–infant pairs. However, integrating new interventions into existing services or reinforcing those in place should avoid creating unintended challenges and strengthened collaboration within and across services were needed. The lack of transport and resources to pay for referring mother–infant pairs to specialised care in hospitals and the lack of specialised mental healthcare services were significant challenges in the South Sudan case, and no local solutions were available.

It was hoped that local health partner coordination systems, such as the Health Pooled Fund, could support the integration of the MAMI Care Pathway approach into routine care, but because the approach was not seen as part of essential services, it was not eligible for support by this technical and financing mechanism. It was felt that a better understanding of the MAMI Care Pathway as an approach that builds on and strengthens existing services, rather than being a new and parallel mechanism of care, would be helpful. Such understanding could garner additional support from decision-makers, implementing partners and donors in future.

Most of the MAMI assistants had a clinical background, and while they were not meant to be involved in care delivery, they were often asked to assist because of the heavy workload of the MOH staff and the time-consuming nature of the combined IMNCI and MAMI consultations. Looking ahead, better integrating the MAMI Care Pathway approach into routine services and ensuring that health workers' job descriptions reflect provision of services across an integrated care pathway for at-risk mother–infant pairs, rather than employing MAMI assistants to complete tasks, would improve staff capacity to provide quality care.

The introduction of the MAMI Care Pathway approach involved sufficient participatory discussions and field testing to adapt the 2021 MAMI Care Pathway Package materials to the context. As the scope for adapting existing BHI or IMNCI materials was limited, a lot of repetition made providing the services and filling the forms very time-consuming. Further adapting and simplifying implementation materials and using digitised systems could streamline activities and make them less daunting for health workers and mother–infant pairs. Also BHWs saw MAMI activities as add-ons to the normal services they provided, creating resistance to the increased workload. This further underlined the need to integrate the MAMI Care Pathway's community activities into the BHI package.

As implementation of the MAMI Care Pathway approach was restricted to five implementation sites with defined health catchment areas for community-based activities, there was confusion when mother–infant pairs who attended the health facilities from outside the catchment areas were enrolled. Further, the abrupt end of the study, as planned in the study protocol (care for 500 moderate at-risk pairs), undermined efforts to raise awareness of the vulnerability of infants u6m and their mothers and the need for follow-up visits for care and feeding support. Also, the lack of a plan to transition from the study to programme implementation undermined efforts and investment to continue to strengthen the system for service provision.

5. Embedding the MAMI Care Pathway in routine services

Key information:

- Adequate training, orientation and adaptation to their context helped health workers understand how implementing the MAMI Care Pathway approach built on and strengthened existing services for at-risk mother–infant pairs. They appreciated its value and understood what was required of them to implement it.
- Components of the MAMI Care Pathway that were not included in clinical health workers' job descriptions challenged their commitment to provide this care as routine practice.
- Training, context-specific tools, continuous mentorship (supportive supervision) and participatory discussion were critical for effective implementation and improved quality of care.
- Person-centred care for the mother–infant pair was a new approach for health workers and required a broad skill set and adequate time, which were challenging given workloads and inadequate staff coverage.
- A strong monitoring and quality improvement system supported continuous quality improvement of the organisation and delivery of care within and across implementation sites.

This section describes whether and how health workers in the South Sudan case understood and adopted (normalised) the MAMI Care Pathway approach and embedded it in routine practice in primary care (13, 14). (See Annex 3 for methods and their limitations and Annex 7 for detailed findings.) We interviewed an experienced clinical officer in charge of a PHCC who is MOH staff, and a MAMI assistant who is MIHR staff and was hired to support the implementation of the MAMI Care Pathway.

First, the inquiry explored the degree to which the approach was adopted in routine work, the contribution of individual and collective action to achieve this and what promoting and hindering factors were involved. Four components of the adoption process were considered: coherence, cognitive participation, collective action, and reflective monitoring. Next the likelihood of the MAMI Care Pathway becoming routine practice from the health workers' perspective was appraised.

Mother and baby attending the health centre.

5.1. Exploring adoption

Health workers participating in the inquiry were asked 16 questions to explore whether they:

- Understood the components of the MAMI Care Pathway approach (coherence, or what it is about);
- Were committed to and engaged in implementing the practice (cognitive participation, or who does it);
- Worked with colleagues ¬to enable the practice (collective action, or how it gets done); and
- Appraised the benefits of the practice (reflective monitoring, or how it is understood).

Understanding the MAMI Care Pathway (coherence)

Clinical health workers were asked whether they understood and saw the value of the MAMI Care Pathway approach. Overall, they were able to distinguish between how services were provided before and after implementation, highlight new components of care (measuring MUAC for infants u6m and assessing and enrolling at-risk infants and mothers together) and articulate how the MAMI Care Pathway approach builds on and encourages routine implementation of existing services (IMNCI). Following training and experience implementing the MAMI Care Pathway approach, the health workers agreed on its importance and cited its benefits, including opportunities to identify infants requiring immunisations and facilitating referrals. Because tasks were defined and mapped with the team, clinical health workers understood what they were required to do to implement the MAMI Care Pathway approach in the services they provided.

Coherence was influenced by the following factors:

Enablers

- Orientation and training sessions built a common understanding and created openness to improving practices.
- Competent managers and advisors shared the new knowledge and together adapted materials to their context.
- The MAMI Care Pathway components on their own were mostly known already, with only a few new elements, and were accompanied by practical guidance on implementation.
- The tasks, roles and responsibilities were discussed and decided together based on local capacities.

Barriers

- The health workers were (initially) uncertain about how to operationalise the Care Pathway, how to make it fit into existing services and care pathways rather than as a new parallel intervention.

Engaging with the MAMI Care Pathway (cognitive participation)

Commitment and engagement were required to implement the MAMI Care Pathway approach in clinical practice. MAMI assistants recruited by MIHR to support the implementation drove this forward. While clinical health workers understood the benefits of the approach, the tasks were not included in their job descriptions, and this challenged their commitment to providing this care as routine practice. There was enthusiasm and willingness to implement the MAMI Care Pathway approach in routine services, but a change in policy and updates to job descriptions and the current under-five registry would be needed to embed MAMI-related tasks at the primary care level in MOH-led sites. If led by NGOs, MOH staff would require additional support (salary top-ups, NGO support staff) to maintain care across services.

Cognitive participation was influenced by the following factors:

Enablers

- The study protocol, approved by the national MOH, prescribed the mandatory involvement of health workers in the Care Pathway (at the specific request of the MOH).
- Health workers had access to a supportive supervisor.
- Health workers developed the ability to solve health issues identified in infants u6m (previously ignored), whose benefits became visible to them and the mothers.
- Understanding that actions now reduce more serious conditions in the infant later.
- The ability to identify risks that would otherwise be ignored.
- The involvement of senior MOH actors from the start.
- The boosting effect of positive (unintended) consequences; e.g., improved access to vaccination.

Barriers

- MAMI Care Pathway components were not covered in job descriptions or career development assessments (or not perceived a [partially] covered).
- More and longer consultations made the Care Pathway unpopular with staff (vulnerabilities in infants u6m and their mothers were not identified and thus not addressed before, unless an explicit health or nutrition problem was identified).
- Incentives (salary top-up) for additional work were expected (as is usually done for new activities supported by NGOs) but not received.
- Continued support from the implementing partner was expected until the approach is embedded as a routine national practice.

Organising changes and relationships (collective action)

Operationalising the MAMI Care Pathway approach in primary care and community services required collective action from all health workers. Training and mentorship (including supportive supervision) ensured that health workers could complete the tasks required at their level. While health workers acknowledged that the skills required to implement the MAMI Care Pathway approach were not so different from those used in their routine practice, a lot of training was needed at the start to ensure adequate understanding of, and competency in assessing and providing, care and support, including completing the forms. Health workers felt that the two-day training was too short for the amount of information and lacked sufficient practical sessions on implementing a person-centred approach of infants and their mothers. Also, no counselling training was provided, though it would have been useful to refresh these skills and contextualise them within the MAMI Care Pathway approach. However, health workers thought the MAMI assistants and supervisors provided adequate on-the-job mentoring and support, while they themselves would have benefited from strengthening their mentoring skills.

Collective action was influenced by the following factors:

Enablers

- Comprehensive implementation records adapted to the context (with health workers' involvement) ensured standardised and quality actions (appropriate tools).
- Competent, well-trained health workers built confidence to implement the practice; supportive supervision and continuous on-the job mentoring further improved practices.
- Competent managers and advisors provided good guidance and supported implementation through participatory discussions for quality improvement.

Barriers

- The person-centred and integrated approach was new and required a broader skill set, including for organising the care.
- Teamwork or task sharing was not common because staff were either appointed to do specific tasks or were the only skilled clinicians available; the need for clinical consultation skills did not promote task sharing.
- There were frequent staff changes and absences, without the necessary coverage.
- Clinical health workers faced a high workload in a short timeframe for consultations, and did not organise them differently.
- Most of the care relied on one (clinical) health worker who was already the busiest staff in the health facility.

Appraising the MAMI Care Pathway (reflective monitoring)

Implementing the MAMI Care Pathway approach required ongoing monitoring and reflection to ensure and maintain quality of care and monitor progress. An elaborate M&E system was developed and managed by MIHR's MAMI assistant and coordinator, who provided regular feedback to implementers. However, understanding and collecting information on some of the indicators (e.g., the difference between referral of a pair when classified as at high-risk during the assessment and referral of a pair because of a deterioration during enrolment in care; between pairs who had missed returning for follow-up visits [absent] and pairs who had moved out of the catchment area [lost]) was challenging. The M&E system promoted continuous reflection on quality, and improvements were discussed and agreed together with the clinical health workers. These participatory reflections supported positive changes in organisation of clinical care, and learned lessons on good and challenging practices that were shared within and across sites.

Reflective monitoring was influenced by the following factors:

Enablers

- A strong monitoring and quality improvement system, held in scheduled discussions guided by the MAMI assistants, helped health workers continuously appraise their work and reflect on actions for improvements.
- Involvement in quality improvement discussions facilitated operational changes and boosted appreciation and appropriation.

Barriers

- The 'learning by doing, together' approach led to multiple improvements in forms and working modalities, which were challenging to manage and sometimes confused implementers who were used to stable systems. Implementing the 'plan-do-verify-act' cycle for continuous adaptive learning and management required a change in mindset and a paradigm shift for health workers to not undermine their self-confidence.

5.2. Overall appraisal of the adoption process

The success of implementing the MAMI Care Pathway approach based on the interviews appraised the four adoption components on a five-point Likert sliding scale, with a score from 1 ("not adopted at all") to 5 ("completely adopted"):

Coherence, score 4.8. Confident managers and advisors translated existing knowledge and experience of the MAMI Care Pathway to adapt context-specific guidance and practices. Several advancements made this possible: the topic was covered in the 2013 WHO guideline on the management of severe acute malnutrition; materials (e.g., MAMI Care Pathway materials, briefs and videos) were available for advocacy and implementation; learning experiences were available (e.g., in the ENN *Field Exchange* publication); and evidence was published in medical journals. In addition, the approval of the study protocol by the ethical board of the MOH further unlocked barriers.

Cognitive participation, score 2.5. The low score for the level of engagement with the MAMI Care Pathway may be explained by the fact that clinical health workers were asked to be involved in the Care Pathway by the national MOH and MIHR but had no choice about their involvement. They were asked to complete tasks that were not in their job descriptions and that increased their workload, but they were not compensated for this.

Collective action, score 2.8. Collective discussion on allocating tasks adapted to the local capacities and available skill sets facilitated the organisation of changes and the development of relationships across implementing teams. However, this score may also reflect the limited number of clinical health workers in the system. Both clinical tasks (e.g., IMNCI assessment) and non-clinical tasks (e.g., counselling) were delegated to the same person, who was often the officer in charge, who had to conduct all the consultations while also managing the health centre.

Reflective monitoring, score 4.5. The comprehensive M&E system encouraged health workers to collectively reflect on their work and suggest adaptations to improve quality of care in discussions that were guided by their supervisors. Health workers would not have done this by themselves, unless intuitively, because this reflective culture was lacking .

The scores for the four adoption components were plotted on a spider chart showing the degree of success in the adoption of the MAMI Care Pathway (Figure 2): the larger the area of the spider web, the better the success in adoption.

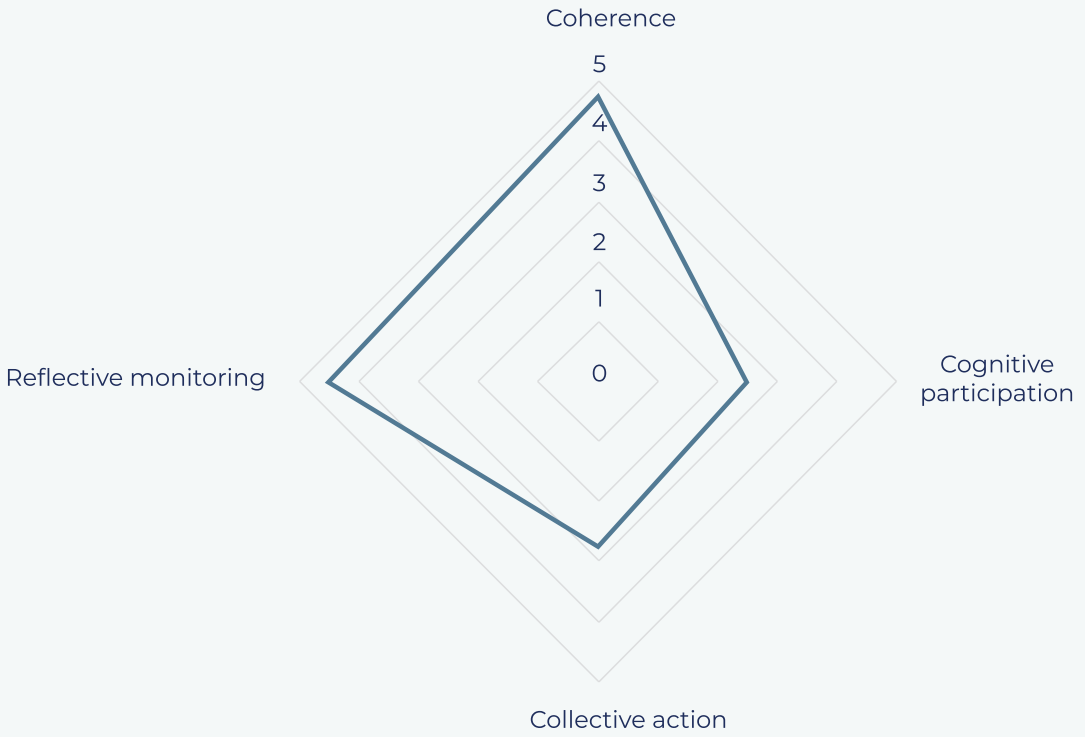

Figure 2. Interpretation of the adoption components of the MAMI Care Pathway implementation in the South Sudan case, 2023
(Adoption was scored on a sliding scale from 1 "not adopted at all" to 5 "completely adopted".)

We concluded that the overall adoption of the MAMI Care Pathway approach had an average score of 3.7, mostly because of strong oversight in regard to complying with the study protocol, rather than health workers deliberately choosing to normalise the intervention in their daily work. Subsequent steps in quality improvement should consider overcoming the barriers identified in this section to improve implementation, and thus the effectiveness of the approach.

6. Considerations for scalability and sustainability

This section examines readiness to scale up the MAMI Care Pathway approach, applying two methods to identify challenges and generate insights to improve scalability.

6.1. Exploring challenges to scale-up, spread and sustainability

Key information:

- The condition of "small and nutritionally at-risk infants and their mothers" was well understood, but some vulnerability factors were more difficult to interpret, which affected care provision.
- Methods to detect and manage certain vulnerability factors required new skills, overlapped with other existing approaches or required contextual adaptations and organisational changes.
- Health workers perceived the new care as beneficial, offering a solution for a problem that was ignored earlier unless it progressed to a severe condition. Mothers did not fully appreciate the benefits when they dropped out early.
- When not fully understood or well managed, the new care pathway threatened health workers' professional identity, values and scope of practice, which affected their motivation.
- Reorganisation of care in a weak health system needed good leadership and organisational skills.
- The paradigm shift to person-centred and continuity of care faced financial and policy support constraints and competing health priorities across health departments.
- To make the MAMI Care Package approach a routine service, multiple health policy dynamics that facilitate or hinder embedding in, and adaptation to, the local context should be considered.

The first method identified challenges and generated insights to improve scalability to explore factors that might predict the success of sustainable scalability of the MAMI Care Pathway (16). (See Annex 3 for methods and their limitations and Table Annex 8a for detailed findings.) We interviewed the global senior nutrition advisor, the MAMI coordinator, one MAMI assistant (MIHR staff), and one clinical health care worker who was officer in charge of one PHCC (MOH staff).

Reflective participatory discussions examined the MAMI Care Pathway approach across seven domains to identify challenges on scalability related to the condition, the technology, the value proposition, who are the adopters, the health or care organisation, the wider system, and embedding and adapting over time. Next, the case study investigators graded the challenges as 1 (simple – straightforward, predictable, few components), 2 (complicated, with multiple interacting components or issues), or 3 (complicated, dynamic, unpredictable, not easily disaggregated into constituent components).

The condition. The condition "small and nutritionally at-risk infants and their mothers" was well described and well-understood by the health work-

ers because of coaching and mentoring, with job aids. It was adapted to their level of care (i.e., community and primary health care). However, some risk factors (e.g., disabilities, congenital abnormalities, maternal mental health) were new and not easily detectable, understood or predictable. Also, the person-centred focus on the mother–infant pair, combining multiple conditions of two people, was a new way to describe a condition. To further complicate matters, co-morbidities and socio-cultural factors (e.g., mother's health, health-seeking behaviour, compliance with treatment, social status, family and peer support) affected the Care Pathway and outcomes in various ways. For example, mothers influenced by family and peers behaved differently in the health facility than at home, misinterpreted or misreported advice, or were not open about the challenges they faced, including mental health issues.

We graded the vulnerable mother–infant condition as **complex** (grade 3) because some factors inherent in the condition affected the Care Pathway and service provision in ways that were not predictable. The severity of a condition for one mother–infant pair could change over time for no strong reason, and the same or a similar condition could show a different degree of severity and have different implications.

The technology. The methods and tools used to screen, assess, classify and support "small and nutritionally at-risk infants" (technology) were mostly familiar, building on and overlapping with the IMNCI, CMAM and IYCF approaches. More challenging was putting the mother–infant pair at the centre of care and shifting the focus from a focus on the disease to a focus on the wellbeing of two individuals, which had different needs and required different skill sets. Moreover, changes in health and nutritional status were visible, but changes in health behaviour, which is influenced by socio-cultural factors, were less so. Generic job aids with detailed instructions were available to build on, but these were complicated and required considerable adaptation to the context.

We graded the technology involved in detecting and addressing the vulnerable mother–infant condition as **complicated** (grade 2) because some factors of the condition were difficult to detect and detection needed new skill sets, contextual adaptation or organisational changes, or overlapped with existing approaches.

The value proposition (benefit, or unique selling point). Health workers appreciated gaining a better understanding of vulnerability factors of infant care and feeding practices that impacted on growth and development. They appreciated being able to identify these factors early and provide targeted risk-based care to prevent infants from developing a more serious condition. Mothers were preoccupied with immediate benefits. Those who received support had more understanding and confidence, and they experienced the positive value of the Care Pathway. Those who did not (e.g., because they had conflicting tasks or faced opposition at home) did not have the opportunity to see the positive value. Consistent communication (health workers speaking the same support language) strengthened mothers' understanding and confidence.

We graded the value proposition of the vulnerable mother–infant condition as **complicated** (grade 2) because, while the perceived benefit of the Care Pathway (good guidance on how to address vulnerability) was well appreciated by health workers and mothers, it was underestimated by those who did not have the opportunity to fully experience the benefits (not involving health workers, early dropout mothers).

The adopters. When introducing the MAMI Care Pathway, staff roles changed or new staff were hired to implement or support the Care Pathway. Staff who took on the Care Pathway as a new responsibility alongside their regular tasks found the increased workload a serious issue that affected their professional and personal lives. Mothers experienced the assessment and support process as burdensome and time-consuming. They had better acceptance of it and gained more confidence when the benefits were clear. Mothers who experienced respectful care were more likely to trust and comply with the intervention. Mothers' support networks (husbands, grandmothers or peers) played a role in influencing, supporting or blocking appropriate care and feeding practices.

We graded the adopters of the Care Pathway as **complex** (grade 3) because the innovation had the potential to threaten health workers' professional identity, values and scope of practice, and to affect mothers' trust and confidence, which in turn are influenced by their support environment.

The health or care organisation. Important changes in the organisation of regular care were needed to introduce the contextualised implementation of the MAMI Care Pathway in South Sudan. When health actors supported the innovation, external financial and technical resources facilitated implementation.

We graded the organisation of the Care Pathway as **complicated** (grade 2) because organisational changes and good leadership were needed, which was challenging in a context with limited resources.

The wider system. National interest in rolling out the MAMI Care Pathway approach grew but needed considerable financial and policy support (including in regard to understanding the burden and the impact of not addressing risk factors) to adapt it to the context and align it with existing programmes and services. Moreover, the person-centred continuity of care of the MAMI Care Pathway approach was new and required a shift from disease-centred care to person-centred care, cutting across health departments with defined responsibilities.

We graded the wider system to absorb the Care Pathway as **complex** (grade 3) because the shift to person-centred and continuity of care faced financial and policy support constraints and competing health priorities across health departments.

Embedding and adapting over time. The implementation of the Care Pathway in South Sudan put a spotlight on the issue of how to embed and adapt the Care Pathway in a dynamic health system as an island of innovation. Monitoring the quality of care supported and stimulated continuous learning and adaptation of the approach and generated information to facilitate alignment with other national approaches. However, the shift to person-centred and continuity of care in the MAMI Care Pathway approach required adapting and aligning approaches with which the Care Pathway overlapped or which it strengthened, and for which the local health system was not yet ready.

We graded the embedding and adapting of the MAMI Care Pathway approach over time as **complex** (grade 3) because it required alignment with multiple existing and continuously changing health and nutrition approaches that it overlapped with or strengthened to be fully absorbed into routine services.

The seven scores were plotted on a spider chart (Figure 3) indicating grade 1 challenges (simple) are understandable or predictable, and relatively straightforward to address; grade 2 challenges (complicated) are less understandable or controllable, thus less straightforward to address; and grade 3 challenges (complex) are incomprehensible or unpredictable, thus systems dynamics methods are required to understand their changing or emergent behaviours. The area of the spider web in figure 3 appraises the overall feasibility or ease of managing the challenges to implementing the MAMI Care Pathway approach in the South Sudan case at scale: the larger the area of the spider web, the more challenging the scalability.

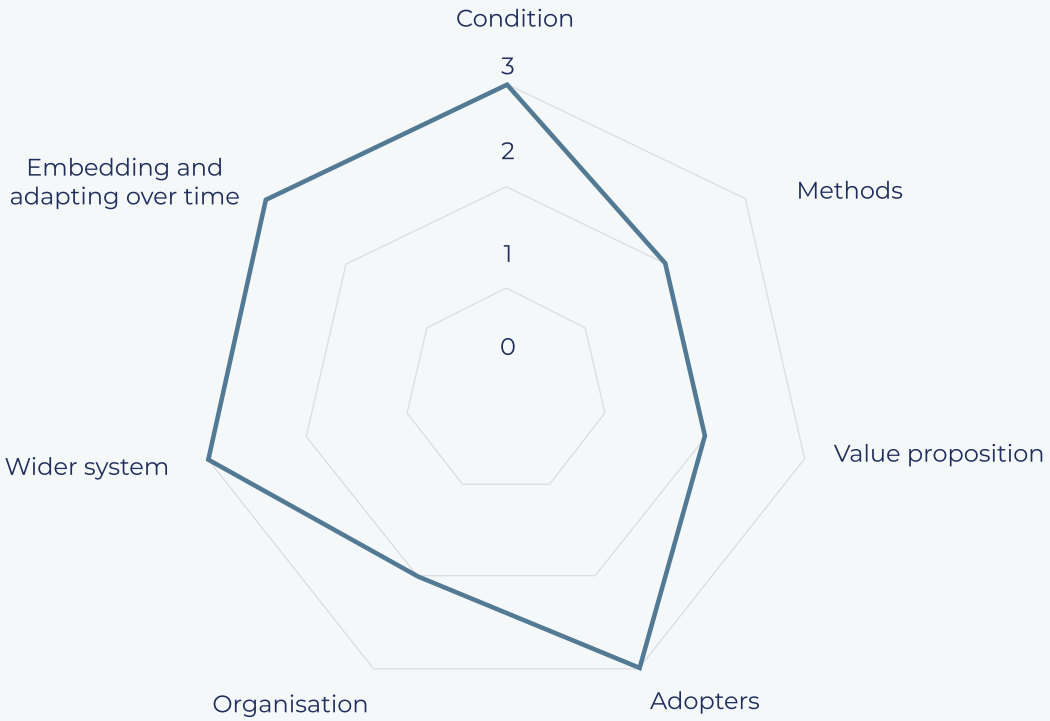

Figure 3. Appraising challenges to the scalability of the MAMI Care Pathway implementation in the South Sudan case, 2023
(Challenges were graded as 1 "simple", 2 "complicated" and 3 "complex" to address.)

We conclude that while health workers involved in implementing the MAMI Care Pathway approach in the South Sudan case found the Care Pathway approach a much needed intervention, filling an identified gap, they also found it challenging to address the condition "small and nutritionally at-risk infants and their mothers" with a person-centred and continuity of care approach. Neither clinical health workers nor the local and national health system, even with support from donors and implementing partners, were ready to address the multiple challenges.

Mothers waiting to attend services at the health centre.

6.2. Exploring readiness for scale-up

Key information:

- Actions the South Sudan case took that facilitated future sustainable scale-up of the MAMI Care Pathway approach included the following:
  - Engaging key stakeholders in a participatory process.
  - Addressing a persistent health condition or service.
  - Considering expectations regarding scale-up in the design.
  - Considering constraining or supporting socio-cultural and gender factors.
  - Keeping the intervention simple, without jeopardising outcomes.
  - Testing the intervention in a variety of socio-cultural and geographic settings.
  - Assessing and documenting health outcomes and the process of implementation.
  - Planning to advocate for changes in policies, regulations.
  - Designing mechanisms to review progress and promote learning.
  - Sharing understanding on the importance of evidence on feasibility and outcomes prior to scale- up.

- Actions the case missed that might facilitate future sustainable scale-up included the following:
  - Testing the intervention under existing human and financial resources constraints.
  - Engaging with donors and technical partners to support scale-up early and continuously.

The second method explored potential scalability to assess readiness for scale-up by considering critical steps in the design to enhance potential large-scale impact (18). (See Annex 3 for methods and their limitations and Annex 8b for detailed findings.) The case study team triangulated the case study information to populate the table in Annex 8b. They explored 12 key actions in the design of the study to provide useful insights for scale-up decision-making. Table 6 shows that all actions for potential scalability had been considered except steps 7 and 9.

Table 6. Appraising potential scalability of the MAMI Care Pathway implementation in the South Sudan case, 2023

Actions for sustainable scale-up	
1. Involved future stakeholders	Yes
2. Addressed a persistent health condition or service	Yes
3. Considered expectations about scale-up in the design	Yes
4. Considered constraining or supporting socio-cultural and gender factors	Yes
5. Kept the package of interventions simple, without jeopardising the outcomes	Yes
6. Tested actions in a variety of socio-cultural and geographic settings	Yes
7. Required no extra human and financial resources for implementation	No
8. Assessed and documented health outcomes and the process of implementation	Yes
9. Engaged with donors and technical partners to support scale-up early and continuously	No
10. Planned to advocate for changes in policies and regulations	Yes
11. Designed mechanisms to review progress and incorporate new learning	Yes
12. Shared understanding of the importance of adequate evidence on feasibility and outcomes prior to scale-up	Yes

In regard to step 7, implementation was only partly tested under the existing resource constraints of the health system, working with locally available resources and keeping external support to the minimum because it included supportive expertise. While the local health system in theory had the capacity to implement care as described in the protocol (staff were trained and received coaching to strengthen their skills), in practice, external backup support for implementing and managing care was an important motivator for the care providers.

In regard to step 9, advocating with donors and other sources of funding, or for financial support beyond the study stage, the MIHR MAMI team had not yet sought funding to support the transition to continue care and scale-up. There have been regular exchanges with the donor (USAID), which has not yet shown an interest in supporting scale-up of the approach as part of MIHR, although it supports implementation of the MAMI Care Pathway by other NGOs in South Sudan. Initially, neither MOH nor UNICEF or in-country NGOs, while linked at the global level in the MAMI Global Network and Implementers Group, had shown an interest in collaborating and exchanging materials and lessons or harmonising the approach, but this situation began to change.

7. Learning to inform practice and scale-up in South Sudan (summary findings)

The process of accessing learning from implementing the MAMI Care Pathway approach integrated into routine MNCH services in South Sudan involved an empirical investigation in a real-life applied research context. Interviewing members of the implementation team to listen to and collect their perspectives and discussing emerging findings together revealed implicit knowledge and expanded mutual learning. Using different lenses to explore what was done, where, by whom, and how, uncovered and helped further generate a range of rich learning about implementing the Care Pathway approach in the given context.

7.1. Planning and implementation

The MAMI Care Pathway approach in the South Sudan case was introduced as implementation research, in five primary care settings across four states with a fixed start and end date. The settings differed socioeconomically. There was also wide variation in the delivery of health services, characterised by strong MOH oversight with well-developed policies, translated into health interventions driven by international financial partners and provided or supported by international technical partners. The study protocol, developed in participation with MOH, guided actions on knowledge management and integrated quality care. Formal MOH ethical approval enabled their involvement in and ownership of the study implementation.

Start-up was a lengthy process because of the participatory approach, which relied on national and local key health and nutrition actors to contextualise implementation modalities and materials. It also involved bringing in a support team with expertise in IMNCI and counselling skills for training and on-the-job mentoring of health workers. The participatory 'learning by doing' approach to adapt the MAMI Care Pathway to the local context proved successful in improving quality of care but required continuous coaching to familiarise health workers with the refined modalities. On the plus side, ongoing mentoring stimulated reflective monitoring by everyone involved, which motivated health workers.

While the study aimed to embed the Care Pathway in routine services, implementing it at small scale with a defined study purpose over a limited time period made it possible to adapt modalities to the immediate context but did not enable the context to adapt in return. For example, risk assessments of infants u6m and their mothers were aligned with and expanded on the IMNCI approach, leading to inevitable duplication (since existing forms and protocols could not be amended) and creating a lengthy assessment that no health worker was used to or could practically accommodate without structural change (and so rebelled against). It was not possible to either adapt the IMNCI approach to the MAMI approach or to revise the job descriptions of MOH staff. Learning was therefore limited to how adaptation was defined rather than realised.

The practical experience of implementing mother–infant-centred care that addressed health, nutrition and psychosocial risk factors of both infants and mothers required a reorganization of care towards a more comprehensive and risk-based continuum of care. In reality, this meant that potential was realised or limited by health workers' personal motivation, capacity and autonomy, within the local health system structures and constraints.

The South Sudan case made major efforts in M&E to improve quality and share learning on the implementation of the MAMI Care Pathway internally and externally. In a next planned step, MIHR will encourage national policy-makers and health and nutrition actors to discuss how this experience can inform development and alignment of policies and practices and identify needs for further research. More evidence on what works within existing systems to what effect and at what cost will be critical to gain buy-in from major stakeholders and drive policy and practice change.

7.2. Normalisation and adoption

Because the MAMI Care Pathway approach was built upon existing services, it was useful to investigate whether clinical healthcare providers and their managers or supervisors, MOH staff, adopted the approach and embedded it in routine practice while being trained and coached to do so.

The process of adopting the MAMI Care Pathway progressed because the provided support helped health workers to understand the approach, acquire the skills to comply with the implementation protocol and be involved in quality improvement and continuous learning. Nevertheless, health workers experienced the intervention as an additional external task and expected to be remunerated. They would not spontaneously adopt the approach in their daily work unless it was covered in their job description and part of their career development. Also, the shift from disease-focused to person-centred care was difficult to achieve in South Sudan's vertical programme-driven health system. Tangible benefits – such as reduced workload by streamlining management to eliminate redundant tasks, better managed resources or improved teamwork and task distribution – were not demonstrated.

The appraisal of the adoption process generated information on facilitators and barriers useful for improving health workers' adherence behaviours to enable more sustainable health outcomes.

7.3. Considerations for scalability and sustainability

Two methods applying different lenses examined the readiness to scale up the MAMI Care Pathway approach, not to determine whether the approach was scalable, but to provide insights on challenges that need to be addressed when preparing for scale-up. Challenges were characterised as easy (simple), difficult but possible (complicated) or challenging (complex) to overcome to consider in the future.

Challenges identified included the need to adapt policies and practices to support comprehensive care of vulnerable mother–infant pairs, to make risk-based care understandable and adoptable by both health workers and mothers, to coordinate support from institutions and donors, and to continue to adapt care over time to have it embedded it in the health system.

The challenges to implementing the MAMI Care Pathway indicated that the health care system was not ready to scale up the approach without coordinated policy changes and resource provision to support the paradigm shift to person-centred care and continuity of care.

7.4. Collective learning and suggestions to strengthen the potential for scale

The empirical investigation of the implementation of the MAMI Care Pathway approach in five sites in South Sudan revealed both achievements and challenges in regard to implementing and adopting the approach, as seen through the eyes of health workers (members of the support team and the implementation team).

While MOH was put in the driver's seat from the start and the implementation aimed for an integrated approach building on existing essential services, the potential for scale-up identified more substantial challenges than expected. Implementing the MAMI Care Pathway according to a defined study protocol proved a double-edged sword: it ensured adherence to the protocol to generate quality information, but required an operational system that was not sustainable. The implementation of the MAMI Care Pathway as described in the research protocol prioritised learning about the feasibility of service provision but did not accommodate planning for sustainable scalability. Both the planning process and the monitoring and learning system were comprehensive and focused on gathering insights involving stakeholders in 'learning by doing, together'.

No attempts had yet been made to plan for scale-up (yet). The MIHR team was waiting for final study results to advocate to decision-makers and donors to expand the approach. The MOH had established a MAMI advisory board to facilitate knowledge sharing that could convene key stakeholders to examine lessons and decide on next steps. This meeting could also stimulate the interest of potential national implementing partners to collaboratively take on the approach.

Ideas from the South Sudan case to improve implementation and scale-up of (or follow-up research or implementation on) the integrated MAMI Care Pathway approach are listed below.

Regarding mothers' perceptions, as understood by health workers, we learned the following:

- Vulnerable mothers considered the integrated Care Pathway beneficial when they saw positive changes to their baby's wellbeing, e.g., improved growth.
- Mothers' adherence to care was affected by various factors and was especially difficult to achieve when advice from health workers conflicted with household and community values and norms.
- Mothers' adherence to care improved when there was clear communication across health workers and services.
- When risks for mother–infant pairs were mostly invisible and there was no perceived tangible benefit (food supplements, drugs or soap), mothers lost interest in complying with care.
- Transport costs were *perceived* as a major barrier to attending follow-up visits or being referred to hospital.

In regard to service implementation, we learned the following:

- While most of the MAMI Care Pathway activities were already part of a national policy or health approach, health care workers still did not consider these to be a part of their routine duties.
- Applying continuity of person-centred quality care needed support across services, sectors and policies, and this was absent.
- The new, additional or strengthened tasks that the MAMI Care Pathway approach brought increased workload but in the context of short-term research did not facilitate a re-organisation of care, task sharing or improved teamwork. Many of the newly added or strengthened tasks were the responsibility of the already busy clinical health workers.
- Simplifying care provision to avoid duplication of actions and resources motivated and enabled health workers to comply with recommended actions.
- Harmonising communication on the MAMI Care Pathway approach stimulated confidence for both service providers and users.

Regarding the health system, we learned the following:

- MOH engagement from the start was essential in regard to overseeing standards, policies and processes across departments (sectors) and services.
- The initial study protocol with MOH ethical approval generated quality information and facilitated MOH's involvement at all levels, but the M&E system was too elaborate to be compatible with routine practices and the routine health information system.
- Simplifying the approach and materials would make it easier to build on, and align it with, existing services and to amend policies and practices to streamline implementation for integration into essential services.
- It was not possible to avoid duplication of actions and resources because the essential health services package was still driven by vertical disease-focused approaches or programmes.
- Duplications with existing approaches (e.g., IMNCI, MIYCN, CMAM) should be avoided to ensure smarter service delivery and use of limited resources. However, to embed the MAMI Care Pathway approach into existing services, policy-makers need evidence on how to do this and why they should do so. It is a challenge to find the 'sweet spot' regarding how to test something that is new by obtaining just enough data to inform change but not so much as to dissuade providers during the process (generating data creates work in itself).
- Reviewing the essential service package and linking it to health workers' job descriptions and career development could not be done but would have facilitated adoption.
- Creating a learning group and facilitating exchanges among stakeholders demanded leadership and commitment that later waned, despite initial enthusiasm.
- A paradigm shift is needed to drive change across departments, service delivery and funding sources to successfully provide person-centred and continuity of care for vulnerable infants and their mothers.
- MIHR's interest was to generate learning on the implementation of the MAMI Care Pathway approach, which it now must share to inform national and international key stakeholders.

8. Conclusion

Guided by different frameworks, the case study painted a rich, nuanced picture of the planning, implementation and adoption of the MAMI Care Pathway approach in the South Sudan implementation. It considered the sustainable scalability of the approach, shared collective learning and made suggestions for strengthening the potential for future scale-up.

From the start, implementation in the South Sudan case intended to follow an integrated approach, building upon existing health services, but this proved difficult within the confines of an implementation research context. Comprehensively addressing vulnerability factors for small and nutritionally at-risk infants and their mothers with a person-centred and continuity of care approach was complex and required good skills and continuous mentoring, which neither the health system nor health workers were used to or ready for. However, testing implementation of the adapted MAMI Care Pathway approach proved a fruitful national learning experience. It deep dived into how to navigate the local health system to achieve comprehensive, respectful quality care for vulnerable infants and their mothers by aligning health approaches, departments and actors, and working together to scale up. Transformative changes in policies and practices are ultimately needed to successfully embed and sustain an integrated approach to care for vulnerable infants and their mothers.

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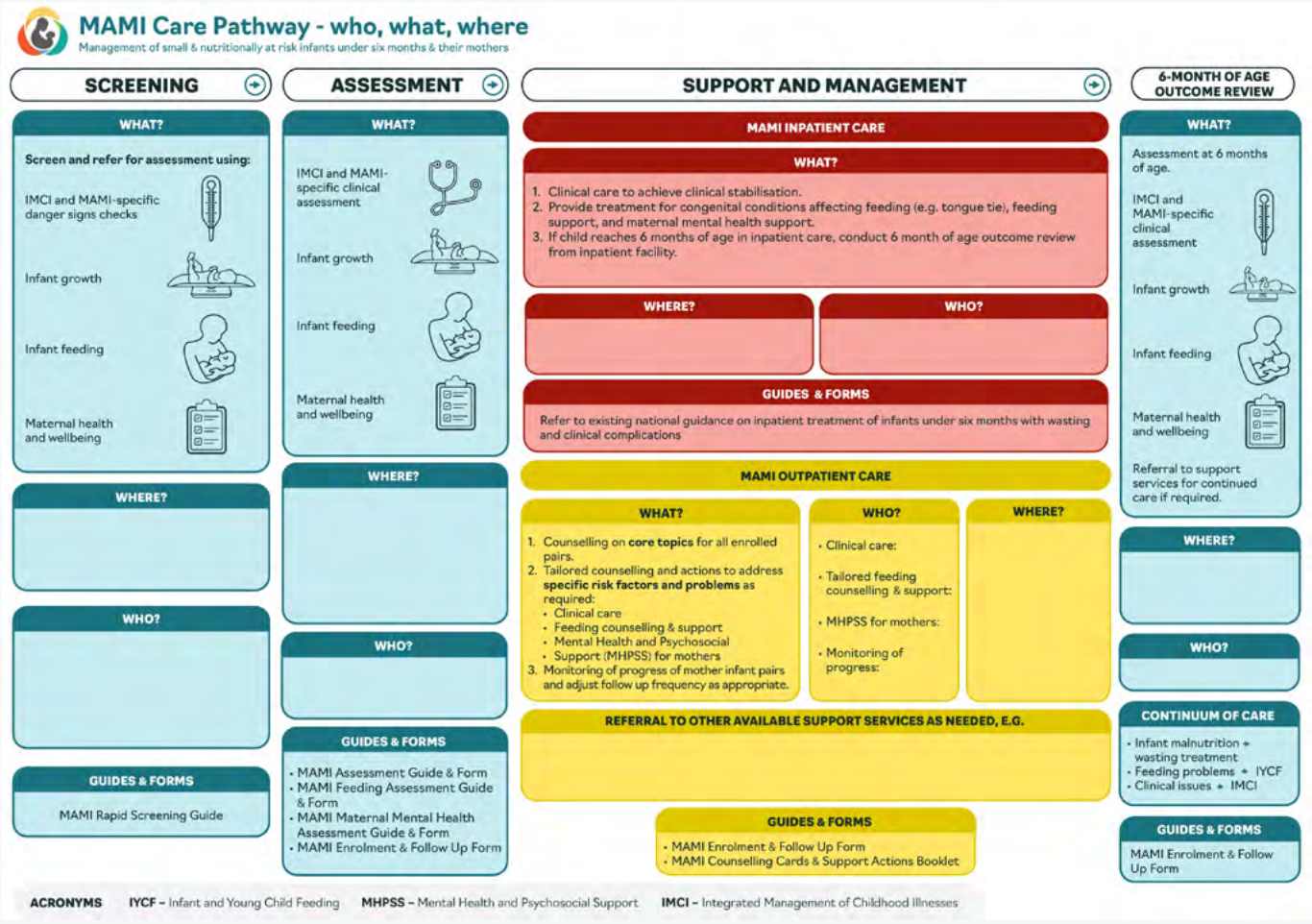
Annexes

Annex 1. MAMI Care Pathway Package: who, what, where matrix



Reference: MAMI Global Network, ENN, London School of Hygiene & Tropical Medicine (2021) ***MAMI Care Pathway Package, Version 3.***

Annex 2. Definitions

Adoption. Implementing new ways of thinking, acting and organising in healthcare and integrating new systems of practice into existing organisational and professional settings. (1)

Continuity of care. The provision of services that are coordinated across levels of care – primary care and referral facilities – and across settings and providers; the provision of care throughout the life cycle; care that continues uninterrupted until an episode of disease or risk is resolved; the degree to which people experience a series of discrete health care events as coherent and interconnected over time and consistent with their health needs and preferences. (2)

Embedding. Routinely incorporating a practice or practices as an integral part of the everyday work of individuals and groups. (1) (3)

Family-centred care. An approach to care delivery that can be practised in health facilities at all levels and that promotes a mutually beneficial partnership among parents, families and health care providers to support health care planning, delivery and evaluation. The principles of family-centred care include dignity and respect, information sharing, participation and collaboration. (4)

Implementation. The social organisation of bringing a practice or practices into action. (1)

Innovation. A health intervention or practice that is new in the local setting and tested in a pilot project or research. (5)

Integrated care pathways. Structured multidisciplinary care plans that detail essential steps in the care of patients with a specific clinical problem and that describe the expected progress of the patient (6). ***See clinical pathway.***

Integrated services. The management and delivery of health care services so that people receive a continuum of health promotion, disease prevention, diagnosis, treatment, disease management, rehabilitation and palliative care through different levels and sites of care in the health system, according to their needs throughout the life course. (7)

Integration. Reproducing and sustaining a practice or practices among the social matrices of an organisation or institution. (1)

Normalisation. The successful implementation and integration of interventions into routine work. (1)
People-centred care. Care that is focused on and organised around the health needs and expectations of people and communities, rather than diseases, encompassing clinical encounters as well as attention to the health of people in their communities and their crucial role in shaping health policy and health services. (8)

Person-centred health care. Conscious adoption of the perspectives of individuals, families and communities as participants in and beneficiaries of trusted health systems; respecting patients' values, preferences and expressed needs in coordinating and integrating care, information, communication and education, physical comfort, emotional support, alleviation of fear and anxiety, involvement of family and friends, transition and continuity. (9)

Quality of care. Health services for individuals and populations that increase the likelihood of desired health outcomes and that are consistent with current professional knowledge, (10) characterised by effectiveness, efficiency, accessibility, patient-/people-centred care, equity and safety (11). Quality of patient care focuses mostly on technical quality, appropriate referral, continuity of care and patient-centredness. (12)

Scale-up. The deliberate attempt to increase the impact of a health service innovation (successfully tested in a pilot or experimental project) to benefit more people and foster lasting policy and programme development. (13)

Spread. The geographic expansion of a health service, making the service available. (3)

Sustainability. The potential to sustain beneficial outcomes for an agreed period at an acceptable level of resource commitment within acceptable organisational and community contingencies. (2, 14)

Sustainability of health services. The capacity to provide ongoing prevention and treatment for a health problem after the termination of major financial, managerial and technical assistance from an external donor. (15)

Sustainable. Able to be maintained, to be upheld or to persist over the long term. (3)

System. A set of things working together as parts of a mechanism or an interconnecting network; a complex whole. (16)

Tacit knowledge. Knowledge-in-practice developed from direct experience and action; highly pragmatic and situation-specific knowledge that is subconsciously understood and applied, difficult to articulate, and usually shared through interactive conversation and shared experience. (17)

Theoretical framework. A conceptual tool that is useful in making sense of a complex social reality and that helps to design a research question, guide the selection of relevant data, interpret the data and propose explanations of causes or influences. (18)

Theoretical generalisability. A process of reflective learning and reflective practice (what, how, why). (19)

Theory. A set of analytical principles or statements designed to structure observation, understanding and explanation of the world; an explanation of how and why specific relationships lead to specific events. (20)

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Annex 3. Methods and limitations

These case studies used a mixed-methods design in which different theories applied different lenses to examine the introduction, implementation and adoption of the MAMI Care Pathway in each case context and to generate learning and ideas on improving implementation and scalability.

Inquiry tools

First, a *Planning and Implementation Process Framework for the MAMI Care Pathway Approach* was developed, inspired by the 2010 WHO ExpandNet "Nine steps for developing a scaling-up strategy", the 2011 WHO ExpandNet "Beginning with the end in mind" (1) and tacit knowledge of co-researchers (Box A3.1). This was used to generate a detailed description of the planning and implementation process within the defined context of each country case.

Box A3.1: Planning and Implementation Process Framework

Context
- Country context
- Organisational context

Situation analysis prior to starting
- Burden and perceived health priority
- Policy context
- Local health system capacities
- Stakeholders

Planning for implementation
- Initiating discussions – agency's preparedness
- Engaging key stakeholders
- Defining the target population
- Selecting sites for implementation
- Designing the implementation modus – tailoring the innovation to the local context and capacities
- Using, adapting, aligning, simplifying, testing materials
- Training for implementation

Service delivery – implementation
- Access: availability, geographic accessibility/delivery points, affordability, acceptability
- Organisation of care in the community, in the health facility
- Organisation of staff
- Participation
- Partnerships

Monitoring, improving and collaborative learning
- Monitoring and reporting
- Improving quality
- Disseminating information and learning
- Maintaining and sustaining quality services
- Ensuring accountability to users, managers and funders of the services
- Advocating for implementation and scale-up

Suggestions for improving implementation

Second, the *Normalisation Process Theory* provided a conceptual framework that helped to understand and evaluate the processes by which the MAMI Care Pathway approach was routinely operationalised in everyday work (2-4). The theory used a participatory method to explore the four components of the adoption process to uncover what individuals and groups either do or do not do to enable normalisation of the intervention:

1. Coherence – meaning and sense-making – defines and organises the components of a practice;
2. Cognitive participation – commitment and engagement – defines and organises the people implicated in a complex intervention;
3. Collective action – work done to enable the intervention to happen – defines and organises the enacting of a practice; and
4. Reflective monitoring – reflecting on or appraising the benefits – defines and organises the assessment of the outcome of a practice.

The success of implementing the MAMI Care Pathway approach by health workers adopting the practice was scored by the case study team on a five-point Likert sliding scale from "not at all" (grade 1) to "completely" (grade 5).

Third, the *Non-adoption, Abandonment, Scale-up, Spread and Sustainability* (NASSS) *Framework* was adapted and used in a participatory process to synthesise insights on evaluating adoption challenges that impact on scaling up and sustainability (5) (Figure A3.1). It was used as a reflexive guide to generate ideas on challenges related to the following: (1) the condition, (2) the technology, (3) the value proposition, (4) the adopters, (5) organisation, (6) the wider system, and (7) embedding and adapting over time. A grading system was used to express whether the challenges identified were simple, complicated, or complex: (1) simple – meaning understandable or predictable, relatively straightforward to address; (2) complicated – meaning less understandable, controllable, thus less straightforward to address; and (3) complex – meaning not understandable or predictable, a dynamic or emergent behaviour.

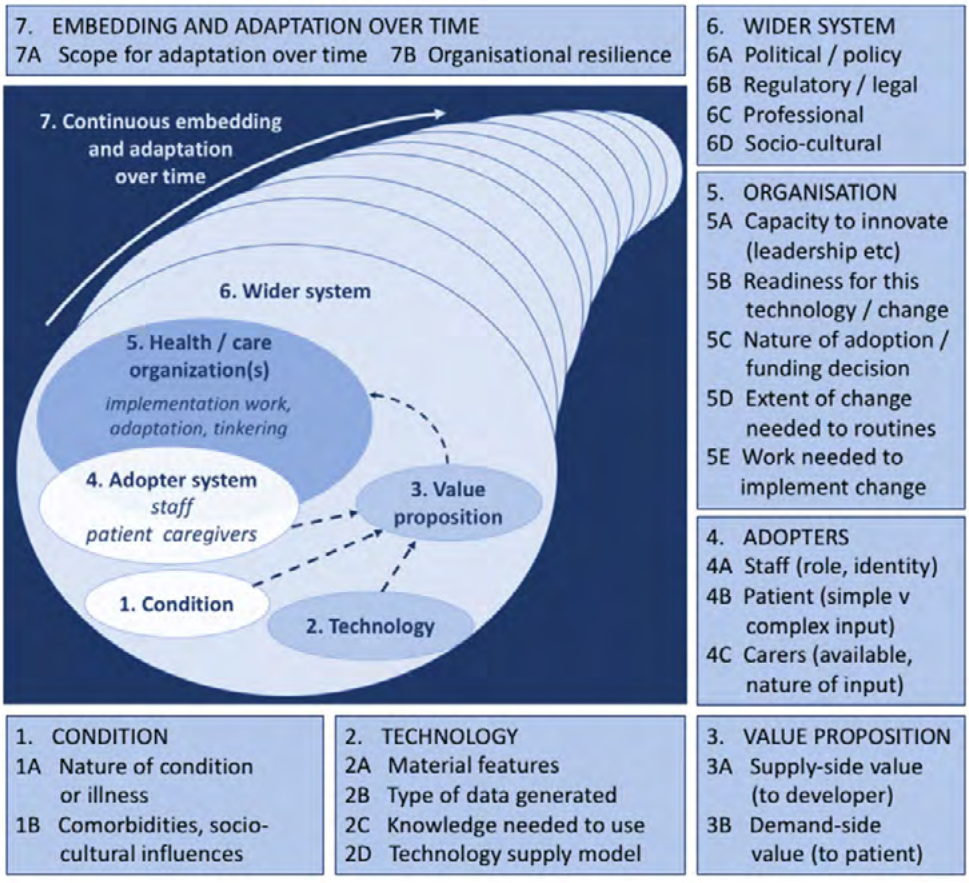

Figure A3.1. The NASSS Framework for considering influences on the adoption, non-adoption, abandonment, spread, scale-up, and sustainability of a health intervention.

Fourth, the *Checklist for Assessing the Potential Scalability* of pilot projects or research (1, 6) was used to explore how easy or difficult it would be to scale up each case and to provide insights into what steps to take to facilitate sustainable scale-up. The checklist provides recommendations in 12 steps on how to design pilot projects considering scale-up that lead to lasting and larger-scale impact (Box A3.2).

Box A3.2: Twelve recommendations on how to design pilot projects with scaling up in mind

Step 1	Engage in a participatory process involving key stakeholders
Step 2	Ensure the relevance of the proposed innovation
Step 3	Reach consensus regarding expectations for scale-up
Step 4	Tailor the innovation to the socio-cultural and institutional settings
Step 5	Keep the innovation as simple as possible
Step 6	Test the innovation in the variety of socio-cultural and institutional settings where it will be scaled up
Step 7	Test the innovation under the routine operating conditions and existing resource constraints of the health system
Step 9	Advocate with donors and other sources of funding for financial support beyond the pilot stage
Step 8	Develop plans to assess and document the process of implementation
Step 10	Prepare to advocate for necessary changes in policies, regulations and other health systems components
Step 11	Develop plans for how to promote learning and disseminate information
Step 12	Plan on being cautious about initiating scale-up before the required evidence is available

Case study selection

Case selection sought a variety of implementation modalities or characteristics, such as the following:

- Implementing a care pathway addressing at-risk infants and their mothers, as a pilot, research or programme;
- Differences in terms of context, implementers, geography;
- Either government-led or partner-led;
- In a development, emergency or fragile setting;
- In a low- or middle-income country setting, either urban, rural or mixed;
- With the availability of data on processes and outcomes;
- With expressed interest and availability to participate in the case study;
- Either in an English- or French-speaking environment.

A primary selection criterion was that participating in this process would add value and contribute to local learning and progress on implementing the MAMI Care Pathway approach.

The country cases selected encompassed a variety of settings where the MAMI Care Pathway approach was applied:

- **Pakistan**: Paediatrician-led services in a private charity hospital in Karachi.
- **South Sudan**: An implementation study where the MAMI Care Pathway approach was integrated into maternal and child health services in urban and rural sites by MIHR project.
- **Yemen**: Pilot implementation integrated into a health and nutrition emergency programme by ADRA.

Data collection

An iterative and participatory process of reflective learning took place across four phases that built on each other. Data tools consisted of generic questionnaires that served as interview guides specifically developed for the MAMI Care Pathway approach and adapted to each country case (Box A3.3) (see Annex 3).

The first phase of investigation was largely descriptive, involving written feedback and clarification. Next, the shared information was built upon, through interviews, to further explore 'how' things happened or not, paying particular attention to social dimensions.

The second phase consisted of participatory discussions with clinical service providers which explored adoption of the MAMI Care Pathway approach as part of their routine work.

The third phase brought together senior managers and clinical health workers to discuss challenges in adopting the MAMI Care Pathway approach.

The fourth phase synthesised the discussion in the third phase across the country cases, allowing for reflection on potential scalability based on triangulating information collected across the three cases.

Box A3.3: Data tools

Phase 1 (Annex 4a): Questionnaire (written and oral investigation) using the Planning and Implementation Process Framework; respondents were (sub-)national health, nutrition, and MAMI managers or advisors.

Phase 2 (Annex 4b): Interview guide applying *Normalisation Process Theory;* respondents were clinical healthcare workers implementing the Care Pathway approach.

Phase 3 and Phase 4a (Annex 4c): Checklist for participatory group discussions using the *NASSS Framework*; respondents were the participating national and (sub-)national health, nutrition, MAMI managers or advisors who discussed their country context in phase 3, and then came together to discuss across countries in phase 4a.

Phase 4b (Annex 4d): *Checklist for Assessing the Potential Scalability* using the information generated across phases.

Respondents were asked to provide their informed consent prior to their participation and withdrawal from the inquiry was possible at any time.

Data were collected through written feedback and during interviews, which were digitally recorded following receipt of consent from all interviewees. Respondents could skip questions for any reason. Where possible, the reason for not answering was recorded but this was not mandatory. Audio recordings were transcribed verbatim within 48 hours of collection using Otter.ai software. All digital data were stored in a password-protected digital space accessible only to investigators. All country-specific data were shared with the country teams.

During data collection and analysis, notes on possible biases, interferences or limitations were recorded and reported on.

Analysis

The stepwise and iterative inquiry appraised the case experiences by applying different lenses to generalise learning through repeated cycles of testing and building ideas (theories) about why things have worked or not, and how (mechanisms of action). This 'theory-driven' iterative analysis involved the following steps:

Descriptive data analysis: Data on introducing and implementing MAMI were summarised by topic to understand processes of planning, introducing, adapting, implementing, monitoring and improving the MAMI Care Pathway approach, to uncover what was done, and how, to appraise readiness for scale-up.

Explorative data analysis: Data on the perceptions of clinical healthcare workers on implementing and adopting the MAMI Care Pathway approach were analysed for emerging themes to explore perceptions on what worked, for whom, and under what circumstances, and to appraise adoption.

Explanatory data analysis: Data on descriptions and perceptions were triangulated and synthesised to inform updates to and evolution of our theories/ideas on the MAMI Care Pathway approach and to identify practical, pragmatic ways to help progress towards scalable, sustainable care.

Data were analysed both deductively (testing our ideas/theories) and inductively (finding new ideas/theories), involving the respondents and requesting their opinion, as well as confirming the generated ideas/theories. Data were synthesised in each step by intuitive-reflective appraisal – which involved perceptions about what immediately felt right or made sense, and then questioning these by considering other possibilities.

Participatory and adaptive, reflexive learning: Interviewers and interviewees were involved in reflective learning building upon each step, thereby 'learning together by doing.' This collaborative 'learning together' deepened the understanding of embedding and adapting the MAMI Care Pathway approach in diverse local systems of health. Besides the strengthening of own capacities and understanding of respondents by tapping into implicit and often invisible and under-appreciated tacit knowledge, this approach was useful for contributing to overall collective learning on the 'how' of the MAMI Care Pathway approach.

Limitations

Each country case covered the introduction and implementation of the MAMI Care Pathway approach on a small scale in a specific context, which limited the generalisability of learnings across broader systems and services within and across countries. Each case study also engaged a limited number of respondents (between two and four, depending on the case), which restricted the breadth of perceptions. However, the different lenses applied through the case study phases generated an in-depth understanding for each case context, while identifying common theories/ideas which influence implementation, adoption, scale-up and sustainability, even across the diverse case contexts, thereby contributing to collective learning.

The qualitative approach involved online interviews, which lack the human presence needed to build trust and to convey the subtleties of eye contact or body language which contribute to multidimensional and nuanced understanding of the ideas/perspectives shared (7).

Specifically, during Phase 2 (*interviews guided by the Normalisation Process Theory*), only one or two clinical health workers responsible for implementing the MAMI Care Pathway approach (assessment, support and progress monitoring of the mother–infant pair) were interviewed. The low numbers of people involved likely limited the extent of perceptions on the normalisation process. The clinical health worker responding was also either an existing, or a newly recruited, staff member accompanied by a trained supervisor or assistant, which may have influenced their answers. Responses often fell into discussions on 'perceived benefits' of the MAMI Care Pathway approach, rather than building on perceptions of the adoption process. Finally, discussions went in various directions, and sometimes the same elements were repeated, or questions were not answered well, or the answer fitted a question that would come later. This resulted in some reorganisation of responses to fit the flow of the interview guide after the discussion.

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Annex 4a. Data tool: Planning and implementing the MAMI Care Pathway approach

[Note that the questions in blue colour are discussed orally, all others are dealt with in writing.]

Responder(s) *(name and function):* _____

Date of response: _____

Agency: _____

1. Context

1.1 Country context relevant to MAMI

1. Describe the demographic and socio-economic context of your country, or the area where you are active.
   (E.g., development or emergency context, stable or fragile/fast changing/chronic, demographic pressure, climate change, political instability or insecurity, rural versus urban population, poverty, migration trends)

2. Describe key determinants that define vulnerability in infants under six months of age (u6m) and young children (data from the most recent survey/surveillance).
   (E.g., exclusive breastfeeding rate, inappropriate/harmful feeding and care practices, adolescent mothers, low birth weight)

1.2 Organisational context for starting MAMI

3. Give name of agency or programme, and a brief description.
   (E.g., expertise/mandate, aim, activities, period of interventions, impact area, future plans, donor)
4. Give the justification for starting MAMI.
   (E.g., expected change, added value, opportunity, contribution, the MAMI Care Pathway could bring)
5. Explain who or what was the tipping point for deciding to start MAMI.
   (E.g., what or who was driving, motivating, enabling the decision; who or what enabled it just then and not earlier)
6. Give the aim or objective of the MAMI project that was defined at the start (and expected result if stated).

2. Situation analysis prior to starting MAMI

2.1 Burden and perceived health priority

7. Give national key health and nutrition indicators (and trend) (with source and year, most recent survey, surveillance). Use the example table to answer.

Example table: Health and demographic information

Information (Year, Source)	Data
Population (YYYY, Ref)	
Population at the MAMI sites YYYY, Ref)	
Fertility rate (YYYY, Ref)	
Live birth rate YYYY, Ref)	
Neonatal mortality YYYY, Ref)	
Infant mortality (YYYY, Ref)	
Low birth weight (YYYY, Ref)	
Assisted deliveries (YYYY, Ref)	
Exclusive breastfeeding YYYY, Ref)	
Global acute malnutrition 6-59m YYYY, Ref)	
Trend information (YYYY, Ref):	

8. Prior to introducing MAMI, was the "vulnerability in infants u6m" recognised as a health or nutrition priority? Specify why or why not, by whom (in your opinion).
   (E.g., for the Ministry of Health (MOH) not a priority presuming that the needs are covered by the various policies and services; for [Agency] a priority because of deteriorating indicators in their impact area)

2.2 Policy context

9. Did you do a policy analysis prior to starting MAMI?

10. If yes, describe what you did, scope, which tool you used. Use the example table to answer.
    (E.g., national integrated management of acute malnutrition (IMAM) guideline covers inpatient treatment of wasting based on weight-for-height z-score (WHZ) <-3 z-score and presence of nutritional oedema in infants u6m; community infant and young child nutrition (IYCN) strategy advises to assess breastfeeding problems and counsel or refer during community growth monitoring sessions; guidelines on mental health cover post-partum depression; guidelines on small and sick newborns include targeted counselling)

    Example table: Health and nutrition policy covering infants u6m and their mothers

Policy, guideline (title, year)	Defined vulnerability in infants u6m and their mothers	Proposed interventions
xx	xx	xx

If no, why not?

2.3 Local health system capacity

11. Did you do a capacity analysis/implementation readiness of the local health system or a feasibility study prior to starting MAMI (or any quick appraisal of readiness of the health facilities that involve in MAMI)?
    - If yes, describe what you did, which tool you used, when you did it in regard to starting MAMI, what are the headlines on what you found.
    - If no, why not?

12. List which MAMI activities were already covered at the community, primary care and tertiary care levels in the planned MAMI sites that were identified prior to starting MAMI?
    (E.g., counselling on breastfeeding difficulties is done by nutrition assistants in the health centre and by community health workers and volunteers in the community as part of the national IYCN strategy)

13. List gaps in services, care, referral for infants u6m and their mothers that were identified prior to starting MAMI?

2.4 Stakeholders

14. Did you do a stakeholder analysis prior to starting MAMI (quick appraisal of who is a MAMI stakeholder, and how to solicit their interest for involving early for what)?
    - If yes, describe what you did, which tool you used, when you did it in regard to starting MAMI, what are headlines on what you found. Please share any report on findings.
    - If no, why not?
15. Could you identify who is a relevant current or future stakeholder to involve in the design, planning, implementation; list who and specify why?
16. Did (could) you identify potential MAMI champions able to generate political will? If yes, who are they?
    (Note: a champion is an influential person who promotes 'a topic' and inspires others to take a more active role in that topic.)
17. List key stakeholders you contacted and had preliminary discussions with on, e.g., introducing MAMI, sharing plans, probing their interest to be involved. Use the example table to answer.
    (E.g., MOH Community Health Department – ways of strengthening active case finding of vulnerable infant-mother pairs, as part of existing community services)

    Example table: Level of interest of key stakeholders to involve in MAMI

Agency, department	Discussion topics on MAMI and level of interest	Name and email contact if appropriate
xx	xx	xx

3. *Planning for MAMI implementation*

18. Give an indicative time line (# months) for inception discussions, designing and planning.

3.1 Initiating discussions - Agency's preparedness

19. Describe key elements of the initial discussions and steps your agency undertook internally, prior to deciding and planning for MAMI implementation.
    (E.g., internal discussion and decision, securing funds for which time span from which source–part of ongoing project, cost extension, additional budget–, hiring staff, securing equipment, planning)
20. Describe key elements of the initial discussions and steps your agency undertook externally, prior to deciding and planning for MAMI implementation.
    (E.g., contacted MOH to discuss the relevance or perceived need, explore their interest in the innovation, feasibility, alignment or integration into the country's health system, roles and responsibilities, departments and technical partners to involve)
21. From whom did you seek approval for introducing MAMI, and how was this approval granted or formalised?
22. Was there a request for a formal description of the project prior to starting? If yes, describe the process, involvement of stakeholders and timeline.
    (E.g., a project outline was shared and reviewed and approved by the MOH, taking two weeks; a study protocol was developed in participation with the MOH and approved (no IRB) taking two months)
23. Did you consult professional expertise within your agency; did you seek support externally? If yes, give profile of expertise and timeline.

- Did your agency conduct formative research prior to starting MAMI, or did you use in-house formative research? If yes, what? Share any reports.
  (Note: formative research typically is done before starting a programme to understand practices and behaviours, needs for an intervention, e.g., a knowledge, attitudes, practices (KAP) survey for a reproductive health project)

3.2 Engaging key stakeholders in the planning process

24. Did you engage with the national and/or local MOH for planning the integration/implementation? Explain how and on what.
25. Who else you engaged with? Explain how and on what.
    (E.g., UNICEF in face-to-face meeting and orientation workshop, for planning and review of materials, offering support for training as resources persons, offering scales and MUAC tapes)
26. In case you organised a meeting or workshop, describe who (and number) participated, how many days, what was the objective and outcome, what topics were covered, what documentation was shared.
27. Did key health and nutrition actors perceive MAMI a relevant innovation? Explain why or why not.
28. Are there lessons you want to share about the process?

3.3 Defining the target population

29. What criteria have been used to define vulnerability in infants u6m, and their mothers?
30. How were key health and nutrition actors involved in defining the target population for MAMI?
31. Are there lessons you want to share about the process?

3.4 Selecting sites for implementation

32. How did you define a MAMI implementation site in your project?
    (E.g., specify the type of health facilities selected for implementing the outpatient Care Pathway, whether referral sites for inpatient care are involved, whether communities in the health catchment area covered, whether links between different sectors at different levels are established)
33. What criteria were used to select the sites?
    (E.g., agency-supported health facilities; referral hospital with inpatient care for severe acute malnutrition)
34. Did key health and nutrition actors involve in selecting the sites? Explain.
35. Are there lessons you want to share about the process?

3.5 Designing the implementation modus

36. Did you tailor the implementation design for MAMI to the local context and capacities? If yes, explain how you did this, with whom and with what tools (if any)?
    (E.g., participatory discussions with key stakeholders in a meeting using the 'who what where map'; informal discussion amongst agency staff)
37. Did you foresee ways of testing and/or adapting the implementation modus based on learning and feedback?
38. How did you appraise the capacity for absorbing MAMI by the local health system, at the selected health facility sites prior to implementing? What tools did you use, what difficulties did you anticipate, how did you plan to fill the gaps?
    (E.g., consider gaps in knowledge, skilled health workers, equipment, space, referral services)
39. Are there lessons you want to share about the process?

3.6 Using, adapting, aligning, simplifying, testing materials

40. Did you use and/or adapt the MAMI Care Pathway v3 materials? If yes, list which of the v3 materials were adapted and how this was done. Use the example table to answer.

    Example table: Adaptation of MAMI Care Pathway v3 materials

MAMI Care Pathway v3 material adapted	Description of adaptation(s) (what)	Method (how)
X	xx	xx
X	xx	xx

41. Did you use existing materials for use in the MAMI Care Pathway? Use the example table to answer.

Example table: Existing materials used and/or adapted in MAMI

Other materials used (adapted)	Description (what)	Method (how)
X	xx	xx
X	xx	xx

42. Did you develop additional materials? Use the example table to answer.

Example table: Materials developed for use in MAMI

Materials developed for use	Description (what)	Method (how)
X	xx	xx
X	xx	xx

43. Who was involved in deciding the final version of materials to use?
44. Did you test the adapted materials prior to using them for implementation? If yes, describe how this was done.
45. Which (if any) materials were translated in a local language?
46. Describe how you overcame the local language barrier.
(E.g., developed a local language vocabulary as a cheat sheet and field tested it).
47. What were key challenges in the adaptation process?
48. Are there lessons you want to share about the process?

3.7 Training for implementation

49. Did you train health workers ahead of implementing MAMI? If yes, explain who was trained (participants), on what (topics), by whom (trainers), how (method), with what materials, for how long (number of days), aiming to achieve what (learning objectives). Use the example table to answer.

Example table: Training for MAMI prior to starting

Training (type and dates)	Participants targeted (profile and #)	Topics covered	Materials used	Learning objectives
xx	xx	xx	xx	xx

50. Were the national and/or local MOH involved in training? If yes, explain.
51. Were supervisors and managers involved in training? If yes, explain.
52. Were existing national or global training materials used? If yes, explain.
(E.g., on breastfeeding, IMNCI, counselling)
53. Did the training develop specific skills? If yes, explain.
(E.g., on using the IMNCI approach, measuring anthropometry, assessing breastfeeding, assessing mental health, targeted counselling)?
54. What skills were considered pre-requisite (skills training not covered)?
55. If you used the MAMI Care Pathway v3 materials, describe how you used these for training.
56. Are there lessons you want to share about the process?

4. *Service delivery – implementation*

[Notes:
***Health services delivery** is about how services are organised and managed to ensure access, quality, safety, and continuity of care across health conditions across different locations and over time. Its core principles are:*

Comprehensive, equitable, sustainable, coordinated, continuous, holistic, preventive, empowering, goal oriented, respectful, collaborative, co-produced, endowed with rights and responsibilities, shared accountability, evidence-informed, led by whole-systems thinking, ethical.

***People-centred care** is an approach to care that consciously adopts the perspectives of individuals, carers, families and communities as participants in, and beneficiaries of, trusted health systems that respond to their needs and preferences in humane and holistic ways. People-centred care also requires that people have the education and support they need to make decisions and participate in their own care.*

https://apps.who.int/iris/bitstream/handle/10665/155002/WHO_HIS_SDS_2015.6_eng.pdf?sequence=1&isAllowed=y]

57. Give an indicative time line for starting implementation support (enrolling first pair).

58. Give an indicative time line (# months) for ending implementation support (exiting of last pair, if relevant).

4.1 Access: availability, geographic accessibility/delivery points, affordability, acceptability

59. Specify the geographical area and sites where MAMI is implemented. Use the example table to answer. (E.g., region, districts, health facilities, start/end date)

Example table: MAMI sites

Region	Health district	Primary care health centre	Referral hospital
Total			

60. Did implementation start at all sites at the same time? If not, why not, how then?
61. Are services free of cost for small vulnerable infants and their mothers? Explain
62. If referral is needed, who organises, who pays for transport? Explain.
63. If referral for inpatient care is needed, who pays the admission fee, who pays for food for the caregiver? Explain.
64. Has your agency plans to expand or scale up MAMI in-country? In other countries? Specify what actions would facilitate this move?

4.2 Organisation of care in the community (evidence-based, continuity (referral), coordinated, integrated, comprehensive, people-centred, equipped, equity)

65. What activities are provided at the community, how, where by whom? Use the example table to answer.

Example table: Who delivers where what services in the community

Activities	How	Where	By whom
Sensitization			
Health and nutrition promotion			
Screening			
Referral			
Follow-up in the home during enrolment			

66. Which MAMI activities were already in place? Did they have to be strengthened or re-organised?
67. Which MAMI activities had to be newly added?
68. Is active screening working well in the community? What screening criteria do you use?

69. How are community health workers/volunteers linking to the health facility? Explain.

70. How did community health workers perceive the extra tasks they were asked to do? Did they express concerns, and if so, what were they?

4.3 Organisation of care in the health facility (evidence-based, continuity (referral), coordinated, integrated, comprehensive, people-centred, equipped, equity)

71. What activities are provided at the health facility, how, where by whom? Use the example table to answer.

    Example table: Who delivers where what services in the primary healthcare centre

Activities	How	Where	By whom
Sensitization on risks			
Health and nutrition promotion			
Screening (rapid assessment)			
IMNCI assessment, triage			
Anthropometry assessment			
MAMI risk assessment			
Feeding assessment			
Mental health assessment			
Classification and referral			
Treatment and support plan			
Enrolment			
Treatment and support			
Targeted counselling on feeding issues			
Targeted counselling on mental health issues			
Targeted counselling other (specify)			
Frequency of attendance decision for follow-up			
Referral in case of deterioration during enrolment			
Evaluate progress			
Evaluate outcome			
Referral in case of non-recovery at 6m			
Follow-up after exit			

72. Which MAMI activities were already in place? Did they have to be strengthened or re-organised?

73. Which MAMI activities had to be newly added?

74. Is routine screening done in all health services and units frequented by infant-mother pairs? What screening criteria are used?

75. Was referral for maternal mental health possible?

76. How is referral to inpatient care organised for pairs whose status deteriorates, does it work well, or not?

77. How is counter-referral to outpatient care organised for pairs discharged from hospital, does it work well, or not?

78. What further support was most needed at 6 months?

79. Is there a follow up period after pairs exit at infant age 6m? If yes, for how long? and how is it organised?
80. Describe how are pairs are followed across services and in time (continuity of care).

4.4 Organisation of staff: numbers, skill sets, sharing of tasks, supportive supervision, mentoring, job aids

81. Were sufficient number of skilled workers available to absorb MAMI? Explain.
82. What guidance or job aids did you use or develop? Explain.
83. Did you use v3 materials (if any) for organising and supporting health facility y implementation (job aids), and how?
84. How are clinical health workers linking, collaborating, sharing tasks, communicating on MAMI care at the health facility? Explain.
85. How are clinical health workers linking, communicating on MAMI care to other health facilities? Explain.
86. How organised and ready for quality implementation were you at the start (your opinion)? What went well, what went less well? Were roles and responsibilities clear for all implementers prior to starting? Explain.
87. Is supportive supervision and mentoring being provided? If yes, how is it organised, which tools are used?
88. How did health workers perceive to adopt the innovation/increase consistency/merge with what they were already doing? Specify for the different activities at the different levels.
89. How did clinical health workers perceive the extra tasks they were asked to do? Did they express concerns, and if so, what were they?

4.5 Participation

90. Do you involve caregivers (community members) in care? Explain.
91. Prior to assessing risks and enrolling, did you ask the caregiver's perceived need and interest in receiving this service?
92. Were caregivers well informed and had a choice, were encouraged to take active part in care, how?
93. How did caregivers perceive the effort to return for follow-on visits? How do you motivate them?
94. Prior to assessing MAMI risks and enrolling pairs, did you ask the caregiver's perceived need and interest in receiving this service?
95. Did you assess the caregiver's satisfaction during and when exiting the MAMI Care Pathway?

4.6 Partnerships

96. What is the role of the local health management system; how are MOH focal points involved in planning, supervising and improving quality, mentoring, evaluating?
97. Are there other technical partners providing support at the MAMI Sites? Who are they, what do they cover, how you collaborate?
98. Are there other technical partners providing support at the MAMI Sites? Who are they, what do they cover, how you collaborate?
99. Is there a communication or coordination system linking the various partners?

5. *Monitoring and collaborative learning*

5.1 Monitoring and reporting

100. Have you a monitoring system in place? If yes, to what degree you use existing data and systems?

101. List the indicators you report on monthly and give results for the period of reporting. Use the example table to answer.

Example table: Key indicators (country or site, period of reporting)

	Total
Sensitization	
MAMI sensitization in the community (# of people reached)	
MAMI sensitization in the health facility (# of people reached)	
Screening (rapid assessment)	
Total pairs screened in the community	
Pairs screened at risk, referred for in-depth assessment	
Total pairs screened in the primary care facility	
Pairs screened at risk, referred for in-depth assessment	
In-depth assessment	
Total pairs assessed	
a. Pairs assessed - male infant	
b. Pairs assessed - female infant	
Pairs assessed classified at moderate risk (yellow)	
Pairs assessed classified at high risk (red) and referred	
Enrolment in outpatient care	
Total pairs newly enrolled	
a. Pairs newly enrolled - male infant	
b. Pairs newly enrolled - female infant	
Referral during outpatient care	
Total pairs referred to hospital	
a. Pairs referred to hospital - infant high risk	
b. Pairs referred to hospital - mother high risk	
Outcome of outpatient care	
Total pairs exited from the outpatient Care Pathway	
Total pairs exited at infant age 6m	
Pairs not recovered at infant age 6m and referred to continue care	
a. Pairs not recovered at infant age 6m - infant special care	
b. Pairs not recovered at infant age 6m - mother special care	
Pairs recovered at infant age 6m	
Total pairs exited before infant age 6m	
Pairs died before the age of 6m	
Pairs lost to follow up (defaulted) before the age of 6m	

Example table: MAMI enrolment by age group (country or site, period of reporting)

	Total
Age of infants at enrolment in outpatient care	
<1 month	
1–<2 months	
2–<3 months	
3–<4 months	
4–<5 months	
5–<6 months	

102. Do you consolidate monthly monitoring data on service performance? Do you use digitized tools? Explain.

103. Do you consolidate individual data on assessment and enrolment? Do you use digitized tools? Explain.

104. Describe if and what qualitative data you collect, for what purpose, how you collect it, with what tools, and how you consolidate and report on them?

105. Do you capture lessons? Explain.

106. What key lessons have you learned that you think would be helpful for managing small and nutritionally at-risk infants u6m and their mothers?

107. What key successes you want to share?

108. What key challenges did you face? Which actions you have undertaken to overcome these, and did you succeed to overcome these, or not?

5.2 Improving quality

109. Are monitoring results (data tables and figures and lessons) used for quality improvement (QI) to identify weaknesses in data collection and quality of care that needs improvement (e.g., in monthly meetings)? Explain.

110. Do you use adaptive management for quality improvement and learning (e.g., using the plan-do-verify-adapt cycle)? Explain.

111. What has MAMI added to your work and experience?

5.3 Disseminating information and learning

112. How is in-country sharing of information on MAMI organized? Explain the different pathways.

113. How is wider sharing of information on MAMI organized, outside of the country? Explain the different pathways.

114. What learning methods or communication platforms are being used by your managers, by the implementers, and how did they come about? Explain.

115. Have you established a national learning and information sharing entity (e.g., community of practice, Country Chapter)? Explain.

116. Have you involved national research institutions in MAMI? Explain.

117. How did you explore their potential involvement in documenting lessons, evaluating evidence gaps and proposing research studies (including donors).

118. Is any evaluation in progress or planned? Explain.

119. Have you identified any research gaps? If so, what are they?

5.4 Maintaining and sustaining quality services

120. Are the MAMI activities that you implement sustainable? Explain.
121. How can the specific MAMI activities be made more sustainable? what are barriers and facilitators? Explain.
122. Are they resilient to shocks? Explain.
123. Can the specific MAMI activities be made more resilient? what are barriers and facilitators? Explain.

5.5 Ensuring accountability to…

124. Who are you accountable to, how and for what?

5.6 Advocating for … strengthening services and adapting policies

125. Are you engaging decision-makers, champions, gate-keepers in MAMI?
126. What advocating tools you use or have you developed to highlight the burden, the importance of addressing MAMI, the effectiveness of MAMI?
127. Are you involved/do you plan to engage in national policies, guidelines, strategies, processes for contributing to evidence and learning? If yes, in what way?
128. Is the accountability of MAMI in your implementation design sufficient, or what is missing, what should be strengthened and how?

6. *Recommendations*

129. List or describe changes you suggest for simplifying or improving the v3 materials.
130. List or describe additional resources you wish to have to improve planning, organizing, implementing, monitoring, learning, or expanding the evidence base.
131. What do you identify as most important gap / need that should be addressed, by whom and at what level?
132. Share any other general or specific recommendations you have?

Annex 4b. Data tool: Adopting the MAMI Care Pathway approach

Name of the responder and position: _____

Date of response: _____

Agency: _____

QUESTIONS Clinical healthcare worker – key informant interview

PRE-QUESTIONS

1. Please confirm, your name is [...], your current position is [...]
2. Where are you working, in which establishment, health facility?
3. Since how long have you worked there? Give start date.
4. When was the MAMI Care Pathway introduced at your health facility? Give start date.
5. What is your function in relation to the MAMI Care Pathway?
6. (If started working after MAMI was introduced) Were you exposed to MAMI before joining the health facility? Where? In what function?
7. (If started working after MAMI was introduced) Did you have specific MAMI knowledge and skills prior to joining the current position?

QUESTIONS

Questions seek the opinion of the clinical health worker about implementing the MAMI Care Pathway in his/her setting versus what they did before for small vulnerable infants and their mothers. Ask the respondent to explain their answer (if yes, explain how, if no, explain why not) and give a grade on a Likert scale from 0 (not at all) to 5 (completely):

Coherence – meaning and sense-making

1. Is the MAMI Care Pathway easy to describe? Can you appreciate how it differs from current ways of working, from what you did before to support small vulnerable infants and their mothers?
   Participants distinguish the intervention from current ways of working: not at all to completely

2. Do you and your colleagues have a common understanding of the aims, objectives and expected outcomes of the MAMI Care Pathway?
   Participants collectively agree about the purpose of the intervention: not at all to completely

3. Do you understand what implementing the MAMI Care Pathway requires from you (specific tasks and responsibilities)?
   Participants individually understand what the intervention requires of them: not at all to completely

4. Can you easily grasp the potential value, benefits and importance of the MAMI Care Pathway?
   Participants construct the potential value of the intervention for their work: not at all to completely

Cognitive participation – commitment and engagement

5. Are you (or other key individual) able and willing to get others involved in the MAMI Care Pathway? Are you actively engaged in making the MAMI Care Pathway work in your setting?
   Key individuals drive the intervention forward: not at all to completely

6. Do you believe and agree that being involved is right, and that by accepting the MAMI Care Pathway as part of your work you contribute to its implementation?
   Participants agree that the intervention should be part of their work: not at all to completely

7. Do you have the capacity and are you willing to organise you and your colleagues and collectively contribute to the work involved for implementing the MAMI Care Pathway?
   Participants buy in to the intervention: not at all to completely

8. Do you have the capacity and are you willing to collectively define the actions and procedures needed to keep the practice going (invest your time, energy to keep it going)?
   Participants continue to support the intervention: not at all to completely

Collective action – work done to enable the intervention to happen

9. Are you and your colleagues able to undertake the tasks required to implement the MAMI Care Pathway (to operationalise its components in practice)?
   Participants perform the tasks required by the intervention: not at all to completely

10. Do you maintain trust in the intervention and in each other's work and expertise in implementing the MAMI Care Pathway?
    Participants maintain their trust in the intervention and in each other: not at all to completely

11. Is the work required for implementing the MAMI Care Pathway distributed to participants with the right mix of skills and training? Did it impact on the division of labour, resources, power, responsibilities between colleagues (tasks and skill sharing)? Was extensive training needed before implementing the MAMI Care Pathway? (originally Q13)
    The work of the intervention is appropriately allocated to participants: not at all to completely

12. Is the implementation of the MAMI Care Pathway adequately supported by the advisor/manager?
    The intervention is adequately supported by its host organisation: not at all to completely

Reflective monitoring – reflect on or appraise the benefits

13. Do you have access to information on the quality of care and outcome of the MAMI Care Pathway (monitoring and evaluation information)?
    Participants access information about the effects of the intervention: not at all to completely

14. Do you collectively agree on the quality of care and the effects of the MAMI Care Pathway because of formal monitoring?
    Participants collectively assess the intervention as worthwhile: not at all to completely

15. Do you individually think the MAMI Care Pathway is worthwhile?
    Participants individually assess the intervention as worthwhile: not at all to completely

16. Can you make changes to the intervention as an individual or group in response to the appraisal?
    Participants modify their work in response to their appraisal of the intervention: not at all to completely

Annex 4c. Data tool: Scale-up, spread and sustainability of the MAMI Care Pathway approach

Applying the (non-)adoption, abandonment, scale-up, spread, and sustainability (NASSS) framework in real time (Greenhalgh et al., 2017).

Respondents			
Date of interview			
Context (where, for how long, whom, purpose/design)			
ORIGINAL NASSS QUESTIONS	**ADAPTED NASSS QUESTIONS**	**GRADING CONSIDERATIONS** 1= understandable or predictable aspects are relatively straightforward to address (simple). 2= less understandable or predictable aspects or many factors are involved (complicated). 3= inherently not understandable or predictable, but dynamic or emergent aspects are involved (complex).	**RESPONSE**
Domain 1: The condition or illness (risk factors) Addresses how far the **condition** "small and nutritionally at-risk infants and their mothers" is a) well-characterised, well-understood and predictable, and b) how care is being affected by socio-cultural factors and co-morbidities.			
1a. What is the nature of the condition or illness?	1a. Is the condition "small and nutritionally at-risk infants and their mothers" well-characterised, well-understood and predictable?	1) Is the condition well-characterised, well-understood, predictable? OR 2) Not fully characterised, understood or predictable? OR 3)Poorly characterised understood, unpredictable?	
1b. What are the relevant socio-cultural factors and co-morbidities?	1b. Are socio-cultural factors and co-morbidities relevant for the condition "small and nutritionally at-risk infants and their mothers"?	1) Are socio-cultural factors and co-morbidities unlikely to affect care significantly? OR 2) To affect care and must be factored in? OR 3) Pose significant challenges to care planning and service provision?	
Domain 2: The technology Addresses whether **the methods (technologies)** of the MAMI Care Pathway used for detecting, classifying, and supporting "small and nutritionally at-risk infants and their mothers" a) are newly introduced, b) need new knowledge, c) need continued support, and d) need specific adaptations.			
2a. What are the key features of the technology?	2a. What are key features of the methods (technologies) used to assess, classify and support "small and nutritionally at-risk infants and their mothers"? Are methods known, do they exist?	1) Are methods (technologies) used to assess, classify and support "small and nutritionally at-risk infants and their mothers" already installed or existing, dependable? OR 2) Are they new and need to be developed? OR 3) Do they need to be embedded in an existing (complex) system?	
2b. What kind of knowledge does the technology bring into play?	2b. Is new knowledge generated or made visible when applying the methods to assess, classify and support "small and nutritionally at-risk infants and their mothers"? Has it the potential to detect changes in health and nutrition status?	1) Do the methods used to detect, classify and support "small and nutritionally at-risk infants and their mothers" make risks or changes in risks visible or measurable? OR 2) Partially or indirectly visible/measurable? OR 3) Changes are unpredictable or can be contested.	

2c. What knowledge and/or support is required to use the technology?	2c. What knowledge and/or technical support is required to assess, classify and support "small and nutritionally at-risk infants and their mothers"?	1) No new knowledge is required to assess, classify and support "small and nutritionally at-risk infants and their mothers"? OR 2) Detailed instructions and training are needed. OR 3) Advanced training and support are necessary.	
2d. What is the technology supply model?	2d. Are the methods used in the MAMI Care Pathway generic and standardised?	1) Are the "small and nutritionally at-risk infants and their mothers" methods used in the approach generic, standardised and straightforward to implement? OR 2) Are significant organisational changes in the management of health services needed? OR 3) Is it highly vulnerable to support withdrawal?	
Domain 3: The value proposition Explores whether the MAMI Care Pathway is considered a **valuable intervention and for who** it has value: a) the care provider and b) the user.			
3a. What is the developer's business case for the technology (supply-side value)?	3a. How do health workers perceive the value of the MAMI Care Pathway? Do they understand the value of the short-/mid-/long-term benefits?	1) Is the perceived benefit of the MAMI Care Pathway approach well-understood, over the short/mid/long term? OR 2) Is it undervalued (at risk?) OR 3) Is it unlikely that it will be maintained (after the pilot period), and at risk?	
3b. What is its desirability, efficacy, safety, and cost effectiveness (demand-side value)?	3b. How do the mothers (caregivers) perceive the value of the MAMI Care Pathway? Do they understand the need, do they appreciate the care, is the opportunity cost a barrier?	1) Is the MAMI Care Pathway approach considered needed, desirable, safe, cost-effective by the user? OR 2) Is it unknown, contested? OR 3) Is it considered not needed, undesirable, unsafe, ineffective or unaffordable by the user?	
Domain 4: The adopter system Explores whether the MAMI intervention has been **adopted (accepted) and by who:** a) health staff, b) mothers, c) lay support system of the mother.			
4a. What changes in staff roles, practices, and identities are implied?	4a. Did important changes have to be made for health workers (staff in the health facility) to take on their role in the MAMI Care Pathway? Did new skills have to be learned, new staff be appointed, new tasks be taken on?	1) When adopting the care pathway, were there no changes in staff roles and practices? OR 2) Did existing staff have to learn new skills and/or were new staff appointed? OR 3) Did it pose a threat to current professional identities, values and scope of practices (risk of job loss)?	
4b. What is expected of the patient (and/or immediate caregiver) – and is this achievable by, and acceptable to, them?	4b. Were specific or new actions expected of the mother?	1) Nothing is expected of the mother (principal caregiver). OR 2) Routine tasks and changes in behaviour are expected. OR 3) Complex tasks are expected? Are these achievable, acceptable?	
4c. What is assumed about the extended network of lay caregivers?	4c. By offering MAMI, are other lay caregivers in the mother's network affected (e.g., family members, volunteers, community members), and are there new requirements or expectations for them? Is the wider network requested to be involved?	1) Nothing is required from the extended network of lay caregivers. OR 2) Caregivers are assumed to be available. OR 3) A network of caregivers is needed/expected to coordinate their inputs.	

Domain 5: The organisation Addresses whether **the organisation** of the MAMI intervention required important changes and inputs in the given organisational context: a) capacity, b) readiness to adopt, c) easiness of adoption and funding decision, d) changes in teamwork, and e) tasks to be undertaken (the work).			
5a. What is the organisation's capacity to innovate?	5a. Did the organisational setup have the capacity to innovate, change, and adapt ways of working, and did it have the resources for doing so?	1) Local health system is well-organised (good managerial capacity, well-supported), flexible and available resources, good management, risk taking is encouraged. OR 2) Resources are inflexible, local leadership is suboptimal and risk taking is not encouraged. OR 3) Severe resource pressure, weak leadership, weak resilience.	
5b. How ready is the organisation for this technology-supported change?	5b. Was the organisational setup ready / open to innovating, changing, and adapting ways of working, and did it have the resources for doing so?	1) High tension for change, openness to innovation, widespread support. OR 2) Little tension for change, moderate innovation. OR 3) No tension for change, poor innovation, opponents to change.	
5c. How easy will the adoption and funding decision be?	5c. How easy will the adoption and funding decision for the MAMI Care Pathway be (resources, cost savings, new infrastructure to manage by MOH, NGO or donor lead)?	1) Single organisation with sufficient resources; anticipated cost savings; no new infrastructure or recurrent costs required. OR 2) Multiple organisations with partnership relationship; cost–benefit balance favourable or neutral; new infrastructure found (e.g., repurposing staff roles, training). OR 3) Multiple organisations with no formal links and/or conflicting agendas; funding depends on cost savings across system; costs and benefits unclear; new infrastructure conflicts with existing and significant budget implications.	
5d. What changes will be needed in team interactions and routines?	5d. What changes were needed in MOH, NGO, and health worker team organisation to adopt MAMI? Did team interactions and team routines change (new), align or conflict?	1) No new team routines or care pathways needed. OR 2) New team routines or care pathways that align readily with existing ones. OR 3) New team routines or care pathways that conflict with existing ones.	
5E. What work is involved in implementation and who will do it?	5e. What work is involved in implementing and improving the quality, and who will do it?	1) Established shared vision, few simple tasks, uncontested and easily monitored. OR 2) Some work needed to build shared vision, engage staff, enact new practices, monitor impact. OR 3) Significant work needed to build shared vision, engage staff, enact new practices, monitor impact.	
Domain 6: The wider context Explores whether **financial and policy requirements** are in place nationally for rollout.			
6a. What is the political, economic, regulatory, professional (e.g., medicolegal) and socio-cultural context for programme rollout?	6a. Are financial and policy requirements for MAMI in place for programme rollout? a) what was it like in the previous context, b) what is it like in the new context?	1) Financial and regulatory requirements are in place nationally; professional bodies and civil society are supportive. OR 2) Are being negotiated nationally; professional bodies and lay stakeholders not yet committed. OR 3) Raise tricky or legal or other challenges, professional bodies and lay stakeholders are opposed.	

Domain 7: Embedding and adaptation over time Explores the feasibility of **embedding and adapting** the MAMI approach over time: the feasibility of a) continuing to adapt and evolve over the medium and long term, and b) building organisational resilience.			
7a. How much scope is there for adapting and co-evolving the technology and the service over time?	7a. What is the feasibility of continuing to embed and adapt the MAMI approach (intervention modalities) over time (medium- to long-term)? Are you expecting certain barriers?	1) Strong scope for adapting and embedding the MAMI approach. OR 2) Potential for adapting and co-evolving the MAMI services is limited and uncertain. OR 3) Significant barriers to the further adaptation or co-evolution of the MAMI approach.	
7b. How resilient is the organisation in regard to handling critical events and adapting to unforeseen eventualities?	7b. What is the organisation resilience to detecting and overcoming critical issues or barriers (barriers related to embedding, handling critical events, adapting to unforeseen eventualities?)	1) Sense-making, collective reflection and adaptive action are ongoing and encouraged. OR 2) Are difficult and viewed as a low priority. OR 3) Are discouraged in a rigid, inflexible implementation model.	

Annex 4d. Data tool: Planning for successful scale-up of the MAMI Care Pathway approach

Questions related to potential scalability	Yes (+)	No (–)	More information / action needed
1. Is input about the project being sought from a range of stakeholders (e.g. policy-makers, programme managers, providers, NGOs, beneficiaries)?			
Are individuals from the future implementing agency involved in the design and implementation of the pilot?			
Does the project have mechanisms for building ownership in the future implementing organisation?			
2. Does the innovation address a persistent health or service delivery problem?			
Is the innovation based on sound evidence and preferable to alternative approaches?			
Given the financial and human resource requirements, is the innovation feasible in the local settings where it is to be implemented?			
Is the innovation consistent with existing national health policies, plans and priorities?			
3. Is the project being designed in light of agreed-upon stakeholder expectations for where and to what extent interventions are to be scaled up?			
4. Has the project identified and taken into consideration community, cultural and gender factors that might constrain or support implementation of the innovation?			
Have the norms, values and operational culture of the implementing agency been taken into account in the design of the project?			
Have the opportunities and constraints of the political, policy, health sector and other institutional factors been considered in designing the project?			
5. Has the package of interventions been kept as simple as possible, without jeopardising outcomes?			
6. Is the innovation being tested in the variety of socio-cultural and geographic settings where it will be scaled up?			
Is the innovation being tested in the type of service delivery points and institutional settings in which it will be scaled up? 7. Does the innovation being tested require human and financial resources that can reasonably be expected to be available during scale-up?			
Will the financing of the innovation be sustainable?			
Does the health system currently have the capacity to implement the innovation? If not, are there plans to test ways to increase health systems capacity?			

8. Are appropriate steps being taken to assess and document health outcomes, as well as the process of implementation?			
9. Is there provision for early and continuous engagement with donors and technical partners to build a broad base of financial support for scale-up?			
10. Are there plans to advocate for changes in policies, regulations and other health systems components needed to institutionalise the innovation?			
11. Does the project design include mechanisms to review progress and incorporate new learning into the implementation process?			
Is there a plan to share findings and insights from the pilot project during implementation?			
12. Is there a shared understanding among key stakeholders about the importance of having adequate evidence related to the feasibility and outcomes of the innovation prior to scaling up?			

WHO ExpandNet (2011) *Beginning with the end in mind: planning pilot projects and other programmatic research for successful scaling up*.

1. Engage in a participatory process involving key stakeholders
2. Ensure the relevance of the proposed innovation
3. Reach consensus on expectations for scale-up
4. Tailor the innovation to the socio-cultural and institutional settings
5. Keep the innovation as simple as possible
6. Test the innovation in the variety of socio-cultural and institutional settings where it will be scaled up
7. Test the innovation under the routine operating conditions and existing resource constraints of the health system
8. Develop plans to assess and document the process of implementation
9. Advocate with donors and other sources of funding for financial support beyond the pilot stage
10. Prepare to advocate for necessary changes in policies, regulations and other health systems components
11. Develop plans for how to promote learning and disseminate information
12. Plan on being cautious about initiating scale-up before the required evidence is available

Annex 5. Implementation materials

Table Annex 5. Summary of materials for implementing the MAMI Care Pathway approach in the South Sudan case, 2021–2023

	Description of change (what)	Method (how)
Materials from the 2021 MAMI Care Pathway Package v3 adapted		
Assessment form Feeding form Mental health form	Adapted to national context and merged as one risk assessment form that includes the national IMNCI form, and an updated IMNCI summary. The first step of the mental health assessment was skipped.	Informed by discussion with key health and nutrition actors of MOH during the orientation meeting; further refined according to feedback during training, field testing and use.
Enrolment and follow up form	Adapted to national context as outpatient care form (for boys and girls), adding the growth chart to plot weight-for-age.	
Who, what, where matrix	Adapted to unpack the MAMI activities and decide "who, what, where", based on the local structure and capacities.	
Existing South Sudan materials used		
National IMNCI form for infants 0–2 months and 2–6 months (up to five years) and chart booklet	Unchanged; included in the risk assessment form as starting point.	MOH refused to revise the IMNCI form to have the MAMI risk assessment included, therefore the IMNCI form was used as starting point.
MOH MIYCN and MAMI counselling cards	Unchanged; added to MAMI counselling card package; used for counselling in the EPI and OPD during consultation.	
BHI materials	Unchanged; comprehensive community health materials, including recording forms and database for infants and children under five years of age and pregnant and lactating mothers; u6m section for recording MUAC measurement missed and needs to be added.	BHWs and their supervisors are trained on MAMI and informed of the need to add u6m information when applicable.
Materials newly developed		
Capacity assessment form	Comprehensive description of the existing structure, services and staff, to understand the capacities and gaps.	Developed prior to starting implementation and adapted after field testing.
Community sensitisation form	Addition to the BHI materials to track people sensitised on vulnerability of mother–infant pairs.	Developed in agreement with implementers, and field tested.
Informed consent form	Informed consent of mother (adult) or legal representative (adolescent mothers).	Requirement for the study.
Anthropometry sheet	Records anthropometry measurements that are done in a different location and then during the consultation in OPD; for ease of use during in-depth assessment; plots the weight-for-age.	Developed in agreement with implementers, and field tested.
Rapid screening form	Checks basic health and nutrition questions for infants and mothers for a quick identification of risk for referral; used in community and health facility.	Developed in agreement with implementers, and field tested.

Registration sheet	Basic information on infant–mother pairs, providing unique number and indicating return to follow-up visits and date of reaching six months of age.	Developed in agreement with implementers, and field tested.
Mother's outpatient card	Summarises key information, marks the unique MAMI ID no., and dates for follow-up visits.	Developed in agreement with implementers, and field tested.
Exit interview mother	Interview guide for interviews with mothers exiting the Care Pathway to get a comprehensive understanding of mothers' satisfaction with the care received for their infant and themselves.	Developed in agreement with implementers, and field tested.
Supportive supervision checklist PHCC Supportive supervision checklist for the community	Verifies quality of care and suggests points of attention for mentoring or quality improvement.	Developed in agreement with implementers, and field tested.
M&E tools: data forms and reporting templates	Reporting forms for monthly monitoring of performance, capturing lessons, and quality improvement: screening tally sheet, monthly reporting sheet, consolidated report template; including a secure data storage system.	Developed in agreement with implementers, and field tested.
Implementation guidance	Supports the implementation and data management of the MAMI Care Pathway approach.	Updated at intervals when changes or adaptations in processes occur.
Database for quantitative monitoring information (Excel and Kobo)	Comprehensive database in Excel for key monitoring indicators collected monthly, with automatic analysis and dashboard, used for quality improvement and progress evaluation	Developed in agreement with implementers, and field tested.
Database for qualitative information (Excel and Kobo)	Comprehensive database in Excel to collect all qualitative data for capturing and learning from lessons.	Developed in agreement with implementers.
Database for individual data records (Excel and Kobo)	Comprehensive database in Excel and Kobo to collect all data from the individual records (from screening to exit).	Developed in agreement with implementers, and field tested.
Training materials: modules, planning tools, handouts and job aids	Supports implementation training sessions on screening, assessing, outpatient support, counselling at the health facility and community level and preparing for implementation and M&E for quality improvement at the management level.	Developed, tested and refined in various contexts at health facility and community level.

Annex 6. Training sessions

Outline of training sessions, objectives and materials used in the South Sudan case, 2021–2023

Training sessions conducted

At the start of implementation (October 2022–January 2023):

A two-day implementation training workshop, followed by one-day on-the-job training for clinical health and nutrition staff from the MAMI sites on knowledge and skills for implementing the MAMI Care Pathway:
48 participants were health workers (17% female) from the PHCCs, MOH's Directorate of Nutrition, CHD, PHCCs, hospitals, and implementing partners, along with MIHR staff.
A one-day implementation training workshop followed by one-day on-the-job training for BHWs from all five PHCCs' health catchment communities on implementing the MAMI Care Pathway using the BHI materials and job aids for MAMI:
49 participants were BHWs (45 MOH staff) and CLOs (four MIHR staff).
A two-day management and learning training workshop on MAMI data management system for recording and reporting activities, conducting supportive supervision, continuous quality improvement and capturing learning:
15 participants were MIHR staff: MAMI assistants, CLOs, maternal health advisor, child health advisor, community service advisor, and representatives from the Monitoring, Evaluation, Research and Learning (MERL) team.

Ongoing on-the-job mentoring and support for quality implementation for the MIHR MAMI team, supported by the senior nutrition advisor from headquarters and the MAMI expert (August 2022–ongoing).

Training objectives for implementing and managing the MAMI Care Pathway approach

At all levels (adapted to the level), be able to:
(1) understand the MAMI Care Pathway and integrated implementation modus and materials

At the health facility level, be able to:
(1) screen all mother–infant pairs and identify and refer those at risk to the OPD for investigation
(2) assess, classify, enrol, counsel, and monitor moderate-risk mother–infant pairs until the infant reaches six months, and refer high-risk pairs to hospital
(3) use the MAMI Care Pathway monitoring and reporting tools
(4) counsel and motivate mothers
(5) organise case management and support task sharing

At the community level, be able to:
(1) sensitise communities on the risk of poor growth and development of the infant and risk of the mother
(2) screen mother–infant pairs in the community, refer risk pairs to the PHCC for investigation, and follow up risk pair households
(3) monitor and support risk pairs in the community

At the management level, be able to:
(1) collect and analyse monitoring indicators for quality improvement, learning and adaptive management
(2) collect and analyse qualitative data to capture lessons on good practices and challenges
(3) ensure quality data management
(4) report on lessons and achievements and disseminate learning

Training materials

Materials	*Use*	*Origin*
Preparatory tools Terms of reference Plans List of materials and printing needs	Prepare for training sessions	MIHR
Training modules (7): Introduction to the training materials, Introduction to MAMI, Screening, Assessment, Enrolment, Community implementation, MERL	Guide training knowledge and skills for MAMI implementation and monitoring	MIHR, with some inputs from Save the Children materials
Handouts Case scenarios Counselling scenarios Who does what where report (filled) Capacity assessment report (filled) Evaluation of training sessions Icebreakers	Provide tools for training	MIHR, with some inputs from Save the Children materials

Training materials are available on request

Annex 7. Appraising the adoption process

Table Annex 7. Degree of normalisation* of the MAMI Care Pathway approach in the South Sudan case, 2021–2023

Normalisation domain question	Summary of finding
1. Is the MAMI Care Pathway easy to describe? Can you describe how it differs from current ways of working, from what you did before for at-risk infants under six months of age (u6m) and their mothers?	Before MAMI, growth monitoring and measuring MUAC was only done for children aged 6–59 months. Infants u6m received immunisation through EPI and some IYCF counselling to encourage breastfeeding. Health workers were trained to provide IMNCI services for ill children, but these were not routinely practised. Malnourished infants u6m, if identified (there was no systematic screening), were referred to the hospital for treatment. When MAMI started, measuring MUAC for infants u6m and assessing and enrolling at-risk mother–infant pairs were new components of care. The MAMI Care Pathway approach also builds on, and encourages, routine implementation of the IMNCI approach. Participants distinguished the intervention from current ways of working: **Grade 4**
2. Do you and your colleagues have a common understanding of the aims, objectives and expected outcomes of the Care Pathway?	After being trained in and implementing the MAMI Care Pathway, health workers understood it and agreed on its importance. MAMI was seen as important because it identifies issues that may have started during the antenatal period, screens mothers for health risks, identifies infant illness, and refers mothers and infants as needed. It also identifies infants that may have lost their mothers and who require specific support. Participants collectively agreed on the purpose of the intervention: **Grade 5**
3. Do you understand what implementing the Care Pathway requires from you (specific tasks and responsibilities)?	The tasks were defined and mapped together with the team. "I know why and how to assess the infant and mother, do counselling, observe feeding, and explain to the mother." Participants individually understood what the intervention requires of them: **Grade 5**
4. Can you easily grasp the potential value, benefits and importance of the Care Pathway?	Participants saw that the MAMI Care Pathway approach monitors the infant and identifies problems that need to be solved, addresses issues that mothers have and aids referral to other services. They realised that MAMI improves EPI coverage, providing an opportunity to identify infants requiring immunisation and to refer them to EPI. "Mothers who are malnourished may not be aware of vulnerabilities but when they come for screening, it can be identified, and they can be referred." "Mothers do not understand MAMI because it does not provide a tangible service. (Monitoring health and growth and counselling are not seen as health services)." Participants construct the potential value of the intervention for their work: **Grade 5**
5. Are you (or other key individuals) able and willing to get others involved in the Care Pathway? Are you actively engaged in making the Care Pathway work in your setting?	Colleagues were invited to participate and showed an interest in engaging. The MAMI assistants supported the implementation. "There is a dialogue with them to tell them about the benefits of MAMI, talk to facility staff about the programme." Key individuals drive the intervention forward: **Grade 4**

6. Do you believe and agree that being involved is right, and that by accepting the Care Pathway as part of your work you contribute to its implementation?	While the benefits of MAMI were understood, it is premature to expect MOH to adjust job descriptions to include the Care Pathway tasks. MAMI tasks were therefore not seen as health worker duties, and involvement was more of a compromise, expecting the benefit indirectly later. Participants agree that the intervention should be part of their work: **Grade 2**
7. Do you have the capacity and are you willing to organise yourself and your colleagues and collectively contribute to the work involved in implementing the Care Pathway?	There was willingness to continue to invest time and energy, and colleagues were enthusiastic. However, if the approach is MOH-led, MOH staff will need a policy change to deliver a minimum package and/or updated job descriptions that include MAMI-related tasks at the primary care level. If it is NGO led, MOH staff will need a salary top-up or assistance from NGO staff to maintain the services. The responsible clinical health workers' involvement in the MAMI Care Pathway affected their own work considerably because their routine tasks were maintained. Participants buy in to the intervention: **Grade 2**
8. Do you have the capacity and are you willing to collectively define the actions and procedures needed to keep the practice going (invest your time, energy to keep it going)?	Colleagues asked for salary top-ups, and efforts had to be made to motivate them to fulfil their tasks. Talking with colleagues and building good relationships, along with providing airtime for their phones, motivated them. Participants continue to support the intervention: **Grade 2**
9. Are you and colleagues able to undertake the tasks required to implement the Care Pathway (to operationalise its components in practice)? (Interactional workability)	Training and mentoring (supportive supervision) ensured that colleagues could do the tasks and contributed to operationalising the tasks at their levels (across various units of the health facility; e.g., EPI, prevention of mother-to-child transmission of HIV, maternity, postnatal care and family planning, consultations). Participants perform the tasks required by the intervention: **Grade 4**
10. Do you maintain trust in the intervention and in each other's work and expertise in implementing the Care Pathway? (Relational integration)	When the lead clinician was absent, screening continued (done by others), but assessment and support stopped. Replacing the clinical officer when absent was a major issue. Some people were trained and have the skills but would not be interested in doing the assessment and providing support. "I do not trust that they would do it if I was not there; however, they have been trained." Participants maintain their trust in the intervention and in each other: **Grade 1**
11. Is the work required for implementing the Care Pathway distributed to participants with the right mix of skills and training? Did it impact the division of labour, resources, power or responsibilities (tasks and skill sharing)? Was extensive training needed to implement the Care Pathway? (Skill set workability)	A lot of training was needed at the start, although the supervisor felt that the skills needed for MAMI were not so different from those for other aspects of care. Also, the training was short (two days) and a lot of information needed to be understood, without comprehensive practical sessions. The content for MAMI implementation is not difficult, but the methods of examination and completing the forms are challenging. Counselling went well, but no specific training on counselling was received (health workers were assumed to have these skills). While MICYN is also part of CMAM, no specific MAMI counselling training has ever been received. The work of the intervention is appropriately allocated to participants: **Grade 2**
12. Is the implementation of the Care Pathway adequately supported by the advisor/manager? (Contextual integration)	MAMI supervisors and supervisors from other health departments provided adequate support. The latter participated in the orientation meeting for stakeholders. The intervention is adequately supported by its host organisation: **Grade 4**
13. Do you have access to information on the quality of care and outcome of the Care Pathway (monitoring and evaluation information)?	An elaborate M&E system existed, managed by the organisation's MAMI assistant and coordinator, who provided regular and monthly feedback to implementers. There were challenges in understanding some of the information. Lessons within and across sites were shared. Participants access information about the effects of the intervention: **Grade 4**

14. Do you collectively agree on the quality of care and the effects of the Care Pathway because of formal monitoring?	Improvements in quality of care were discussed together (after very busy workdays); e.g., when measuring MUAC, improving recording during assessment and management of records. Participants collectively assess the intervention as worthwhile: **Grade 5**
15. Do you individually think the Care Pathway is worthwhile?	Multiple benefits of the Care Pathway were identified (see above). The comprehensive and quality care promoted by the Care Pathway effectively addressed the risks of the mother–infant pair. Participants individually assess the intervention as worthwhile: **Grade 4**
16. Can you make changes to the intervention as individual or group in response to the appraisal?	The M&E system promoted continuous reflection on quality and what to improve, and positive changes in organisation or clinical care were supported. Also, lessons on best practices and challenges were captured and shared. Participants modify their work in response to their appraisal of the intervention: **Grade 5**

* Findings were informed by the Normalisation Process Theory (13, 14) (see Annex 3 Methods and limitations), adapted to the MAMI Care Pathway approach, to understand the path followed towards adoption, including enablers and barriers. We also assessed the likelihood of the Care Pathway becoming routine in practice. The quotes are from the participatory discussions with the MAMI implementation team.

Annex 8. Appraising readiness for scale

Table Annex 8a. Appraising challenges to scale-up, spread and sustainability of the MAMI Care Pathway in the South Sudan case, 2021–2023

Domain 1. The condition (including risk factors)	Addresses a) how well the **condition** "small and nutritionally at-risk infants and their mothers" is characterised, understood and predicted, and b) how care is affected by socio-cultural factors and co-morbidities
1a. Is the condition "small and nutritionally at-risk infants and their mothers" well-characterised, well-understood, and predictable?	It is not difficult to characterise and understand (detect) the condition. Some risk factors are covered by an existing practice or policy guidance, or clinicians are familiar with these. One new element added is the maternal mental health aspect.
1b. Are socio-cultural factors and co-morbidities relevant for the condition "small and nutritionally at-risk infants and their mothers"?	Socio-cultural factors play a role in the planning and provision of care but are not easy to assess. For example, mothers may report things incorrectly (e.g., if they are working, the age of the infant) or not be open about the challenges they face.
Domain 2. The technology	Addresses whether **the methods (technologies)** of the MAMI Care Pathway used for detecting, classifying and supporting "small and nutritionally at-risk infants and their mothers" are a) newly introduced, b) need new knowledge, c) need continued support, and d) need specific adaptations.
2a. What are key features of the methods (technologies) used to assess, classify and support "small and nutritionally at-risk infants and their mothers"? Are methods known, do they exist?	Assessment tools are elaborate appropriate and clear. One question leads to another and adds up to the classification of risks. Some questions are not appropriate to ask the way they are written and need to be adapted to take account of socio-cultural factors.
2b. Is new knowledge generated or made visible when applying the methods to assess, classify and support "small and nutritionally at-risk infants and their mothers"? Can it detect changes in health and nutritional status?	Navigating the mother through the questions may help to obtain information that otherwise could not be asked about directly.
2c. What knowledge and/or technical support is required to assess, classify and support "small and nutritionally at-risk infants and their mothers"?	Each time the Care Pathway is implemented (interview with mother or screening of infant), new knowledge is gained through the interactions of risk factors. Skills are built on knowledge gained during training, and special skills are needed to help mothers to share information. Assessment of maternal mental health or certain feeding aspects, as well as measuring MUAC in infants, requires additional instructions and training. New knowledge is gained through various training (and mentoring?) opportunities. The flow of assessment (IMCI and "small and nutritionally at-risk infants and their mothers' risk assessment") and support are critical for the adequate growth of the infant, but the flow of the assessment aspects is complex and needs additional training.
2d. Are the methods used in the MAMI Care Pathway generic and standardised?	The Care Pathway approach is new, and health workers will need time to implement it without support. It is too early to leave them on their own to do this. The forms have many questions, and health workers do not necessarily answer these carefully, or they get confused. With the knowledge they have acquired, some understand the MAMI Care Pathway approach well, and these individuals could help others to cover gaps. The approach implemented as a pilot is intensive and requires external support. When the pilot is finished, if MOH decides to continue the Care Pathway, the forms should be condensed and simplified to better integrate the Pathway into existing services.
Domain 3. The value proposition	Explores whether the MAMI Care Pathway is considered a **valuable intervention and by whom** (a) the care provider and b) the user).
3a. How do health workers perceive the value of the MAMI Care Pathway? Do they understand the value of the short-/mid-/long-term benefits?	The MAMI Care Pathway has a benefit because it helps to understand more factors relating to the infant's vulnerability, explains changes in weight (losing weight/ not improving). Monitoring an infant's weight and MUAC changes alone is not enough. Communities may not like to access immunisation services and may not come to the facility, while MAMI provides an opportunity to identify these missed opportunities in infants during occasional visits to the health centre. For community health workers or volunteers, it is more challenging to see the benefits and they need a strong(er) structure to identify and refer vulnerable infants and their mothers to the health centres.

3b. How do the mothers (caregivers) perceive the value of the MAMI Care Pathway? Do they understand the need, do they appreciate the care, is the opportunity cost a barrier?	How mothers perceive the value of the MAMI Care Pathway depends on their communities, level of concern and support from the BHW. Mothers who are attentive and concerned about their infants see MAMI as beneficial, and as an opportunity to connect to other mothers and existing services. For other mothers, community structures could be strengthened to increase awareness. The current design of the MAMI Care Pathway approach is not well embedded in the BHI. BHWs have approximately 40 households to visit regularly, and they could be more involved. They know where the mother/infants stay and can access them easily. On the other hand, mothers going to the health facility who do not live in the catchment area are difficult to follow up, as they are not on the list of households to be monitored.
Domain 4. The adopter system	Explores whether the MAMI intervention has been **adopted (accepted) and by whom:** a) health staff, b) mothers, c) lay support system of the mother.
4a. Did important changes have to be made for staff in the health facility to take on their roles in the MAMI Care Pathway? Did new skills have to be learned, new staff appointed or new tasks taken on?	New staff were hired to support the MAMI activities. The structure had to be strengthened: health workers needed to learn new skills to simultaneously boost the IMNCI and MAMI care pathways. Existing staff can do the work, but concerns about the workload remain.
4b. Were specific or new actions expected of mothers?	When the MAMI Care Pathway started, mothers felt that a lot of questions were asked that took a lot of time, and they often ignored the request to return for follow-up visits. By going, mothers came to know MAMI and appreciated the increased attention. The assessment process and number of questions asked seemed a lot for mothers, but once the problem was identified, the follow-up steps were less taxing. Sensitising and counselling helped mothers understand the importance of increasing the frequency of breastfeeding, taking infants regularly to the facility for growth monitoring, and demonstrating good feeding practices.
4c. By offering MAMI, are other lay caregivers in the mother's network affected (e.g., family members, volunteers, community members), and are there new requirements or expectations for them? Is the wider network requested to get involved?	The MAMI Care Pathway asks the mother to involve the extended family to support her in the infant's care indirectly. It is up to the mother to inform family members of what needs to be done to support the infant.
Domain 5. The organisation	Addresses whether **the organisation** of the MAMI intervention required important changes and inputs in the organisational context: a) capacity, b) readiness to adopt, c) easiness of adoption and funding decision, d) changes in teamwork and e) tasks
5a. Did the organisational setup have the capacity to innovate, change, and adapt ways of working, and did it have the resources for doing so?	MIHR South Sudan identified the opportunity to expand its support and pilot the MAMI Care Pathway in five health facilities for a limited time, with clear roles and responsibilities and a defined start and stop date.
5b. Was the organisational setup ready / open to innovate, change, and adapt ways of working, and did it have the resources for doing so?	The organisational setup of MIHR was ready to take on and implement the MAMI Care Pathway but required approval from MOH to move forward. Because health facilities were not ready or did not have adequate human resources to absorb this programme, MIHR brought in extra staff. People were open to a new programme, but existing roles and responsibilities and the heavy workload in the child clinics made implementation difficult.
5c. How easy will the adoption and funding decision for the MAMI Care Pathway be (resources, cost savings, new infrastructure to be managed by MOH, will NGOs or donor lead)?	The public health system has many competing health priorities. Health service provision relies heavily on external financial and human resources. This situation will not change, but it influences effective implementation of the Care Pathway. Ongoing support by partners ensures that the Care Pathway can be made available and will need to continue if the MAMI Care Pathway approach is to be adopted and sustained.
5d. What changes were needed in MOH, NGO, health worker team organisation to adopt MAMI? Did team interactions and team routines change (new), align or conflict?	For it to continue in the health facility, MAMI will need to be merged into existing programmes, including the reporting system (e.g., merged health registers). MOH dictates what needs to be done in the health facility. If MAMI is not routine, external support and incentives will be required to motivate health workers to apply it.
5e. What work is involved in implementing and improving the quality, and who will do it?	MIHR and health facility actors collaborate and work together to increase buy-in and commitment to providing quality of care. Health workers doing their jobs are concerned about quality of care.

Domain 6. The wider context	Explores whether national **financial and policy requirements** are in place for rollout.
6a. Are financial and policy requirements for MAMI in place for programme rollout, considering the past and future contexts for expansion?	For the pilot, financial and policy requirements were met. The MOH and donor expressed commitment and eagerness to take it on, and there is a promising environment for continuing. Opportunities probably exist to continue MAMI after the pilot. It seems unlikely that MOH will lose interest. It remains to be seen how MOH will respond at end of the study when continuation is discussed.
Domain 7. Embedding and adaptation over time	Explores the feasibility of **embedding and adapting** the MAMI Care Pathway approach over time, including the feasibility of a) continuing to adapt and evolve in the medium and long term, and b) building organisational resilience.
7a. What is the feasibility of continuing to embed and adapt the MAMI Care Pathway approach (intervention modalities) over time (medium to long term)? Do you expect certain barriers?	The potential to embed the MAMI Care Pathway approach and further adapt it over time depends on the willingness of MOH to embed the approach in the national policy guidance and of donors to support implementation. There are limited capabilities (barrier) and competing priorities (threat) for the same limited financial and human resources. New initiatives or programmes are continuously proposed and implemented, demanding the attention of MOH and its partners.
7b. What is the organisational resilience in regard to detecting and overcoming critical issues or barriers (related to embedding, handling critical events, adapting to unforeseen eventualities)?	The MAMI Care Pathway approach needs to be seen as advantageous and cost effective if it is to be prioritised.

Table Annex 8b. Appraising the potential scalability of integrating the MAMI Care Pathway in South Sudan, 2021–2023, and suggested actions

Scale-up appraisal		Appraisal of potential scalability and suggested actions
1. Is input on the project sought from a range of stakeholders (policy-makers, programme managers, providers, NGOs, beneficiaries)?	Yes	Stakeholders at the national, sub-national and implementation levels were solicited to participate in the pilot, and knowledge and evidence were shared.
Are individuals from the future implementing agency involved in the design and implementation of the pilot?	Yes	Stakeholders were involved in designing the study and adapting the key materials to the context. Training sessions and continuous coaching built the knowledge and skills of health workers at various levels for implementing and managing the MAMI Care Pathway approach.
Does the project have mechanisms to build ownership in the future implementing organisation?	Yes	An elaborate monitoring and information system was put in place that included sharing of learning and establishing a community of practice.
2. Does the innovation address a persistent health or service delivery problem?	Yes	National policies addressed most health and nutrition needs, covering very ill or severely malnourished infants through IMCI and CMAM, but a comprehensive primary care approach was lacking.
Is the innovation based on sound evidence and preferable to alternative approaches?	Yes	The innovation was built on the MAMI Care Pathway approach, which is based on the plausible application of existing content to the care of at-risk infants and their mothers and implementation evidence generated over the past 10 years.
Given the financial and human resource requirements, is the innovation feasible in the local settings?	Yes	If national policies were implemented correctly, this innovation, which builds on them, would not require additional resources. The innovation enabled the continuity of care person-centred on the vulnerable mother–infant pair.
Is the innovation consistent with existing national health policies, plans and priorities?	Yes	Same as above.
3. Is the project being designed in light of agreed stakeholder expectations for where and to what extent to scale up interventions?	Yes	The aim was to first pilot and learn, and then to simplify the approach for scale-up.
4. Has the project identified and taken into consideration community, cultural and gender factors that might constrain or support implementation of the innovation?	Yes	The primary care setting for the study comprehensively limited the ability to address community and socio-cultural factors. There was a limit to what health workers could realistically do.
Have the norms, values and operational culture of the implementing agency been taken into account in the design of the project?	Yes	Norms and values dictated what was feasible in the selected facilities.
Have political, policy, health sector and other institutional opportunities and constraints been considered in designing the project?	Yes	The pilot worked with MOH from the start.
5. Has the package of interventions been kept as simple as possible, without jeopardising outcomes?	Yes	The existing package was contextualised and adapted/simplified, and some tools to monitor quality improvement were added. It was recognised that further simplification was needed.
6. Is the innovation being tested in the variety of socio-cultural and geographic settings where it will be scaled up?	Yes	Sites were selected purposively; an effort was made to cover urban and rural sites across four states with high needs and which were safely accessible.
Is the innovation being tested in the type of service delivery points and institutional settings in which it will be scaled up?	Yes	
7. Does the innovation require human and financial resources that can reasonably be expected to be available during scale-up?	No	The integrated approach built on existing systems that themselves were weak and needed continuous external support.
Will financing of the innovation be sustainable?	No	Commitment would be needed from MOH to prioritise and finance the innovation.
Does the health system have the capacity to implement the innovation? If not, are there plans to test ways to increase health system capacity?	No	Capacity was present, and implementation would be feasible if care were integrated into existing services and health workers' job descriptions.

8. Are appropriate steps being taken to assess and document health outcomes, as well as the process of implementation?	Yes	An elaborate monitoring, evaluation and learning system was in place for continuous quality improvement and learning, which provided information for decision-making.
9. Is there provision for early and continuous engagement with donors and technical partners to build a broad base of financial support for scale-up?	No	Plans were made to advocate for MOH to take up the innovation beyond the pilot.
10. Are there plans to advocate for changes in policies, regulations and other health system components needed to institutionalise the innovation?	Yes	Plans were in place to meet with MOH to discuss the next steps.
11. Does the project design include mechanisms to review progress and incorporate new learning into the implementation process?	Yes	An elaborate capacity strengthening, monitoring and learning system was in place.
Is there a plan to share findings and insights from the pilot project during implementation?	Yes	The advisory team was not very active.
1. Do key stakeholders understand the importance of adequate evidence for the feasibility and outcomes of the innovation prior to scaling up?	Yes	There was an expanded learning system, and MOH was involved.

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