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# Applying WHO Prioritization Criteria for Moderate Wasting: Programmatic Implications

Isabel Potani[1,2] | Zachary Tausanovitch[1] | Grace Heymsfield[1] | Christian Ritz[3] | Cecile Cazes[4,5] | Philip T. James[6] | André Briend[7,8] | Issa Niamanto Coulibaly[9] | Jessie Jane Khaki[10] | Geoffrey Manda[2] | Osborne Potani[2] | James A. Berkley[10,11,12] | Jeanette Bailey[1] | Suvi T. Kangas[1]

[1]International Rescue Committee, New York, New York, USA | [2]Ripple Global Health Network, Lilongwe, Malawi | [3]National Institute of Public Health, SDU, Denmark | [4]ALIMA, Paris, France | [5]National Institute for Health and Medical Research (INSERM) UMR 1219, Research Institute for Sustainable Development (IRD) EMR 271, Bordeaux Population Health Research Centre, University of Bordeaux, Bordeaux, France | [6]Emergency Nutrition Network, Oxford, UK | [7]Tampere Center for Child, Adolescent and Maternal Health Research, Faculty of Medicine and Health Technology, Tampere University and Tampere University Hospital, Tampere, Finland | [8]Department of Nutrition, Exercise, and Sports, Faculty of Science, University of Copenhagen, Copenhagen, Denmark | [9]International Rescue Committee, Bamako, Mali | [10]Department of Nutrition and Dietetics, School of Global and Public Health, Kamuzu University of Health Sciences, Malawi | [11]Clinical Research Department, KEMRI/Wellcome Trust Research Programme, Kilifi, Kenya | [12]Centre for Tropical Medicine and Global Health, University of Oxford, Oxford, UK

**Correspondence:** Isabel Potani (isabelpotani@gmail.com)

**Received:** 18 June 2025 | **Revised:** 2 November 2025 | **Accepted:** 25 November 2025

**Keywords:** combined protocol | mid-upper-arm circumference | moderate wasting | ready-to-use therapeutic food | simplified | specially formulated food

## ABSTRACT

The World Health Organization's 2023 recommendations for managing moderate wasting provide criteria for prioritizing children to receive specially formulated foods (SFF) rather than counseling alone. However, the practical programmatic impact of such prioritization is unclear. This secondary analysis aimed to describe the caseload and treatment outcomes among moderately wasted 6- to 59-month-old Malian children, categorized into higher-priority (HP) and lower-priority (LP) groups. All children admitted with a MUAC ≥ 115 to < 125 mm without nutritional edema received SFF (500 kcal/day) until they achieved a MUAC ≥ 125 mm for 2 consecutive visits. HP criteria were < 2 years old, WAZ < −3 SD, or MUAC 115–119 mm; LP criteria were ≥ 2 years, WAZ ≥ −3 SD, or MUAC ≥ 120 mm. We reported the caseload per priority criterion and compared treatment outcomes, including recovery and anthropometric changes, between LP and HP children. Of the 35 685 children included in the analysis, 95% met at least one priority criterion. The proportion of children recovered was similar between LP and HP children, regardless of the criterion used. MUAC-for-age z-score and WAZ weekly changes showed similar trajectories. Furthermore, although classified as LP, children > 2 years exhibited lower WAZ throughout treatment compared to children < 2 years. Most moderately wasted children (MUAC < 125 mm) met at least one priority criterion, raising concerns about the feasibility and rationale of the prioritization approach. The similar recovery rates in higher- and lower-priority groups after both received SFF highlight the need for research to assess the impact of different interventions.

## 1 | Background

Wasting is a major health problem affecting 42.8 million children aged under 5 years and is associated with heightened risk of morbidity and mortality in children (World Health Organisation and UNICEF 2025). Wasting can be diagnosed using a weight-for-height/length z-score (WHZ/WLZ) < −2 standard deviations and/or a mid-upper arm circumference (MUAC) < 125 mm. Wasting typically reflects recent, severe weight loss resulting from acute undernutrition, though in some cases it may persist for prolonged periods (Bhutta et al. 2017). It commonly arises when dietary intake is insufficient in quantity or quality and/or when

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**Summary**

- The WHO 2023 anthropometric and age-based prioritization criteria for moderate wasting classify most of the children as high priority in a MUAC-based enrollment protocol for wasting treatment.
- Given the limited selectivity of these criteria, alongside the increased complexity they introduce, their added value for programmatic decision-making remains uncertain.
- Evidence is needed to inform optimal implementation of the prioritization criteria and to understand whether different treatment approaches yield differential outcomes for children categorized as high- versus low-priority.

individuals experience frequent or prolonged infectious diseases (Bhutta et al. 2017).

Wasting is further classified as moderate or severe, with severe wasting defined as WHZ/WLZ < −3 SD or MUAC < 115 mm with or without nutritional edema, and moderate wasting as WHZ/WLZ ≥ −3 SD to < −2 SD or MUAC from 115 to 124 mm (World Health Organisation 2023a). Moderate wasting accounted for 70% of all wasting cases in 6-59-month-old children globally in 2023 (United Nations Interagency Group for Child Mortality Estimation UNIGME 2024). Moderately wasted children have a higher mortality and morbidity risk compared with children without wasting (Olofin et al. 2013) and also risk progressing to severe wasting if unsuccessfully treated (Chang et al. 2013). Providing nutritional support to children with wasting facilitates weight gain (Padhani et al. 2023; Potani et al. 2024), which is associated with improved health outcomes. However, providing nutrition support has programmatic and consumable costs, especially when specially formulated foods (SFFs), such as lipid-based nutrient supplements (LNS) or fortified blended foods (FBF), are used.

While WHO guidance on management of severe wasting is more established, that is since 1999 (United Nations Children's Fund UNICEF, World Health Organization WHO, and International Bank for Reconstruction and Development/The World Bank 2023; World Health Organization 1999, 2013), the recommendations on management of moderate wasting were only released in 2023 (World Health Organisation 2023a).

The WHO recommends that children who are moderately wasted in high-risk settings be considered for SFFs, receive counseling on local, nutritious foods, and that their households ensure they get nutritious meals at home foods. However, in non-high-risk settings, children who meet a specific criterion should be given priority for SFFs. To be considered Higher Priority (HP), moderately wasted children need to have any of the following factors: MUAC 115–119 mm; weight-for-age z-score (WAZ) < −3; age < 2 years; moderate wasting relapse; history of severe wasting; failure to recover from moderate wasting after receiving other interventions (e.g., nutrition counseling only); presence of comorbidities, and social factors such as poor maternal health/well-being. The WHO planned the selection of the appropriate priority criteria to be context-specific. To facilitate the understanding of context-specific variation, WHO encourages studies on prognostic factors, response to moderate wasting treatment, and feasibility of various moderate wasting treatment approaches (World Health Organisation 2023a; World Health Organization 2023b).

Although robust estimates of global treatment coverage for children with moderate wasting are unavailable, we estimate that only 12% of affected children receive treatment. This estimate is based on 10 million children treated annually compared to an estimated 31.4 million children with moderate wasting at any given time, applying an incidence correction factor of 2.6. (United Nations Children's Fund UNICEF, World Health Organization WHO, and International Bank for Reconstruction and Development/The World Bank 2023; World Food Program 2023). Recent reductions in global nutrition funding are expected to further constrain many countries' ability to provide widespread treatment for wasting (Locks et al. 2025; Osendarp et al. 2025). Given these constraints, the 2023 WHO guidelines' recommendation to prioritize treatment for high-risk subgroups of moderately wasted children becomes even more relevant. However, distinguishing between "high-risk" and "low-risk" settings, as well as assigning "higher-priority" and "lower-priority" designations to children with moderate wasting, may introduce implementation complexity and cost. Greater clarity is needed to ensure that these distinctions do not inadvertently hinder program efficiency or equitable access to treatment.

An analysis of data from current moderate wasting treatment programs is needed to understand the caseload of moderately wasted children with higher-priority criteria who can be expected to be enrolled for treatment with SFFs. With the increasing use of MUAC and edema-only enrollment criteria (Wrabel et al. 2022) due to their potential to increase coverage (Charle-Cuéllar et al. 2023; López-Ejeda et al. 2020; Sánchez-Martínez et al. 2023), the question of the relevance of applying additional criteria in programs using only MUAC and edema as enrollment criteria is important to investigate.

## 2 | Objectives

In a cohort of children with moderate wasting by MUAC and treated with 1 sachet (500 kcal/day) of RUTF per day until MUAC ≥ 125 mm, the study aimed to:

i. Describe the proportion of children classified as HP at admission using three HP criteria: Age < 2 years, MUAC 115–119 mm, and WAZ < −3 SD.
ii. Describe the proportion of children with MUAC 120–124 mm at admission who would be classified as HP due to age < 2 years or WAZ < −3 SD.
iii. Compare the weekly changes in WAZ and MUAC z-score (MUACZ) between HP and LP children.
iv. Compare the overall change in WAZ and MUACZ when disaggregated by HP and LP criteria.
v. Compare the treatment duration and the proportion of recovered, died, non-recovered, and transferred to inpatient treatment between children classified as HP and LP.

### 2.1 | Ethics Statement

The Institut National de Recherche en Sante Publique Mali (INRSP) initially approved the study (decision number: 22/2018/CE-INRSP) in October 2018. In 2023, upon learning of the INRSP closure, the study obtained ethical approval from the University of Sciences, Techniques, and Technologies of Bamako (USTTB), the relevant ethics body in Mali, to ensure compliance with Mali's ethics regulations (Decision number: 2023/36/CEUSTTB). The ethics committee at the senior author's institution approved ethical approval (decision number H 1.00.025). Since the data were derived from routine healthcare records, which were anonymized before data cleaning and analysis, neither the primary study (Kangas et al. 2022) nor this secondary analysis obtained individual consent.

## 3 | Methods

### 3.1 | Study Design

This is a secondary data analysis of an observational study looking at the effectiveness of using a simplified, combined protocol for the treatment of wasting with or without mild or moderate edema (Kangas et al. 2022). The data were collected from December 1, 2018 to December 31, 2023. For this secondary analysis, the data were accessed on 1 April 1, 2024, and the Data Analyst did not have access to any identifying data.

### 3.2 | Setting

Data were collected in the Koulikoro region, specifically in the Nara district, located in southwest Mali, across all 39 functional health areas. This region primarily consists of dry land; its residents rely on small-scale agriculture and livestock herding for their livelihoods (Global Agriculture and Food Security Program 2014; USAID 2018). Unlike the northern and central regions, Koulikoro is less impacted by political instability and conflict (The World Bank 2025). From 2018 to 2023, food security in the region was relatively stable (FEWS.NET 2018, 2020, 2021, 2022). However, healthcare access remained a significant issue; in 2020, 42% of the region's population lived more than 15 km from essential health services (Ministère de la Santé et du Développement Social 2020). Only 48% of children aged 12–24 months were fully immunized, while malaria affected 22% of children under 5 years old (Institut National de la Statistique [INSTAT] 2019). From 2021 to 2022, the prevalence of wasting, defined by a WHZ $< -2$, was estimated to be between 9.9% and 10.9% (Institut National de la Statistique 2019; Institut National de la Statistique and Cellule de Planification et de Statistique Secteur Santé-Développement Social et Promotion de la Famille [CSP/SS-DS-PF] 2019).

### 3.3 | Participants

The data used is from a wasting treatment program that enrolled children aged 6–59 months with MUAC $< 125$ mm or mild or moderate edema. The program followed the Combined Protocol for Acute Malnutrition Study (ComPAS) treatment protocol (Bailey et al. 2018), which is a simplified adaptation of the community-based management of acute malnutrition (CMAM) (World Health Organisation 2008).

Enrolled children were screened for malnutrition by health workers, community health workers, volunteers, or trained caregivers. Screening took place at health facilities or through community campaigns and active case finding. Caregivers used MUAC tapes and edema checks to identify and refer their children.

Children with a MUAC $< 115$ mm or mild or moderate edema received 1000 kcal/day of RUTF while children with MUAC $\geq$ 115 mm but $< 125$ mm (moderate wasting) received 1 sachet (500 kcal) of RUTF per day. Children with MUAC $< 115$ mm transitioned to receiving 1 daily RUTF sachet once they reached a MUAC $\geq 115$ mm. Recovery was declared after achieving a MUAC $\geq 125$ mm without edema for two consecutive visits. Weekly treatment visits were implemented throughout treatment until April 2023, and thereafter, 20 out of the 39 health areas implemented fortnightly visits for children with MUAC $\geq 115$ mm. A more detailed description of the recruitment process and treatment protocol of the cases is described elsewhere (Kangas et al. 2022).

#### 3.3.1 | Eligibility Criteria

This analysis included children with moderate wasting (a MUAC of 115–124 mm without edema at admission).

### 3.4 | Definition of Outcomes and Exposures

As described in Table 1, we retrospectively created binary variables classifying children as HP or LP. An "HP" criterion included all children who met one or more of the following criteria at admission: MUAC 115–119 mm, WAZ $< -3$, age $< 2$ years. These criteria were selected because they were the only WHO-proposed criteria in the data set. They are also likely to be the only ones available in routinely collected data in most settings that adhere to WHO guidelines for managing moderate wasting in children aged 6–59 months.

The outcomes included the proportion of children classified by the various HP and LP classifications at admission, absolute WAZ and MUACZ change, the percentage recovered, non-recovered, defaulted, died, and referred to inpatient care, and duration of treatment days (Supporting Information S1: Table S1).

### 3.5 | Data Analysis

Data were analyzed using R statistical software (Version 4.4.2) (RStudio Team 2020), and findings were reported according to STROBE-nut guidelines (Lachat et al. 2016). Categorical variables were reported as counts and percentages, whereas continuous variables were represented as medians and interquartile ranges (q1, q3) in the data summary statistics. Additionally, all-priority criteria were presented in a Venn diagram

**TABLE 1** | Risk criteria and outcomes of interest.

| Priority criterion | Group | Description |
|---|---|---|
| Any priority | HP | Child has any of these: WAZ $< -3$, age = 0.5–1.9 years, MUAC = 115–119 mm, at admission |
| | LP | Child has none of the above. |
| MUAC priority | HP | MUAC = 115–119 mm at admission |
| | LP | MUAC = 120–124 mm at admission |
| Age priority | HP | Age = 0.5–1.9 years at admission |
| | LP | Age $\geq 2$ years at admission |
| WAZ priority | HP | WAZ $< -3$ at admission |
| | LP | WAZ $\geq -3$ at admission |
| MUAC-Age priority | HP | MUAC = 115–119 mm and age = 0.5–1.9 years at admission |
| | LP | MUAC = 120–124 mm or age $\geq 2$ years at admission |
| WAZ-Age priority | HP | WAZ $< -3$ and age = 0.5–1.9 years at admission |
| | LP | WAZ $\geq -3$ or age $\geq 2$ years at admission |
| MUAC-WAZ priority | HP | MUAC = 115–119 mm and WAZ $< -3$ at admission |
| | LP | MUAC 120–124 mm or WAZ $\geq -3$. |
| Combined priority | HP | Meets all: WAZ $< -3$, age = 0.5–1.9 years, MUAC = 115–119 mm at admission |
| | LP | Does not meet all the individual criteria. |

| **Outcome variables** | |
|---|---|
| **Outcome** | **Description** |
| Absolute total change in WAZ (Δ) | Absolute value of the difference between WAZ at admission and at last recorded visit within 16 weeks. |
| Absolute change in MUACZ (Δ) | Absolute value of the difference between MUACZ at admission and at last recorded visit within 16 weeks. |
| Length of stay (days) | Days from admission to last visit within 16 weeks. |
| Recovered | Child attained MUAC $\geq 125$ mm for 2 consecutive visits within 16 weeks. |
| Non-recovered | Child didn't meet recovery criteria by 16 weeks. |
| Defaulted | Child missed $\geq 2$ consecutive follow-up visits or was lost to follow-up. |
| Transferred to inpatient care | Child was referred to inpatient care during treatment due to medical complications. |
| Died | Child died during treatment. |
| Transferred to another health facility | Child was transferred to another health facility before meeting any other treatment outcome. |
| Early discharge | Child had only MUAC $\geq 125$ mm at prior discharge, i.e. did not have two weekly consecutive MUACs MUAC $\geq 125$ mm. |

to show the proportion of children in exclusive priority classification.

Generalized additive models were used to plot the children's growth as measured by weekly changes in WAZ and MUACZ.

Comparisons between HP and LP within each priority were conducted using Wilcoxon Rank-Sum tests (Mann-Whitney U tests) for the following outcomes: absolute change in WAZ, absolute change in MUACZ, and treatment duration (medians). A Fisher's Exact Test for categorical outcomes (percent recovered, non-recovered, defaulted, and transferred to inpatient treatment). Statistical significance was determined at $p < 0.05$.

All variables of interest in the data set were examined for completeness. All children were included in the analysis; where data were missing, it was reported as part of the outcomes. Only visits up to the 17th week of follow-up were used for the analysis.

## 4 | Results

A total of 52,612 children aged 6–59 months, with a MUAC of $< 125$ mm or mild or moderate edema, were enrolled in the simplified treatment of acute malnutrition program between December 2018 and December 2023 (Figure 1). This analysis included children with moderate wasting (MUAC $\geq 115$ mm and without edema) at admission to treatment ($n = 35{,}685$).

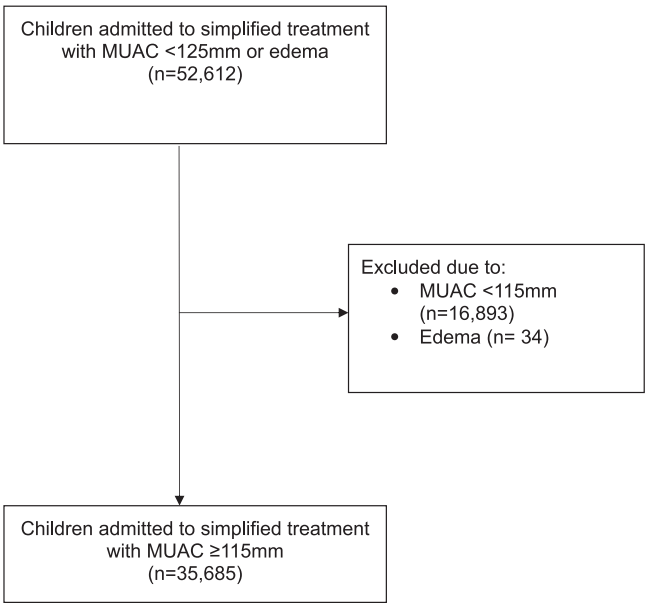


**FIGURE 1** | Inclusion of participants into the secondary analysis of caseload and treatment outcomes among children with moderate wasting by prioritization criteria among children with MUAC 115 to 124cmm admitted to simplified treatment in Mali.

At enrollment, 53% of the children were male; all children had a median age of 13 [10, 22] months (Table 2). The median [q2, q3] MUAC was 120 [118, 121] mm. Most (95%) of the children had at least one priority factor at admission. Children under 2 years of age accounted for 77% of the sample, and those with a MUAC of 115–119 mm accounted for 41%. 72% of all children captured by HP-WAZ were male, whereas the other HP groups captured an approximately equal proportion of boys and girls. The baseline characteristics of children meeting more than 1 WHO priority criterion are presented in Table S2. Up to 91% of children with MUAC 120–124 mm were aged $< 2$ years or had a WAZ $< -3$ (Table S3).

Only 2% of children with at least 1 HP criteria had a low MUAC (115–119 mm) only as their sole priority criterion (i.e., did not have any other priority criteria), whereas 29% of children with at least 1 HP criteria were aged $< 2$ years without other priority features (Figure 2).

The progression of change in MUACZ and WAZ between LP and HP groups was plotted over a maximum of 11 weeks of treatment (Figure 3). The cut-off was chosen because of the limited sample size ($n < 30$) among children who exited treatment after 11 weeks of therapy in some LP groups. Overall, the pattern of change in MUACZ and WAZ between LP and HP groups (Figure 3) was similar, showing initial catch-up followed by stagnation and decline. However, HP generally continued their catch-up longer, resulting in greater gains in WAZ and MUACZ than LP children (Table 3). Furthermore, children classified as HP-WAZ had more severe WAZ and MUACZ deficits at baseline than LP-WAZ, whereas this pattern was less pronounced for HP-MUAC versus LP-MUAC and inverse with HP-Age versus LP-Age.

The severity of the MUACZ and WAZ deficits at baseline varied when more than one criterion per child was considered (Figures S1 and S2). Children with more than one priority criterion had greater changes in WAZ and MUACZ, as well as a longer treatment duration, compared with their corresponding LP group ($p > 0.001$) (Table S4). The duration of treatment was generally higher for all HP children, irrespective of the priority criteria used (Tables 2 and S4), with a median [q1, q3] of 28 [21,35] days duration of treatment for all children.

Recovery was $\geq 95\%$ across both LP and HP classifications, regardless of the priority criteria used (MUAC, WAZ, age, or their various combinations), with low mortality ($< 1\%$), low referral to inpatient care ($< 1\%$), and a minimal proportion of children non-recovered ($< 1\%$).

## 5 | Discussion

This study describes the caseload and the response to treatment among children with moderate wasting (MUAC 115–124 mm) enrolled in a simplified treatment program when classified as HP or LP according to some of the moderate wasting priority (including all anthropometry-based) criteria recommended in the WHO 2023 guidelines (World Health Organisation 2023a). The findings show that nearly all (95%) children with moderate wasting (MUAC 115–124 mm) met one of the three WHO criteria (MUAC 115–119 mm, WAZ $< -3$, or age $< 2$ years) for prioritizing moderately wasted children who should receive SFFs. Among children with MUAC 120–124 mm, up to 91% were classified as HP according to WAZ or age criteria. Response to treatment among HP and LP appeared very similar, with a slightly longer catch-up growth phase and a higher absolute change in WAZ and MUACZ among children classified as HP compared to LP, except for age.

Up to 96% of children recovered, with no differences between the children classified as HP and LP. However, because all children received RUTF, the study could not determine how moderately wasted children might have fared without treatment, limiting conclusions about the true necessity of RUTF for this group. The 96% proportion recovered in this study is higher than the 70%–86% reported in earlier studies on moderately wasted children (Ackatia-Armah et al. 2015; Karakochuk et al. 2012; LaGrone et al. 2012; Matilsky et al. 2009). Notably, the earlier studies used WHZ in addition to MUAC to diagnose moderate wasting, and this may have resulted in differences in the health profiles of the children admitted to treatment (Kumar et al. 2018). Furthermore, these studies used alternative SFFs (not RUTF), which may have a suboptimal nutrient profile relative to RUTF (Isanaka et al. 2010). These discrepancies underscore the need to assess the performance of the priority factors in other contexts, as they may perform differently when admission characteristics differ, when other SFFs are utilized, and when moderate wasting recovery is lower.

The high proportion (95%) of children with moderate wasting (defined as MUAC 115–124 mm) meeting at least one criterion for HP raises questions on the added benefit of the additional burden of stratification using the WHO criteria in contexts using or considering using MUAC or edema as the only criteria for enrolling children wasting treatment. We did not have data on the other criteria (because they are not routinely collected) proposed by WHO, including moderate wasting relapse, history

**TABLE 2** | Baseline characteristics of moderately wasted (MUAC 115–124 mm) at admission into a wasting treatment program in Mali.

| Characteristic at admission | Any priority | | MUAC priority | | WAZ priority | | Age priority | | All |
|---|---|---|---|---|---|---|---|---|---|
| | HP | LP | HP | LP | HP | LP | HP | LP | |
| Total (*n*) (%) | 33,794 (95%) | 1891 (5%) | 14,625 (41%) | 21,060 (59%) | 17,181 (48%) | 18,504 (52%) | 27,375 (77%) | 8,310 (23%) | 35,685 (100%) |
| Male, *n* (%) | 18,338 (54%) | 618 (33%) | 7,968 (54%) | 10,988 (52%) | 12,353 (72%) | 6,603 (36%) | 14,593 (53%) | 4,363 (53%) | 18,956 (53%) |
| Age (months), median [Q1, Q3] | 13 [10, 19] | 24 [24, 28] | 12 [10, 20] | 14 [11, 23] | 16 [12, 24] | 12 [9, 16] | 12 [9, 15] | 24 [24, 28] | 13 [10, 22] |
| MUAC (mm), median [Q1, Q3] | 120 [117, 121] | 122 [120, 123] | 117 [115, 118] | 121 [120, 122] | 120 [117, 120] | 120 [118, 122] | 120 [117, 121] | 120 [118, 122] | 120 [118, 121] |
| Weight (kg), median [Q1, Q3] | 6.9 [6.3, 7.6] | 9.1 [8.6, 10.0] | 6.7 [6.1, 7.4] | 7.2 [6.5, 8.0] | 6.6 [6.0, 7.4] | 7.2 [6.6, 8.1] | 6.7 [6.2, 7.4] | 8.1 [7.4, 8.8] | 7.0 [6.3, 7.8] |
| Height (cm), median [Q1, Q3] | 71.1 [68.0, 75.4] ($n = 23,803$) | 81.6 [78.5, 86.0] ($n = 1,259$) | 71.0 [67.0, 75.0] ($n = 10,343$) | 72.2 [68.5, 76.8] ($n = 14,719$) | 71.0 [67.2, 75.8] ($n = 11,632$) | 72.0 [68.2, 76.3] ($n = 13,430$) | 70.0 [67.0, 74.0] ($n = 19,774$) | 78.0 [75.0, 82.0] ($n = 5,288$) | 72.0 [68.0, 76.0] ($n = 25,062$) |
| WAZ, median [Q1, Q3] | −3.0 [−3.7, −2.2] | −2.4 [−2.7, −2.0] | −3.2 [−3.9, −2.4] | −2.8 [−3.5, −2.0] | −3.7 [−4.2, −3.3] | −2.2 [−2.6, −1.7] | −2.8 [−3.5, −2.0] | −3.5 [−4.2, −2.9] | −2.9 [−3.7, −2.2] |
| WHZ, median [Q1, Q3] | −2.5 [−3.3, −1.9] ($n = 23,782$) | −1.8 [−2.4, −1.2] ($n = 1,257$) | −2.7 [−3.4, −2.0] ($n = 10,332$) | −2.4 [−3.1, −1.7] ($n = 14,707$) | −3.1 [−3.7, −2.4] ($n = 11,614$) | −2.1 [−2.7, −1.5] ($n = 13,425$) | −2.5 [−3.2, −1.8] ($n = 19,773$) | −2.6 [−3.3, −1.8] ($n = 5,266$) | −2.5 [−3.2, −1.8] ($n = 25,039$) |
| HAZ, median [Q1, Q3] | −1.9 [−3.2, −0.8] ($n = 23,803$) | −1.9 [−2.8, −1.1] ($n = 1,259$) | −2.1 [−3.4, −1.0] ($n = 10,343$) | −1.9 [−3.0, −0.7] ($n = 14,719$) | −3.0 [−4.0, −2.2] ($n = 11,632$) | −1.1 [−1.9, −0.2] ($n = 13,430$) | −1.7 [−2.8, −0.6] ($n = 19,774$) | −3.1 [−4.2, −2.1] ($n = 5,288$) | −1.9 [−3.2, −0.8] ($n = 25,062$) |

Abbreviations: HAZ, height-for-age Z-score; HP, high priority; LP, lower priority; MUAC, mid-upper arm circumference; WAZ, weight-for-age Z-score; WHZ, weight-for-height Z-score. *n* indicated where missing observations were > 0.

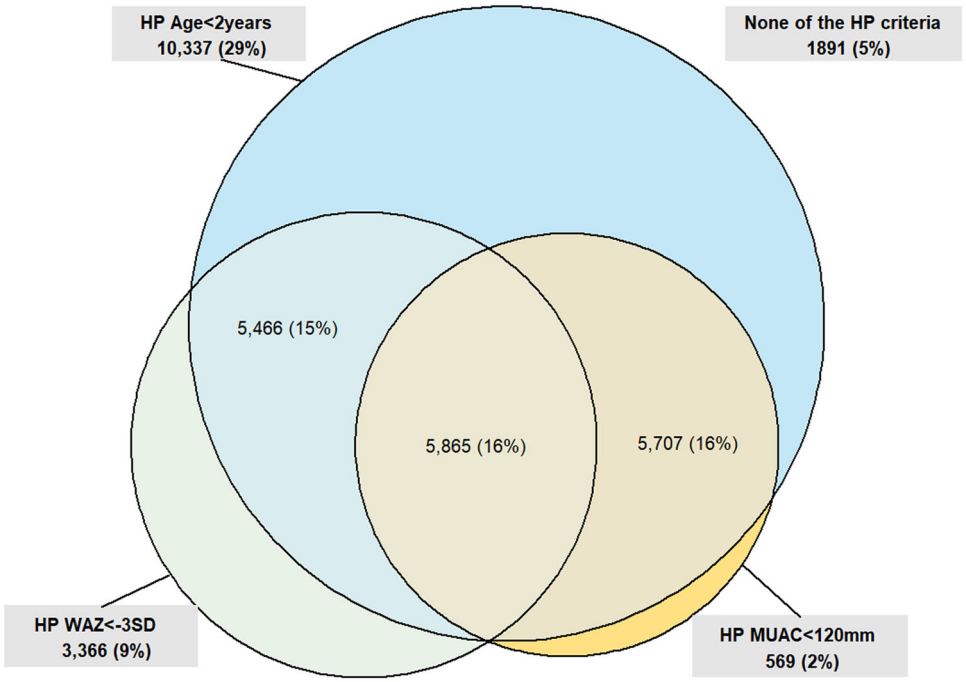


**FIGURE 2** | Venn diagram showing the distribution of high-priority (HP) criteria among children with moderate wasting defined by a MUAC of 115–124 mm.

of severe wasting, failure to recover from moderate wasting when treated previously, presence of co-morbidities, poor maternal health/well-being or maternal death, which, if applied, could further capture more children as HP. Notably, the caseload implications of the WHO moderate wasting priority criteria were not considered when developing the moderate wasting treatment guidelines (World Health Organization 2023b). Earlier perspectives on risk-based screening argue that screening for risk factors is often imprecise, time-consuming, and resource-intensive, particularly regarding human resources (Backett et al. 1984; Hayes 1991; World Health Organisation 1974). The identifiable risk factors may be complex, have limited predictive value, or result in a high rate of false negatives (Backett et al. 1984; Hayes 1991; World Health Organisation 1974).

Beyond contexts currently using the simplified treatment protocol, it is worth studying the feasibility and acceptability among health workers and caregivers in applying the priority criteria. For instance, in most contexts, only MUAC is used to screen children in the community, including through the Family MUAC approach (Screening of Acute Malnutrition by the Family at community level Rapid Review 2020), and thus, not prioritizing all children with a (yellow) MUAC of 115–124 mm to receive SFFs might undermine the treatment program's acceptability and lower general treatment-seeking behavior. Future studies should consider investigating the feasibility of applying priority criteria, as it may be challenged by the complexity of collecting multiple anthropometric measurements, converting them to z-scores, and using them for priority stratification (Myatt et al. 2006). Additionally, the various steps involved in risk stratification, such as assessing age, WAZ, maternal and medical history, can introduce added complexity at the point of care. In settings with limited staffing and high caseloads, this may prolong screening and enrollment procedures, increasing the likelihood of errors and inconsistent application of criteria. Programs might then struggle to determine eligibility in a timely manner, leading to potential delays in treatment initiation for at-risk children or inappropriate exclusion of others. Such challenges can undermine caregivers' confidence in the quality of services (Myatt et al. 2006), when children who meet the MAM anthropometric criterion as not prescribed SFF, ultimately affecting both coverage and uptake wasting interventions.

The likely reason for prioritizing treatment of moderately wasted children into sub-groups, despite not being specified in the WHO 2023 guidelines, is limited budgets and the need to optimize supply chains. In our analysis, the priority criteria were not strongly discriminative, suggesting that their application may have limited value in identifying subgroups of moderately wasted children who are at substantially higher risk or who would benefit disproportionately from treatment. While our study did not assess programmatic factors such as cost efficiency, supply chain optimization, or implementation feasibility, these remain important considerations for policymakers and program implementers. Any targeted approach would only be justified if it demonstrably improves efficiency without compromising program effectiveness, acceptability, or equity. Achieving such strategic priority and oversight is often feasible only in better-resourced settings, whereas most government-led CMAM programs continue to face resource and capacity constraints. Therefore, future operational research should evaluate whether risk-based priority adds meaningful programmatic value beyond simpler, more inclusive treatment approaches.

In addition to the implementation challenges, there is mixed evidence regarding the clinical appropriateness of the proposed stratification of moderately wasted children (World Health Organization 2023b). The priority criteria were primarily based on studies of moderately wasted children already undergoing

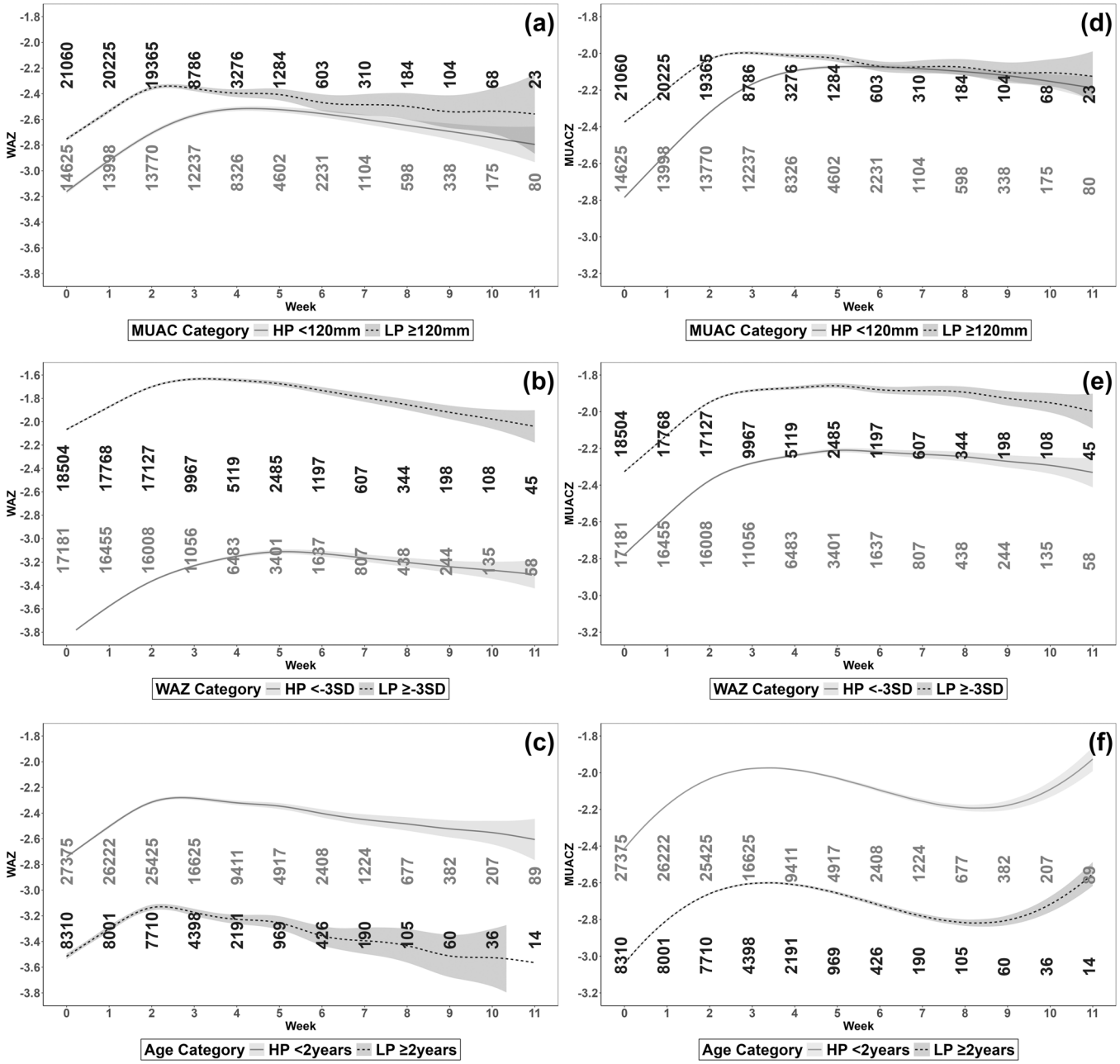


**FIGURE 3** | Longitudinal changes in anthropometric z-scores over 11 weeks by priority classification criteria. footnotes to Figure 3: Weight-for-age z-scores (WAZ) trends are shown in panels (a–c), and mid-upper arm-circumference-for-age z-scores (MUACZ) in panels (d–f). Children were classified as Higher Priority (HP, dotted lines) or lower priority (LP, solid lines) based on three different criteria: MUAC < 120 mm vs. ≥ 120 mm (a, d), WAZ < −3SD vs. ≥ −3SD (b, e), and age < 2 years versus ≥ 2 years (c, f). Numbers along trend lines indicate sample sizes at each time point, with decreasing numbers reflecting recovery and discharge from the program. Gray shading represents 95% confidence intervals.

treatment (World Health Organization 2023b), which associated HP factors with adverse outcomes, such as treatment non-response, mortality, and/or reduced sustained recovery (including reduced anthropometric recovery and deterioration to severe wasting (Chang et al. 2013; Daures et al. 2020; James et al. 2016). However, the suitability of these criteria is questionable, as it is unclear whether children exhibiting these risk factors respond to nutritional interventions.

In the present study, the most common HP feature was age under 2 years, capturing 77% of all children as HP. However, regarding the overall change in WAZ, the HP-Age showed lower gains than the LP-Age, which was inconsistent with the HP groups on other criteria. This indicates that age-based classification alone may not reliably capture those most likely to experience nutritional recovery. Notably, the age-targeting criteria in the WHO guidelines were based on literature suggesting that children younger than 2 years have a higher risk of adverse outcomes (Group WHO-RSWG and Schwinger 2024). However, there is also evidence of no difference in the mortality risk of children with wasting between the two age groups (Thurstans et al. 2022). In terms of treatment response, an earlier study reported that supplementing moderately wasted children under 2 years of age resulted in a 37% higher recovery rate than no

**TABLE 3** | Treatment outcomes of moderately wasted (MUAC 115–124 mm) children at admission by priority criteria.

| | All priority | | MUAC priority | | WAZ priority | | Age priority | | |
|---|---|---|---|---|---|---|---|---|---|
| **Treatment outcome** | **HP** | **LP** | **HP** | **LP** | **HP** | **LP** | **HP** | **LP** | **All** |
| Total (*n*) (%) | 33,794 (95%) | 1891 (5%) | 14,625 (41%) | 21,060 (59%) | 17,181 (48%) | 18,504 (52%) | 27,375 (77%) | 8,310 (23%) | 35,685 (100%) |
| Change in WAZ, median [Q1, Q3] | 0.3 [0.0, 0.6]*** | 0.2 [0.0, 0.4] | 0.5 [0.3, 0.8]*** | 0.2 [−0.1, 0.4] | 0.5 [0.2, 0.8]*** | 0.1 [−0.1, 0.4] | 0.3 [−0.0, 0.6]*** | 0.4 [0.2, 0.7] | 0.3 [0.0, 0.6] |
| Change in MUACZ, median [Q1, Q3] | 0.6 [0.4, 0.8]*** | 0.5 [0.3, 0.5] | 0.9 [0.7, 1.0]*** | 0.5 [0.3, 0.5] | 0.6 [0.5, 0.9]*** | 0.5 [0.4, 0.7] | 0.6 [0.4, 0.8] | 0.6 [0.4, 0.8] | 0.6 [0.4, 0.8] |
| Length of stay, median [Q1, Q3] | 28 [21, 42]*** | 21 [21, 28] | 35 [28, 42]*** | 28 [21, 28] | 28 [21, 42]*** | 28 [21, 35] | 28 [21, 42]*** | 28 [21, 35] | 28 [21, 35] |
| Recovered, *n* (%) | 32,443 (96%) | 1,845 (98%) | 13,881 (95%) | 20,407 (97%) | 16,460 (96%) | 17,828 (96%) | 26,249 (96%) | 8,039 (97%) | 34288 (96%) |
| Died, *n* (%) | 20 (< 1%) | 1 (< 1%) | 10 (< 1%) | 11 (< 1%) | 15 (< 1%) | 6 (< 1%) | 18 (< 1%) | 3 (< 1%) | 21 (< 1%) |
| Defaulted, *n* (%) | 636 (2%) | 25 (1%) | 341 (2%) | 320 (2%) | 335 (2%) | 326 (2%) | 515 (2%) | 146 (2%) | 661 (2%) |
| Non recovered, *n* (%) | 56 (< 1%) | 1 (< 1%) | 33 (< 1%) | 24 (< 1%) | 28 (< 1%) | 29 (< 1%) | 49 (< 1%) | 8 (< 1%) | 57 (< 1%) |
| Referred to inpatient care, *n* (%) | 195 (< 1%) | 3 (< 1%) | 114 (< 1%) | 84 (< 1%) | 111 (< 1%) | 87 (< 1%) | 167 (< 1%) | 31 (< 1%) | 198 (< 1%) |
| Referred to another Health facility *n* (%) | 128 (< 1%) | 7 (< 1%) | 62 (< 1%) | 73 (< 1%) | 64 (< 1%) | 71 (< 1%) | 110 (< 1%) | 25 (< 1%) | 135 (< 1%) |
| Early discharge, *n* (%) | 316 (< 1%) | 9 (< 1%) | 184 (1%) | 141 (< 1%) | 168 (< 1%) | 157 (< 1%) | 267 (< 1%) | 58 (< 1%) | 325 (< 1%) |

*Note:* Number of missing observations only indicated where missing variables were > 0.
Abbreviations: HAZ, height-for-age Z-score; HP, high priority; LP, lower priority; MUAC, mid-upper arm circumference; WAZ, weight-for-age Z-score; WHZ, weight-for-height Z-score.
***$p < 0.001$; **$p < 0.01$.

supplementation, which was higher than the 8% difference observed in older children (Rivera and Habicht 1996). Interestingly, in our study, HP children, according to age (< 2 years), started with higher WAZ and MUACZ than LP children, and this difference was sustained throughout 11 weeks of treatment. The more severe WAZ deficit in older children may be because of the older children´s likelihood of having severe HAZ deficits (< −3SD) because of relatively more prolonged exposure to adverse conditions that promote undernutrition (Akombi et al. 2017; Quamme and Iversen 2022). This finding suggests that age-based priority alone may not effectively identify children most likely to benefit from treatment. Programs may need to consider alternative criteria to better target children with the highest potential for nutritional recovery.

While WAZ can help identify children at high risk of poor outcomes, including those missed by MUAC alone, its practical application is constrained by measurement challenges and limited accuracy in many field settings. Nearly half (48%) of moderately wasted children by MUAC had a WAZ < −3 SD, which aligns with the 43% reported in a pooled analysis of datasets from nine countries (Odei Obeng-Amoako et al. 2022). Considering that in most settings where wasting is prevalent, determining the child's exact age in months is challenging (Ifrah Fayyaz et al. 2023; Oshaug et al. 1994), the practicality and accuracy of the WAZ priority criterion are limited. Despite the potential challenges in determining and using WAZ as a priority criterion, there is evidence that children with a WAZ < −3SD have lower recovery rates, increased transfer to inpatient care, and higher mortality risk (Odei Obeng-Amoako et al. 2022).

The present study identified 41% of children as HP-MUAC due to a MUAC of 115–119 mm. However, up to 91% of children who would not have been prioritized based on MUAC (meaning, who had a MUAC 120-124 mm at admission) had another priority criterion, i.e., HP-WAZ (42%), HP-Age (72%), thus questioning the idea of prioritizing only MUAC < 120 mm, particularly in contexts defining moderate wasting using MUAC < 125 mm without considering WHZ. Compared to the age-priority criterion, MUAC inherently identifies a higher proportion of younger children as high priority, that is, those that would be captured as HP-age. This, however, is not the same as saying that using age-priority criteria alone would capture all cases of HP-MUAC. Clear programmatic guidance is necessary to ensure the appropriate use of age and MUAC as priority criteria, so that when one is favored over the other, high-risk children are not inadvertently missed.

Despite the similar proportions of LP and HP children who recovered in the present analysis, there were differences in absolute change in MUACZ and WAZ per priority criteria, where, for most criteria (except for the age criteria), HP children had a higher mean change in WAZ and MUACZ compared to LP children. Although there were differences in the severity of anthropometric deficits at baseline, e.g., HP-MUAC and HP-WAZ having lower WAZ and MUACZ compared to their respective LP groups, LP and HP children showed similar trends in weekly WAZ and MUACZ change throughout treatment, irrespective of priority criteria.

Another important consideration is that most moderately wasted children come from families who cannot afford nutritious food. As reported by the Food and Agriculture Organization, healthy diets are unaffordable for 57 percent of the population in sub-Saharan Africa and Southern Asia, as well as high proportions of people in South-eastern Asia (> 45 percent), Melanesia (> 40 percent), and Latin America (> 20 percent) (Herforth et al. 2020). It is highly likely that moderately wasted children, classified as lower priority and not provided with SFF, whose wasting largely results from poor dietary intake, cannot afford healthy diets to improve their nutritional status; therefore, they would remain nutritionally deprived.

This study's strength lies in its large sample size and the use of routine program data, which strengthens our confidence in the programmatic relevance of our conclusions. Our findings apply to similar settings and contexts where MUAC and edema-only admission criteria are used. However, the study had several limitations. First, although the study highlights differences in recovery times and anthropometric gains between HP and LP groups treated with 500 kcal/day of RUTF under a MUAC-only-based enrollment into a wasting treatment protocol, it does not tell us what would have happened in the context of a different treatment protocol, applying, for example, both MUAC and WHZ to admit and discharge children. Moreover, the present study did not have data on other priority criteria recommended by WHO, such as moderate wasting relapse, history of severe wasting, failure to recover from moderate wasting when treated with nutrition counseling only, presence of co-morbidities, poor maternal health/well-being or maternal death (World Health Organisation 2023a) and thus does not fully capture the caseload as per all priority criteria. Furthermore, the sustainability of moderate wasting recovery is also an essential research area (Lenters et al. 2013). For example, although the HP children treated with the simplified protocol in this sample have a longer treatment duration than their LP counterparts, their long-term health outcomes are unclear. Finally, studies are needed to compare targeted and nontargeted treatments for moderate wasting to understand their impact on cost–benefit, feasibility, and treatment coverage.

## 6 | Conclusion

Our findings show that, according to the WHO 2023 priority, nearly all (95%) children with moderate wasting (MUAC 115–124 mm) would qualify for at least one of the proposed priority criteria. This raises important questions about the practicality and justification of applying these criteria to determine SFF eligibility, given that such a large share of children would be classified as high-priority. In addition, the comparable recovery rates observed between children who did and did not meet the priority criteria, once both groups received SFF supplementation, highlight the need for further evaluation of whether these criteria meaningfully guide intervention choices or outcomes.

### Author Contributions

S.T.K. conceptualized the study and is responsible for the content of the manuscript. I.P. led the development of the analysis plan, data analysis, and manuscript writing. J.J.K., O.P., Z.T., and G.M. contributed to the data analysis. All authors reviewed the analysis plan and manuscript.

**Acknowledgements**

We acknowledge Hastings Ndebvu, and Blessings Likoswe for their editorial contributions to the manuscript.

**Conflicts of Interest**

The authors declare no conflicts of interest.

**Data Availability Statement**

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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## Supporting Information

Additional supporting information can be found online in the Supporting Information section.
**S1 FIG. S2 FIG. Supporting Table 1:** Outcomes of Interest Formulas. **Supporting Table 2:** Baseline characteristics for children with MUAC

115 to 124mm admitted to a simplified treatment program in Mali by more than 1 priority criteria. **Supporting Table 3:** Baseline characteristics of children with MUAC 120–125mm admitted to a simplified treatment program in Mali. **Supporting Table 4:** Treatment outcomes for children with MUAC 115 to 124mm admitted to a simplified treatment program in Mali with more than one priority criterion.