Received: 26 February 2019 | Revised: 29 June 2019 | Accepted: 3 July 2019

DOI: 10.1111/mcn.12876

ORIGINAL ARTICLE

WILEY | Maternal & Child Nutrition

Feasibility of engaging caregivers in at-home surveillance of children with uncomplicated severe acute malnutrition

Sheila Isanaka[1,2] | Fatou Berthé[3] | Fabienne Nackers[1] | Kevin Tang[1] | Kerstin E. Hanson[4] | Rebecca F. Grais[1]

[1] Department of Research, Epicentre, Paris, France

[2] Departments of Nutrition and Global Health and Population, Harvard T.H. Chan School of Public Health, Boston, Massachusetts, USA

[3] Epicentre Niger, Niamey, Niger

[4] Médecins Sans Frontières Operational Center of Paris, Paris, France

Correspondence
Sheila Isanaka, Department of Research, Epicentre, 8 rue Saint Sabin 75011, Paris, France.
Email: sheila.isanaka@epicentre.msf.org

Funding information
Medecins Sans Frontieres- Operational Center Paris; Médecins Sans Frontières—Operational Center Paris

Abstract

Many factors can contribute to low coverage of treatment for severe acute malnutrition (SAM), and a limited number of health facilities and trained personnel can constrain the number of children that receive treatment. Alternative models of care that shift the responsibility for routine clinical and anthropometric surveillance from the health facility to the household could reduce the burden of care associated with frequent facility-based visits for both healthcare providers and caregivers. To assess the feasibility of shifting clinical surveillance to caregivers in the outpatient management of SAM, we conducted a pilot study to assess caregivers' understanding and retention of key concepts related to the surveillance of clinical danger signs and anthropometric measurement over a 28-day period. At the time of a child's admission to nutritional treatment, a study nurse provided a short training to groups of caregivers on two topics: (a) clinical danger signs in children with SAM that warrant facility-based care and (b) methods to measure and monitor their child's mid-upper arm circumference. Caregiver understanding was assessed using standardized questionnaires before training, immediately after training, and 28 days after training. Knowledge of most clinical danger signs (e.g., convulsions, edema, poor appetite, respiratory distress, and lethargy) was low (0–45%) before training but increased immediately after and was retained 28 days after training. Agreement between nurse–caregiver mid-upper arm circumference colour classifications was 77% (98/128) immediately after training and 80% after 28 days. These findings lend preliminary support to pursue further study of alternative models of care that allow for greater engagement of caregivers in the clinical and anthropometric surveillance of children with SAM.

KEYWORDS

clinical surveillance, community-based management of acute malnutrition (CMAM), MUAC, Niger, severe acute malnutrition, task shifting

1 | INTRODUCTION

Since 2007, the community-based management of acute malnutrition has been standard care for the treatment of severe acute malnutrition (SAM; World Food Programme, World Health Organization, United Nations System Standing Committee on Nutrition, and the United Nations Children's Fund, 2007). This approach transformed the management of uncomplicated SAM, shifting treatment from hospital settings to outpatient centres where children receive clinical and anthropometric surveillance and treatment with ready-to-use therapeutic foods for home use on a weekly or biweekly basis. Although outpatient care has been shown to be highly effective, cost-effective (Bachmann, 2009; Tekeste, Wondafrash, Azene, & Deribe, 2012; Wilford, Golden, & Walker, 2012), and acceptable (Puett, Coates, Alderman, & Sadler, 2013) across a variety of settings, only 10% of children with SAM receive treatment each year (UNICEF, 2017).

Many factors can contribute to low treatment coverage, and limited health infrastructure and trained personnel continue to constrain the number of children that receive treatment in facilities (Guerrero, Myatt, & Collins, 2010). Alternative models of care, which further shift the responsibility for routine surveillance from the health facility to the household, could reduce the burden of care associated with frequent facility-based visits for both healthcare providers and caregivers. Engaging mothers in the treatment of uncomplicated SAM in the routine clinical and anthropometric surveillance at home could, for example, be used to reduce both the staff time and household opportunity costs associated with frequent facility-based visits, as well as support early presentation for life-threatening complications.

Task shifting, or the transfer of tasks normally conducted by health professionals to lower cadres of health workers and trained members of the community (World Health Organization, 2008), has been adopted in other areas of public health with success (Crowley & Mayers, 2015). Prior research in nutrition has shown that mothers have the ability to diagnose SAM similarly to community health workers immediately following training (Blackwell et al., 2015). However, evidence for the transfer of clinical surveillance to caregivers of sick children and for longer periods of time is limited. To assess the feasibility of shifting clinical and anthropometric surveillance to caregivers in the outpatient treatment of uncomplicated SAM, we conducted a pilot research study to assess caregivers' ability to retain knowledge related to the surveillance of clinical danger signs and anthropometric measurement over a 28-day period.

Key messages

- Many factors can contribute to low coverage of treatment for severe acute malnutrition. Models of care that shift the responsibility for routine care from the health facility to the household could be considered for the potential to reduce the burden of care associated with frequent facility-based visits.
- We assessed caregivers' understanding and retention of key concepts related to the surveillance of clinical danger signs and anthropometric measurement over a 28-day period.
- Our results suggest that the short training provided to caregivers in this study could support greater engagement of caregivers in the outpatient treatment of SAM. Further evaluation of this approach is ongoing and should further evidence on its safety, effectiveness and cost effectiveness for the duration of treatment (ClinicalTrials.gov ID: NCT03140904).

2 | METHODS

2.1 | Study setting

This study took place in the Madarounfa Health District of the Maradi region in south-central Niger. Since 2001, Médecins Sans Frontières (MSF) has collaborated with the Ministry of Health of Niger to provide treatment for SAM in the Madarounfa Health District. In 2014, the MSF-supported therapeutic feeding programme treated >13,000 children with SAM, with 94% recovery, 2% default, <1% nonresponse, and 3% mortality.

2.2 | Study population

Study enrolment was conducted at an outpatient therapeutic feeding centres from June to November 2014. Study inclusion criteria required caregivers to have a child eligible for new admission to outpatient SAM treatment according to national protocol and to reside within <15 km of the outpatient centre. Children were considered eligible for outpatient SAM treatment if they were between 6 and 59 months old, weight-for-height *z* score (WHZ) < −3 according to the 2006 WHO Growth Standards (World Health Organization) and/or a mid-upper arm circumference (MUAC) < 115 mm; had sufficient appetite according to a test feeding of ready-to-use therapeutic foods; and were free of clinical complications requiring hospitalization (Ministère de la Santé Publique du Niger, 2012).

2.3 | Study procedures

At the time of a child's admission for nutritional treatment, a study nurse provided a short training (less than 30 min) to groups of no more than 10 caregivers on two topics: (a) nine clinical danger signs in children with SAM that warrant any facility-based care and (b) methods to measure and monitor their child's MUAC. The clinical danger signs included convulsions, diarrhoea, edema, fever, persistent cough, poor appetite, respiratory distress, lethargy, and vomiting. The training used illustrated flipcharts developed in the local language and field tested using focus groups and semistructured interviews by MSF and

Epicentre in collaboration with the Laboratoire d'Etudes et de Recherche sur les Dynamiques Sociales et le Développement Local. All caregivers were provided with a water-resistant, postcard-size copy of the illustrations and a colour-coded UNICEF MUAC tape marked in 1-mm increments for home use. Children received all medical and nutritional care on a weekly basis at the outpatient centre according to the national protocol. No further training to caregivers was provided during follow-up.

Caregiver understanding of the clinical danger signs was assessed by standardized questionnaire at three time points: before training, immediately after training, and 28 days after training. The questionnaire was field tested by study staff prior to use and asked participants to list clinical danger signs in children with SAM that would warrant facility-based care, as well as list three defining characteristics of respiratory distress (i.e., rapid breathing, impeded ability to talk/eat, sinking chest when inhaling, and sounds during breathing) and five steps in the assessment of nutritional edema (i.e., examine both feet, gently press tops of both feet with thumbs, press for 3 s, remove fingers, and look for dent in skin; and bring child to health centre if dent exists on both feet). Knowledge of these specific clinical danger signs was considered to be a necessary condition for the caregiver to engage in correct care seeking behaviour if a child was ill. Twenty clinical case scenarios were also presented to caregivers (Table 1), to which caregivers were asked to determine whether the scenario presented a situation for which any facility-based care should be sought or not. The scenarios were intended to explore caregivers' translation of their theoretical understanding to correct care seeking behaviour. Study staff not involved in the education sessions administered the questionnaires after training, and no additional education or corrections were introduced at the time of assessment. Responses to the questionnaire before training versus after training were compared with assess the immediate effect of training on caregiver understanding. Responses to the questionnaire immediately after the training versus 28 days later were compared to assess longer term retention of this information.

Proper technique to measure a child's MUAC was assessed at two time points: immediately after and 28 days after training. Caregivers and study nurses independently measured each child's MUAC at each time point. During the caregiver's measurement, the nurse observed and recorded whether the four steps in MUAC measurement (i.e., positioning child with left arm down, wrapping band around left arm, positioning band in middle of arm, and correctly tightening band) were

TABLE 1 Clinical care seeking scenarios presented before, immediately after, and 28 days after training

#	Clinical danger sign	Scenario
Facility-based care required immediately		
1	Convulsions	You look at your child and see that the corner of their mouth suddenly makes strange movements (for no apparent reason). You call your child, and (s)he does not answer. A few seconds later, the child looks at you, his/her mouth does not move, but (s)he is very tired.
2	Diarrhoea	The child had very liquid bowel movements four times yesterday and three times today.
3	Diarrhoea	Your child has two emerging teeth. (S)he has very liquid bowel movements four times yesterday and three times today.
4	Edema	The child's feet and hands swell.
5	Fever	Your child feels cold, but it is warm out. (S)he is sitting; you touch him/her and find that his/her body is very hot.
6	Persistent cough	Your child coughed all night. This morning (s)he is still coughing. (S)he coughs so hard that (s)he cannot eat.
7	Dehydration	The child did not drink anything today. (S)he refuses to drink and has dry lips.
8	Poor appetite	The child has no appetite. Since yesterday morning, (s)he took a few bites of his/her meal and swallowed a mouthful of Plumy'nut.
9	Respiratory distress	The child breathes quickly, and you see his/her lower ribs depress when (s)he breathes.
10	Lethargy	The child is very tired, for no obvious reason. (S)he dozes off, and you cannot wake him/her up.
11	Vomiting	Since last night, your child vomits everything eaten and drunk, even water.
Facility-based care not immediately required		
12		Your child is cranky today. (S)he whines often, especially when (s)he is hungry.
13		The child is warm. (S)he drinks and plays as usual.
14		Your child had liquid stool twice today. (S)he eats and drinks well.
15		Your child vomited after lunch but, (s)he then ate a packet of Plumpy'nut/RUTF and did not vomit.
16		The child has been coughing lightly for 2 days. (S)he have no pain or discomfort. (S)he eats and plays well.
17		Your child loves to play with other children. Yesterday, (s)he played as usual. And today (s)he only wants to sleep.
18		The child fought with another child. The child is very angry, and (s)he moves his/her arms in all directions.
19		One of your child's feet is a little swollen on the side. It is a bit uncomfortable but does not hurt.
20		Your child had a runny nose during the day. Right now, (s)he snores while sleeping.

Abbreviation: RUTF, ready-to-use therapeutic foods.

properly executed. Caregivers read the final colour of their MUAC measurement (red: MUAC < 115 mm; yellow: MUAC = 115 to 124 mm; green: MUAC ≥ 125 mm) while the nurse noted the caregiver's quantitative MUAC reading in millimetres. MUAC measurements of all study nurses were standardized three times during the study period according to the SMART methodology (www.smartmethodology.org).

2.4 | Statistical analysis

To estimate a κ coefficient of .75 for agreement between the nurse–caregiver MUAC measurement with a precision of .15, assuming that 25% of children would have a MUAC < 115 mm and 20% loss to follow-up before 28 days, the target sample size was 128 caregivers. We described the characteristics of all study participants using means ± standard deviations (*SD*s) for continuous measures and counts and proportions for discrete measures.

To assess caregiver understanding of clinical danger signs, the mean (*SD*) number of total signs identified and the proportion of caregivers who correctly identified each clinical danger sign, signs of respiratory distress, and steps to assess nutritional edema were calculated before, immediately after, and 28 days after the training. Similarly, the proportion of caregivers who correctly responded to each of the 20 clinical case scenarios was calculated before, immediately after, and 28 days after the training. Changes over time in the mean number of clinical signs and proportions of clinical scenarios were compared using the *z* test and the Pearson's chi-square test (two degrees of freedom), respectively, and if significant ($p < .05$), paired comparisons were conducted using Tukey tests.

To assess caregiver capacity to measure MUAC, the proportion of participants executing each step of MUAC measurement was calculated immediately after and 28 days after the training, with changes over time assessed using Pearson's chi-square test. A weighted-κ test, standardized on a −1-to-1 scale, was used to assess agreement between the nurse–caregiver colour classification (red/yellow/green), where a positive κ coefficient indicated agreement, a negative coefficient indicated disagreement, and a zero coefficient indicated no relation. Quantitative differences (mm) between nurse–caregiver MUAC measurements were also calculated for each child immediately after and 28 days after training and compared using the *z* test.

2.5 | Ethics

The study was approved by the Comité Consultatif National d'Ethique, Niger, and the Comité de protection des Personnes, Ile-de-France XI. All participants provided written informed consent before the start of any study activities.

3 | RESULTS

A total of 128 caregivers of children with uncomplicated SAM were enrolled (Table 2). Caregivers had a mean ± *SD* age of 28.0 ± 6.9 years old. The majority of caregivers had never attended school (85.9%), but most (62.5%) had prior experience participating in a therapeutic feeding programme. Ninety-eight per cent ($n = 126$) of women completed study follow-up at 28 days after child admission.

TABLE 2 Baseline characteristics of study participants

Total participants, *N*	128
Maternal and household characteristics	
Maternal age (years)	28.0 ± 6.9
Ever attended school	18 (14.1%)
Ever participated in nutrition programme	80 (62.5%)
Number of children <5 years in household	3.5 ± 1.5
Child characteristics	
Child age (months)	22.8 ± 8.4
Female sex	81 (63.3%)
Weight-for-height *z* score (WHZ)	−3.2 ± 0.6
WHZ < −3	83 (64.8%)
Mid-upper arm circumference (MUAC; mm)	117.0 ± 6.1
MUAC < 115	41 (32.0%)
Height-for-age *z* score (HAZ)	−3.0 ± 1.2
HAZ < −3	68 (53.1%)
Presence of edema	2 (1.6%)
Number of times child was previously admitted to nutritional programme	
0	69 (53.9%)
1	38 (29.7%)
≥2	21 (16.4%)

Note. Values are presented as mean ± *SD*s or *n* (%).

Before training, the mean number of clinical danger signs that caregivers were able to identify was 3.3 (95% CI [3.1–3.4], Figure 1). Diarrhoea and fever were identified by the majority of women before training (95% and 88%, respectively), with roughly half of caregivers also identifying vomiting (59%) and persistent cough (45%) as pertinent clinical danger signs (Figure 2). Knowledge of other signs, including convulsions, edema, poor appetite, respiratory distress, and

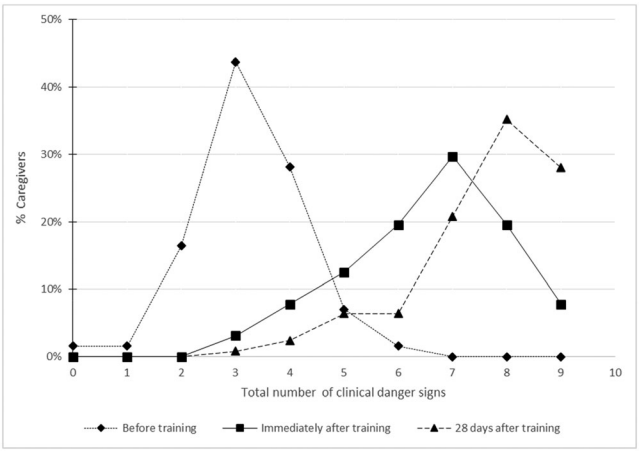
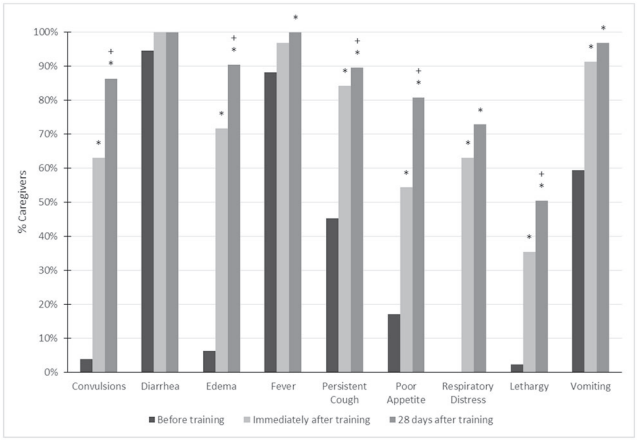


FIGURE 1 Total number of clinical danger signs identified by caregivers before, immediately after and 28 days after training

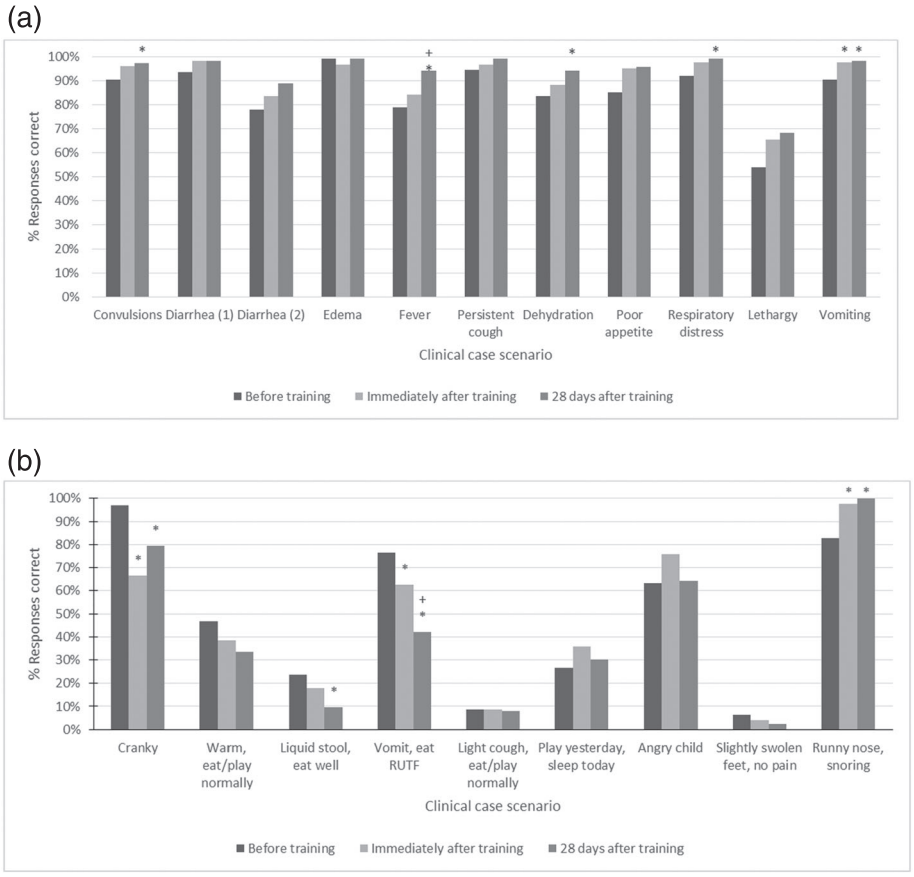


* Significant difference compared to before training, evaluated using the Tukey test.
\+ Significant difference compared to immediately after training, evaluated using the Tukey test.

FIGURE 2 Individual clinical danger signs identified by caregivers before, immediately after and 28 days after training. Asterisks (*) indicate significant difference compared with before training, evaluated using the Tukey test. Plus signs (+) indicate significant difference compared with immediately after training, evaluated using the Tukey test

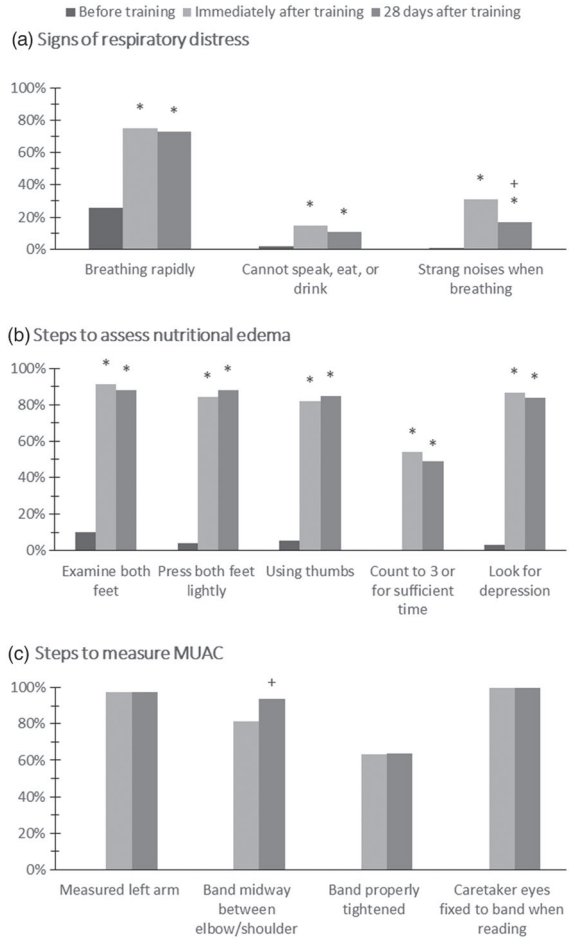
lethargy was low before training (0–45%). The mean number of clinical danger signs that caregivers identified increased to 6.5 (95% CI [6.3–6.8], $p < .001$) immediately after training and to 7.6 (95% CI [7.4–7.8], $p < .001$) 28 days after training. Identification of all individual clinical danger signs significantly increased after training, with the exception of diarrhoea and fever, which were already recognized by most caregivers before training. Knowledge of the three characteristics of respiratory distress and five steps to assess nutritional edema were very low before training (1% to 26% for the three signs of respiratory distress and 0%–10% for the five steps to assess nutritional edema). Knowledge of breathing rapidly in respiratory distress and of nutritional edema significantly increased after training, but knowledge of the two other signs of respiratory distress remained relatively low (Figure 4a,b).

Caregiver application of knowledge of the clinical dangers signs was assessed using 20 clinical case scenarios. Before training, at least 90% of caregivers expressed correct care seeking behaviour for scenarios related to convulsions, diarrhoea, edema, persistent cough, respiratory distress, and vomiting, whereas fewer caregivers indicated facility-based care was required in scenarios related to fever (78.9%)



* Significant difference compared to before training, evaluated using the Tukey test.
\+ Significant difference compared to immediately after training, evaluated using the Tukey test.

FIGURE 3 Per cent of correct response to clinical care scenarios requiring facility-based care (panel (a) and not requiring facility-based care (panel (b) before, immediately after, and 28 days after training. Asterisks (*) indicate significant difference compared with before training, evaluated using the Tukey test. Plus signs (+) indicate significant difference compared with immediately after training, evaluated using the Tukey test



* Significant difference compared to before training, evaluated using the Tukey test.

\+ Significant difference compared to immediately after training, evaluated using the Tukey test.

FIGURE 4 Proportion of caregivers aware of individual signs of respiratory distress (a), steps to assess nutritional edema (b), and steps to measure mid-upper arm circumference (MUAC); (c). Asterisks (*) indicate significant difference compared with before training, evaluated using the Tukey test. Plus signs (+) indicate significant difference compared with immediately after training, evaluated using the Tukey test

and lethargy (53.9%; Figure 3a). Correct care seeking behaviour in response to clinical case scenarios requiring care was maintained or increased immediately after and 28 days after training, with the exception of care seeking related to lethargy, which remained lower throughout follow-up. Correct care seeking behaviour in response to the nine clinical case scenarios not requiring facility-based care were less frequent and less consistent (Figure 3b), with caregivers often indicating that care was necessary when it was not.

The majority of caregivers correctly implemented the four steps to measure their child's MUAC immediately following training, and the correct methods were retained 28 days after training (Figure 4c). Immediately after training, there was 77% (98/128) agreement between nurse–caregiver MUAC colour classifications (κ = .595) and 80% agreement (101/125) after 28 days (κ = .631; Table 3). The absolute quantitative difference between the nurse–caregiver MUAC measurements was <2 mm among 53.6% of caregivers immediately after the training but decreased to 37.1% 28 days after training (Figure 5).

4 | DISCUSSION

This study examined the feasibility of two trainings designed to support caregiver surveillance of clinical signs and anthropometric measurement. Our results provide preliminary evidence to suggest that, with minimal training (e.g., less than 30 min), caregivers understood key concepts of clinical warning signs and MUAC measurement for the surveillance of their malnourished children at home. Furthermore, longer term retention of both trainings was demonstrated, with little loss of understanding of key concepts after 28 days. Overall, these results suggest that task shifting of clinical and anthropometric surveillance to mothers is a potentially feasible model in the outpatient treatment of SAM that warrants further study.

Knowledge of clinical warning signs was low to moderate prior to training and limited to a few specific signs (i.e., diarrhoea and fever). However, short trainings improved and maintained basic knowledge of clinical warning signs, with identification of seven of the nine clinical warning signs immediately after training including specific warning

TABLE 3 Agreement of colour classification between nurse–caregiver MUAC measurements

Nurse measurement	Caregiver measurement immediately after training				Caregiver measurement 28 days after training			
	Red	Yellow	Green	Total	Red	Yellow	Green	Total
Red	27	14	0	41	3	3	0	6
Yellow	8	64	4	76	3	35	6	44
Green	0	4	7	11	0	12	63	75
Total	35	82	11	128	6	50	69	125
Proportion of agreement	77.6%				80.5%			
κ	.595				.631			

Note. Red, MUAC < 115 mm; Yellow, MUAC = 115–124 mm; Green, MUAC ≥ 125 mm.

Abbreviation: MUAC, mid-upper arm circumference.

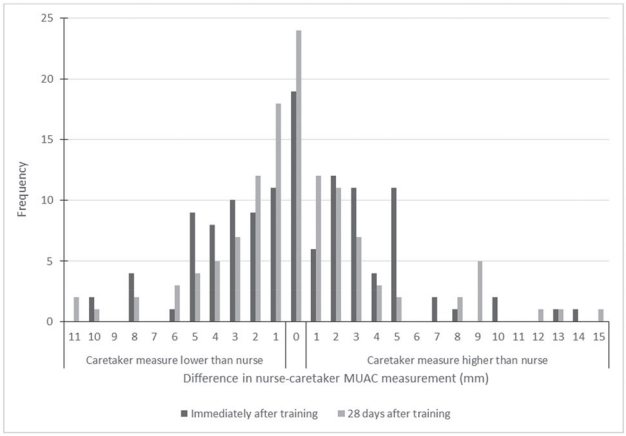


FIGURE 5 Quantitative difference in nurse–caregiver mid-upper arm circumference (MUAC) measurement immediately after and 28 days training difference in means from two-sampled *z* test; $p = .996$

signs that were not well known to caregivers prior to training (e.g., convulsions, edema, respiratory distress, and lethargy). For the first time, we further showed that our cohort of caregivers with relatively low education were capable of retaining key concepts over time. There was no indication that understanding deteriorated over 28 days; on the contrary, awareness of several key concepts significantly increased at final assessment, possibly due to self-initiated review of the take-home tools provided after training.

Our results also suggest that caregivers could correctly perform a MUAC measurement after a short training. Prior research has shown that mothers have the ability to diagnose SAM similarly to community health workers immediately following training. In a small study by Blackwell et al. (2015) from rural Niger, maternal MUAC assessments had strong agreement ($\kappa = .77$), high sensitivity (73%), and high specificity (99%) compared with community health workers. Our study further demonstrates that caregiver understanding of the methods to classify MUAC remained accurate and consistent with those made by trained health professionals over 28 days. Longer term accuracy of MUAC measurements and the ability to detect deteriorations in MUAC at home will be essential to ensure the safety of all children under caregiver surveillance.

This study assessed the retention of concepts immediately after and 28 days after training, measuring immediate recall of recently presented information as previously shown (Blackwell et al., 2015) and for the first time over a longer timescale. Our study also compared caregiver MUAC measurement with trained nurses, which may represent a more accurate gold standard than community health workers. This study, however, had several limitations. This study measured only caregiver awareness and was not able to evaluate the practical application of this knowledge by caregivers. The 20 case scenarios presented in this study were a theoretical assessment of caregiver understanding and cannot be directly generalized to care seeking behaviour. Further study beyond this pilot would be encouraged to extend this preliminary evidence to include further information on how this caregiver knowledge is translated to care seeking practice and ultimately child health outcomes for the full duration of treatment. Finally, it is important to note that this pilot study was implemented within the context of an established, MSF-supported treatment programme and that this population had taken part in the community-based care for the management of malnutrition for many years at the time of the study. Strong programme performance and caregivers' familiarity with community-based care models, as well as other contextual factors such as household food insecurity, may have influenced study results and suggest that further evaluation of such models in other settings are required.

Overall, task shifting has been shown in other areas of public health to have the potential to increase access and affordability to care and increase patient involvement while maintaining similar clinical outcomes expected from trained healthcare professionals (Callaghan, Ford, & Schneider, 2010; Crowley & Mayers, 2015; Joshi et al., 2014; Kredo, Adeniyi, Bateganya, & Pienaar, 2014; Seidman & Atun, 2017). Our findings lend preliminary support to pursue further study of alternative models of care that allow for greater engagement of caregivers in the outpatient treatment of SAM. Models that increasingly shift clinical and anthropometric surveillance to caregivers have the potential to reduce the frequency of health facility visits, reducing the burden on resource-limited health systems and caregivers, and may help detect clinical warning signs before serious complications develop (Ale et al., 2016). The short training provided to caregivers in this study was conducted in less than 30 min and required very basic materials and basic literacy of health staff but not of caregivers, suggesting that caregiver training on clinical warning signs and anthropometric surveillance may be feasible in a range of resource-limited settings. Further evaluation of this approach is ongoing and should provide further evidence on its safety, effectiveness, and cost-effectiveness both during and up to 3 months posttreatment (ClinicalTrials.gov ID: NCT03140904).

ACKNOWLEDGMENTS

We thank all the families and children who participated in this study. We would also like to thank the field, administrative, logistics, and data management staff of Epicentre Niger who helped facilitate this study, as well as the Ministry of Health staff of the district of Madarounfa, Niger, for their support.This study was supported by Médecins Sans Frontières—Operational Center Paris. The funder had no role in study design, data collection, or analysis. Authors from the funder participated in the interpretation of results and writing of this manuscript.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

SI, FN, KEH, and RFG contributed to the conception and design of the study. FB collected the data. KT contributed to the statistical analysis and revision of the manuscript. All authors contributed to the

interpretation of the data, critically reviewed the manuscript for important intellectual content, and approved the final manuscript.

ORCID

Sheila Isanaka https://orcid.org/0000-0002-4503-2861

REFERENCES

Ale, F. G., Phelan, K. P., Issa, H., Defourny, I., Le Duc, G., Harczi, G., … Blackwell, N. (2016). Mothers screening for malnutrition by mid-upper arm circumference is non-inferior to community health workers: Results from a large-scale pragmatic trial in rural Niger. *Arch Public Health*, *74*(1), 38. https://doi.org/10.1186/s13690-016-0149-5

Bachmann, M. O. (2009). Cost effectiveness of community-based therapeutic care for children with severe acute malnutrition in Zambia: Decision tree model. *Cost Eff Resour Alloc*, *7*, 2. https://doi.org/10.1186/1478-7547-7-2

Blackwell, N., Myatt, M., Allafort-Duverger, T., Balogoun, A., Ibrahim, A., & Briend, A. (2015). Mothers Understand And Can do it (MUAC): A comparison of mothers and community health workers determining mid-upper arm circumference in 103 children aged from 6 months to 5 years. *Arch Public Health*, *73*(1), 26. https://doi.org/10.1186/s13690-015-0074-z

Callaghan, M., Ford, N., & Schneider, H. (2010). A systematic review of task-shifting for HIV treatment and care in Africa. *Human Resources for Health*, *8*, 8. https://doi.org/10.1186/1478-4491-8-8

Crowley, T., & Mayers, P. (2015). Trends in task shifting in HIV treatment in Africa: Effectiveness, challenges and acceptability to the health professions. *Afr J Prim Health Care Fam Med*, *7*(1). https://doi.org/10.4102/phcfm.v7i1.807

Guerrero, S., Myatt, M., & Collins, S. (2010). Determinants of coverage in community-based therapeutic care programmes: Towards a joint quantitative and qualitative analysis. *Disasters*, *34*(2), 571–585. https://doi.org/10.1111/j.1467-7717.2009.01144.x

Joshi, R., Alim, M., Kengne, A. P., Jan, S., Maulik, P. K., Peiris, D., & Patel, A. A. (2014). Task shifting for non-communicable disease management in low and middle income countries—A systematic review. *PLoS ONE*, *9*(8), e103754. https://doi.org/10.1371/journal.pone.0103754

Kredo, T., Adeniyi, F. B., Bateganya, M., & Pienaar, E. D. (2014). Task shifting from doctors to non-doctors for initiation and maintenance of antiretroviral therapy. *Cochrane Database of Systematic Reviews*, *7*, CD007331. https://doi.org/10.1002/14651858.CD007331.pub3

Ministère de la Santé Publique du Niger. (2012). Protocole national de la prise en charge integree de la malnutrition aigue. Retrieved from Niamey:

Puett, C., Coates, J., Alderman, H., & Sadler, K. (2013). Quality of care for severe acute malnutrition delivered by community health workers in southern Bangladesh. *Maternal & Child Nutrition*, *9*(1), 130–142. https://doi.org/10.1111/j.1740-8709.2012.00409.x

Seidman, G., & Atun, R. (2017). Does task shifting yield cost savings and improve efficiency for health systems? A systematic review of evidence from low-income and middle-income countries. *Human Resources for Health*, *15*(1), 29. https://doi.org/10.1186/s12960-017-0200-9

Tekeste, A., Wondafrash, M., Azene, G., & Deribe, K. (2012). Cost effectiveness of community-based and in-patient therapeutic feeding programs to treat severe acute malnutrition in Ethiopia. *Cost Eff Resour Alloc*, *10*, 4. https://doi.org/10.1186/1478-7547-10-4

UNICEF. (2017). NutriDash 2.0. Retrieved from https://unicefnutridash.org/login

W. F. P.World Health Organization, United Nations System Standing Committee on Nutrition, and the United Nations Children's Fund. (2007). *Community-based management of severe acute malnutrition*. Retrieved from Geneva:

Wilford, R., Golden, K., & Walker, D. G. (2012). Cost-effectiveness of community-based management of acute malnutrition in Malawi. *Health Policy and Planning*, *27*(2), 127–137. https://doi.org/10.1093/heapol/czr017

World Health Organization. (2008). Task Shifting. Global Recomendations and Guidelines. *World Heal Organization*, 1–88. Retrieved from https://doi.org/10.1080/17441692.2011.552067

How to cite this article: Isanaka S, Berthé F, Nackers F, Tang K, Hanson KE, and Grais RF. Feasibility of engaging caregivers in at-home surveillance of children with uncomplicated severe acute malnutrition. *Matern Child Nutr*. 2020;16:e12876. https://doi.org/10.1111/mcn.12876