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Evaluation of mobile clinics by MSF in pastoralist community in Doolo Zone, Somali region, Ethiopia

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Abstract

Background The Somali region in Ethiopia has poor health infrastructure, coupled with the adversity experienced by the largely pastoralist population through frequent droughts, disease outbreaks and conflict. From January 2019, MSF strategically focused on improving access to primary healthcare in the Doolo zone of the Somali region by providing 15–20 mobile clinics covering a wide geographical area. We aimed to evaluate the extent to which mobile clinics were an appropriate and effective modality to deliver healthcare for populations living in the region.

Methods In this mixed-methods study, we conducted a descriptive analysis of 24 months of routine mobile clinic data (February 2019 to January 2021) to evaluate the appropriateness and effectiveness of mobile clinics. We conducted a patient satisfaction survey to assess perceived benefits and challenges, as well as seven interviews with MSF medical staff and four focus group discussions with community members from mobile clinic sites to explore the appropriateness, effectiveness, and connectedness of mobile clinics.

Results MSF mobile clinics conducted 90,542 outpatient consultations, across 30 mobile clinic sites during the two-year period. However, there were gaps in continuity of care. The ratio of follow-up-to-first antenatal care visits was 0.82, and the ratio of third-to-first dose of DTP/Hib/HepB vaccine was 0.39. The current mobile clinic strategy is generally well perceived by the community in terms of the quality of services provided. However, MSF staff and community members expressed that its appropriateness and effectiveness are limited by mobile clinic opening hours, large patient volumes, referral policies, staffing, and drug supply issues.

Conclusions Limited opening hours, large patient volumes, weak referral processes and supply issues impacted the appropriateness and effectiveness of healthcare provision by mobile clinics to this pastoralist population. These challenges are consistent with those faced by mobile clinics in other contexts. To enhance the effectiveness and appropriateness of mobile clinics for pastoralist populations requires collaboration with both community members and local authorities to design and regularly review the locations, frequency, healthcare service package and referral policies of mobile clinics.

Keywords Mobile clinic, Evaluation, Pastoralist, Ethiopia

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Background

In the past 20 years, Ethiopia has made improvements in the delivery of primary healthcare services including maternal and child health services [1]. However, the Somali region only has half the national coverage of primary healthcare (17.5% vs 34.3%) [2]. The Somali region in Ethiopia poses specific challenges for primary healthcare delivery due to its low population density and proportionally large semi-nomadic pastoralist population [3]. To address the challenge of delivering primary healthcare to the pastoralist population in the Somali region, in 2004, the Regional Health Bureau (RHB) in collaboration with the United Nation Children Fund (UNICEF) set up the mobile health and nutrition teams (MHNTs) [4]. By 2011, there were 24 government-run teams in the Somali region. Recent assessments of the effectiveness of these mobile clinics found them to be a useful way of providing healthcare to pastoralist populations while also recognizing the need for further innovation and adaptation to fully meet the needs of the population [5, 6].

In 2007, Médecins Sans Frontières (MSF) initiated activities in the Doolo zone of the Somali region – one of nine zones in the region – with the initial aim of providing primary and secondary healthcare to conflict-affected populations. Based on Ethiopia's 2007 census, the zone's total population in 2019 was estimated to be 566,870, of whom 43% were women and 37% were pastoralist [3]. From 2007 to 2018, MSF provided healthcare in a combination of fixed-site health facilities and mobile clinics. In 2017, following a long drought, a complex emergency developed including mass livestock deaths, nutrition crises, and disease outbreaks such as acute watery diarrhea, measles, and acute jaundice syndrome [7]. This acute emergency subsided in 2018, and MSF adjusted its strategy to focus on provision of primary healthcare via mobile clinics and strengthening its outbreak surveillance presence in the region. From 2019 through 2021, there were 15 changing mobile clinic sites and a total of 32 locations under surveillance. Mobile clinic sites were selected by MSF in consultation with RHB District Health Officers, and targeted communities meeting several criteria including limited access to fixed-site health facilities such as health posts (greater than 10 kms), not visited by other agencies providing mobile clinic services, and other factors including surveillance information on outbreaks and mobility patterns of the pastoralist community. Once established, a site would operate until either a public-sector health facility was opened, staffed, and functionally serving the community, or population movements away from the site rendered the site unnecessary.

MSF mobile clinic teams visited each site throughout Doolo Zone once per week to provide primary healthcare services, including outpatient, nutrition-related, antenatal care (ANC), and postnatal care (PNC) consultations, and expanded program on immunization. During these visits, teams would also collect surveillance data and meet with local community health workers (CHW) to discuss changes in population movements and possible cases of outbreak-prone disease [8]. A CHW was recruited by MSF from each community hosting a mobile clinic site and was tasked with gathering and sharing information on cases of outbreak-prone disease and population movements with MSF, as well as spreading awareness in the community and surrounding population within a 5 km radius on clinic visit dates and services offered, making referrals to the mobile clinic, and providing support to the mobile clinic with patient registration and flow. This was a separate cadre of CHWs from the Health Extension Workers supported by the Ministry of Health and assigned to health posts [1].

While there is some evidence that mobile clinics are an effective approach to deliver healthcare to pastoralist populations including in the Somali region of Ethiopia [5, 6, 9], there have been few formal evaluations of mobile clinics in humanitarian emergencies [10]. To address this evidence gap, the objective of the study was to evaluate whether mobile clinics were an appropriate and effective modality to deliver care to local and pastoral populations in the Doolo zone of the Somali Region, Ethiopia.

Methods

Study design

A mixed-methods design was used for this evaluation, which was conducted according to the Organisation for Economic Cooperation-Development Assistance Committee evaluation criteria (OECD-DAC), adapted for humanitarian contexts by the Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP), and subsequently further adapted by the MSF's intersectional evaluation unit in Vienna [11]. Evaluation criteria included appropriateness, effectiveness, and connectedness. Appropriateness assessed whether the project was in line with local needs and priorities. Effectiveness assessed the extent to which the project achieved its purpose. Connectedness assessed how the project's short-term emergency nature was connected to a context that took longer-term and interconnected problems into account.

The evaluation criteria were assessed via retrospective analysis of routine health management information systems (HMIS) data collected over a two-year period (2019–2020), a cross-sectional survey of mobile clinic patients, key informant interviews of MSF staff members and focus group discussions (FGDs) among community members from mobile clinic sites were included in the

design to explore patient and staff perspectives related to selected evaluation domains (Table 1).

Analysis of HMIS data

Routine HMIS data that had been collected from all mobile clinics active between February 2019 and January 2021 were analyzed to quantitatively evaluate mobile clinic performance indicators relevant to the evaluation. Data were analyzed to describe the overall quantity of services provided, demographic breakdown of recipients, and continuity of care in terms of follow-up visit to first-visit ratios.

Patient satisfaction survey

A cross-sectional survey of mobile clinic patients was implemented in July 2021 among a sample of patients attending the 14 mobile clinic sites that were active at the time. A sample size (*n)* of 215 was targeted based on 50% having the factor of interest (*p)* — i.e. overall satisfied with service (score four or five on general score), 10% precision (*d)*, 95% confidence (*α)*, 10% non-response (x), and a design effect of 2 to account for potential homogeneity within each facility (*DEFF)*, and the following formula:

$$n = (1 + x) \cdot \frac{DEFF * z^2_{\alpha/2} \cdot p \cdot (1 - p)}{d^2}$$

The number of patients to be sampled per clinic was proportional to the average daily consultations at each mobile clinic. At each clinic, a trained interviewer stationed at the clinic's exit point conducted systematic sampling by interval selection of exiting patients, with an interval derived from the clinic's average daily consultation volume and target sample size. Interviewers were MSF staff hired temporarily for survey data collection, not involved in operation of the mobile clinics, and not residents of the sites where surveys were conducted. To ensure patient privacy, the interviewer conducted the survey in a secluded space. Verbal consent was obtained from each participant. Participant responses were recorded electronically using tablets and KoBoCollect software [12].

The survey consisted of over 30 questions across access to care, technical quality, interpersonal and communication skills, and efficacy. In addition, participants provided demographic data, including age, sex, and classification of their residence as part of a pastoralist community, urban community, or internally displaced people. The survey consisted of a mixture of open-ended response, discrete response (yes/no) and Likert scale (strongly disagree to

Table 1 Evaluation framework including criteria, sub-questions, methodology and measurements

Criteria with sub-questions	Methodology	Measurements
Appropriateness		
Is the intervention appropriate according to the perceptions of the target population?	Analysis of routine data; focus group discussions with community members; patient satisfaction survey	- Population reached (pastoralist vs non-pastoralist) - Acceptability of distance to health facility and opening hours - Acceptability of referral process
Is the strategy appropriate to achieve the medical objectives?	Analysis of routine data	- Number of consultations - Types of services provided
Effectiveness		
To what extent have the medical objectives been achieved?	Analysis of routine data; patient satisfaction survey	- Continuity of care - Ratio of antenatal/postnatal care follow-up visit compared to first visit - Ratio of follow-up vaccination doses to first dose - Perceived quality of care
What were the reasons for achievement or non-achievement of objectives?	Staff interviews; focus group discussions with community members	Perceptions on barriers to healthcare and healthcare delivery
What could be done to make the intervention more effective?	Staff interviews; focus group discussions with community members	Acceptability of current service package
To what extent do the project activities reach the specific target population? Are there any factors that are hindering access for the population most in need?	Analysis of routine data; focus group discussions with community members; staff interviews	- Population reached (pastoralist vs non-pastoralist) - Quality of care - Ease of access to the health facility - Perceptions of the referral strategy
Connectedness		
To what extent do MSF activities connect or compete with the existing health structures?	Staff interviews	- Perceptions on interaction between MSF activities and existing health structures

strongly agree) questions [see Supplementary Material for survey guide]. We performed descriptive and comparative analyses of patient responses, including comparisons between pastoralist and non-pastoralist patients. We tested the statistical significance of differences using two-sample independent t-tests for differences between means, and chi-squared tests for differences between proportions.

Data collection was carried out at 12 of 14 clinics over the course of two weeks, reaching a total of 172 respondents, 80% of the target. A disruption in mobile clinic operations due to suspension of all MSF activities in the country in July 2021 prevented data collection at the remaining two clinics. Although the survey was designed to sample patients such that the sample size for each clinic site was proportional to the site's patient volume, facilitating equal patient probability of selection, the disruption of data collection led to target sample sizes not being met in some clinic sites or being exceeded in other clinic sites. To compensate for this, patient responses were weighted retrospectively according to the patient's probability of selection, calculated by the probability of site selection and probability of patient selection within a site, and scaled to the target sample size. We assumed the probability of site selection to be uniform across all sites and the probability of patient selection to be uniform within each clinic site. Weights were standardized to the sample size ($n=172$) and used in all descriptive and comparative analyses. The distribution of weights ranged from 0.48 in an over-sampled clinic site to 2.62 in an under-sampled clinic site, with a median of 0.95. Analyses were done using R software [13].

Key informant interviews of MSF staff

Seven key informant interviews were conducted in a private space with informed consent by trained research assistants in English [14]. The sample was selected purposively, to enrich responses about the topics of interest and included representatives of different staff roles involved in day-to-day activities of the mobile clinics, including mobile clinic staff, medical team leads, and medical activity managers. Each interview took 30–60 min using a semi-structured interview guide that was audio recorded [see Supplementary Material for staff interview guide]. Immediately after each interview, the researchers used the audio recording to generate a verbatim transcript. These transcripts were then read to look for codes based on deductive themes and then reread to search for themes inductively and to cluster these codes to the deductive themes. Deductive themes were generated from pre-established evaluation domains and applied consistently across all transcripts. The patterns and relationships amongst all themes were identified and interrogated using a framework approach. These tasks were undertaken using the qualitative data analysis software NVivo [15].

Community FGDs

Four FGDs were conducted using a convenience sample from four out of the 14 communities that hosted mobile clinic sites at the time. Participants in each community were selected so that each discussion group included representatives of key roles, comprising CHWs, local leaders or chairmen, elders, and women. The discussion groups comprised 6–8 participants.

The FGDs were facilitated by two trained and experienced facilitators following a semi-structured discussion guide [see Supplementary Material for community FGD discussion guide]. The discussion guide was developed for a separate study being implemented simultaneously, with partially overlapping target communities and discussion topics [8]. Audio recordings and notes from each FGD were used to generate verbatim transcripts in Somali, which were then back translated to English. Transcripts were analyzed with the key informant interviews.

Results

Services provided and population reached (appropriateness)

The retrospective analysis of routine mobile clinic data showed the types of services provided at mobile clinics throughout 2019 and 2020. During this period, a total of 90,542 outpatient consultations were conducted across 30 mobile clinic sites. Each site, while active, was visited once per week with a median of 50 consultations per clinic-day. After outpatient consultations, routine immunization was the second most common service provided with 19,331 total doses administered, a median of 10 vaccination doses per clinic-day. ANC consultations and nutrition or ambulatory therapeutic feeding were less common, with 7,172 and 1,945 consultations each, respectively. In total, 51% of patients were recorded as pastoralists, similar to what was found in the patient survey, where 49% of respondents described themselves as pastoralists (Table 2).

From the patient satisfaction survey, 172 people attending 12 mobile clinics completed the surveys. Of these 120 (69%) were women, the mean age was 39 years and 44% were pastoralist (Table 3).

Success in reaching the pastoralist population was driven in part by CHWs who shared information with rural and pastoralist parts of the community about services provided at the clinic and visit times and days:

Table 2 Demographic characteristics of outpatient consultations, from February 2019 through January 2021

Demographic		Total ($n=90,542$)	Percent
Age	< 5 years	19,457	21.5%
	5–14 years	12,749	14.1%
	≥ 15 years	58,336	64.4%
Sex	Female	54,974	60.7%
	Male	35,568	39.3%
Pastoralist[a]	Yes	37,719	51.3%
	No	35,738	48.7%

[a] Pastoralist classification was missing for 17,085 outpatient consultations (19%), due to the field not being collected during the first six months of the evaluation period

"It depends on how our [CHWs] are doing – if they reach far into the bush, we will get people from far away, otherwise, we will get people coming from close, from the cities." (Community FGD participant)

However, it was noted by a community FGD participant that sometimes a single CHW is insufficient to reach the entire community because of the wide geographic population dispersal:

"The town is very large. People mostly live in rural areas. When you go to somewhere like Lehelow, where it is 35 km away, so the rural area is very wide geographically, [one CHW] alone is not enough to provide awareness to the community." (Community FGD participant)

The distance to the clinic site may also have been a barrier for the pastoralist population, as the patient survey showed that the average travel time to reach the clinic for pastoralists was 101 min, and nearly all (94%) arrived on foot (Table 3). Over half of the patients surveyed found the opening hours or days of the mobile clinics made them difficult to access, 22% did not find the clinic close enough to access, and 32% found it difficult to travel to the mobile clinic (Table 4).

That the clinics only visited each site once per week was also identified as a concern in the community FGDs:

"The organization comes for us on Thursdays and leaves us on Thursdays. Whatever happens to us in an emergency comes to us in loneliness, and we will be forced to look for help from another place where we can get help." (Community FGD participant)

"There is no medical service except on the day the agency arrives, people are sick, they are sick with infections and bacteria. So, when people fall ill, they only wait 'till the day the agency arrives and that will be when a test is done, and they are asked how they are feeling. If we are the elders of the center, we say that people are sick, and we request tests and treatment for the sick people." (Community FGD participant)

Quality of care (effectiveness)

In the patient survey, the perceived quality of care received at mobile clinics was described to be generally

Table 3 Respondent demographics, by pastoralist status, MSF mobile clinic patient satisfaction survey, Somali, Ethiopia, July 2021

	Pastoralist ($n=84$, 44% (weighted))	Not pastoralist ($n=88$, 56% (weighted))	Total ($n=172$)
Age (years), mean, 95% CI	38.2 (34.9, 41.5)	39.6 (36.2, 42.9)	39 (36.6, 41.4)
Sex, %, (95% CI)			
Female	74.4 (63.1, 83.7)	65.4 (54.9, 74.8)	69.4 (61.9, 76.1)
Male	25.6 (16.3, 36.9)	34.6 (25.2, 45.1)	30.6 (23.9, 38.1)
Marital Status, %, (95% CI)			
Married	96.5 (89.6, 99.4)	88 (79.8, 93.8)	91.8 (86.6, 95.4)
Single	3.5 (0.6, 10.4)	7.1 (2.9, 14.3)	5.5 (2.6, 10.1)
Education (Highest level completed), %, (95% CI)			
No formal education[a]	87.3 (77.7, 93.8)	62.5 (52, 72.2)	73.5 (66.3, 79.9)
Primary[a]	9.7 (4.1, 18.7)	29 (20.1, 39.2)	20.4 (14.7, 27.2)
Religious education only	3 (0.5, 9.7)	2.3 (0.3, 7.7)	2.6 (0.8, 6.3)
Patient mode of travel to mobile clinic site, %, (95% CI)			
Car or other motor vehicle[a]	6.2 (1.9, 14.1)	24.3 (16.1, 34.1)	16.2 (11.1, 22.6.)
Walk[a]	93.8 (85.9, 98.1)	75.7 (65.9, 83.9)	83.8 (77.4, 88.9)
Time patient spent travelling to reach mobile clinic site (minutes), mean, (95% CI)[a]	101 (85, 118)	34 (24, 45)	64 (54, 75)

[a] Indicates a significant difference between pastoralist and non-pastoralist respondents ($p<0.05$)

Table 4 Subjective patient perceptions of mobile clinic services: percent agreeing with each statement on a Likert-scale, MSF mobile clinic patient satisfaction survey, Somali, Ethiopia, July 2021

Domain and statement	Pastoralist ($n=84$)	Not Pastoralist ($n=88$)	Total ($n=172$)
Access			
The mobile clinic is close enough for me to access	68.8% (56.9, 79)	86% (77.2, 92.3)	78.3% (71.3, 84.3)
I do not find it difficult to travel to the mobile clinic (inverted)	58.3% (46.1, 69.8)	76.5% (66.5, 84.7)	68.5% (60.8, 75.5)
Registration at the clinic was easy and quick	95.7% (88.3, 99.1)	95.5% (89.1, 98.7)	95.6% (91.3, 98.2)
The opening hours do not make it difficult to access the clinic (inverted)	36.4% (25.4, 48.6)	47.6% (37.2, 58.2)	42.7% (35.1, 50.6)
Technical quality			
The waiting area was clean and in good condition	99.4% (94.1, 100)	100% (96.1, 100)	99.7% (97.3, 100)
The consultation areas were clean and in good condition	100% (95.3, 100)	100% (96.2, 100)	100% (97.9, 100)
I did not have to wait too long to be seen by a healthcare worker (inverted)	66.5% (54.4, 77.2)	67.5% (56.8, 77)	67% (59.2, 74.2)
I was confident in the skill of the healthcare worker who saw me (inverted)	83.2% (72.5, 91)	75.9% (65.4, 84.5)	79.2% (72, 85.3)
I was given enough time with the healthcare worker (inverted)	81.3% (70.8, 89.3)	79.8% (70.3, 87.4)	80.5% (73.7, 86.1)
Inter-personal interaction			
I was given privacy during the registration and screening process	84.6% (74.5, 91.9)	83.9% (74.9, 90.7)	84.2% (77.8, 89.4)
I was given privacy during the consultation	100% (95.2, 100)	100% (96.2, 100)	100% (97.9, 100)
The healthcare worker who saw me understood my problem (inverted)	84.1% (73.6, 91.6)	87.6% (79, 93.6)	86% (79.7, 90.9)
The healthcare worker who saw me treated me with courtesy and respect	100% (95.3, 100)	99.2% (94.7, 100)	99.6% (97, 100)
Communication			
The healthcare worker explained what was causing my health problem	86.8% (77, 93.6)	84.3% (75.3, 91)	85.5% (79.2, 90.4)
The healthcare worker gave clear instructions for follow-up care	90.3% (81.4, 95.9)	89.5% (81.5, 94.9)	89.9% (84.3, 94)
Staff explained what medication was for, or how to take it (inverted)	90.1% (81, 95.8)	93.1% (85.8, 97.3)	91.7% (86.5, 95.4)
Efficacy/outcomes			
The health problem that I came to the clinic with was addressed (inverted)	87.9% (78.1, 94.4)	90.6% (82.6, 95.8)	89.4% (83.6, 93.7)
General			
Overall, I was satisfied with the care I received	98.8% (93.1, 100)	98% (92.7, 99.8)	98.4% (95.1, 99.7)
If I had a choice, I would not use a different healthcare provider (inverted)	50% (37.9, 62)	61.7% (50.7, 71.8)	56.4% (48.3, 64.2)
I would recommend the mobile clinic to my family, friends, and others in my community	100% (95.2, 100)	100% (96.1, 100)	100% (97.8, 100)

All values shown are % (95% CI). No differences between pastoralist and non-pastoralist respondents were significant ($p<0.05$)

high, with 98% of respondents reporting satisfaction with the care they received, and 89% reporting that the problem they came to the clinic with was addressed (Table 4). Quality was assessed in general and across domains of access, technical quality, interpersonal interaction, communication, outcomes in the patient survey. Proportions are shown in Table 2 by pastoralist and non-pastoralist populations, although no significant differences in perceived quality were found between these groups.

Despite the patient survey showing generally high levels of satisfaction with the services received at mobile clinics, the analysis of routine HMIS data and the feedback provided by staff and community in interviews and FGDs suggested a few areas where quality could be improved: in the continuity of care, referral strategy, and diagnostics.

We assessed the continuity of care in the retrospective weekly aggregate data from the mobile clinics by comparing the numbers of follow-up visits to first visits for treatment requiring multiple visits. For routine vaccinations, we estimated the ratios of either second or third doses in a series to first doses, and for maternal health services, we estimated the ratios of either follow-up ANC visit or PNC visit to first ANC visit (Table 5).

The continuity of care, as measured by these ratios, was found to be worse in clinics with higher patient volume. Comparing the quartile of sites with highest patient volume (median 126 consultations per site visit) to that with the lowest patient volume (median 37 consultations per site visit), the ratio of second-to-first doses of DTP/Hib/HepB was 0.52 at sites with the highest patient volume and 0.67 at sites with the lowest patient volume, with similar differences comparing third-to-first doses. The ratio of follow-up-to-first ANC visits followed a similar pattern, at 0.60 for sites with the highest patient volume, compared to 0.97 for sites with the lowest patient volume.

The analysis of feedback provided by staff in interviews and community members in FGDs for the most part indicated that continuity of care should be improved,

Table 5 Continuity of immunization and maternal health care: health information system data, February 2019 through January 2021

Dose/Visit	Total	Ratio to first dose or visit
DTP/HepB/Hib vaccination		
First dose	3310	–
Second dose	1994	0.60
Third dose	1290	0.39
Measles vaccination		
First dose	3350	–
Second dose	1559	0.47
Polio vaccination		
First OPV dose	3199	–
Second OPV dose	1911	0.60
Third OPV dose	1272	0.40
IPV	665	0.21
Maternal health services		
ANC first-visit	7172	–
ANC follow-up visit	5906	0.82
PNC visit	656	0.09

ANC antenatal care, *DTP/Hib/Hep B* vaccine against diphtheria, tetanus, pertussis, hepatitis B, and Haemophilus influenza type B, *OPV* oral polio vaccine, *IPV* inactivated polio vaccine, *PNC* postnatal care

highlighting patient volume, referral strategy and diagnostics availability as barriers to continuity of care. The impact of high patient volume on quality of care was identified as a concern by one MSF staff member: *"Geladi and Bokh places are with high number of patients although not common sometimes patients go without getting the service (ANC and PNC)."* High patient volume was further exacerbated by the distance that teams would travel to reach clinic sites – leaving a limited time window for clinic operations, as indicated by another MSF staff member: *"The other main challenge is short time at the mobile clinic and due to limitation of speed to 45 km/h, our stay at the mobile clinic was limited to three or four hours maximum five hours."*

The referral strategy and availability of other health services in Doolo Zone also impacted continuity of care. The mobile clinics provided primary healthcare services only and referred patients requiring more advanced care to secondary care facilities, such as the RHB government hospital in Wardher. MSF staff expressed concern with the completion of unsupported referrals and the quality of healthcare received at referral facilities. Under the strategy adopted in 2019, MSF did not support referral services. Referred patients frequently ask for support, including transportation to and from the referral facility and assurance of quality care there. Some MSF staff expressed frustration in referring patients to health facilities where the quality of care may be below MSF standards or where the patient may not have the resources necessary to follow through with the referral:

> *"There is a challenge concerning referrals. We see in our data that most of our referrals are not successful – and these are the ones that need emergency care or medical follow-up. Sometimes, they are referred to Wardher, but they don't have money to take care of themselves in Wardher." (MSF Staff Interviewee)*

> *"The health centers are there, and we visit sometimes. Sometimes there are no nurses, or even if nurses there is no appropriate care – so how can we help our patients holistically. Can we take them to there?" (MSF Staff Interviewee)*

> *"We usually come across closed Health Posts because of lack of staff or lack of commitment, in that the staff is not opening the clinics regularly. This is a problem for mobile clinics as we refer patients to the health center. We refer, but then wait at health center and there is no one to see the patient, or they don't have medicines and refer further to Wardher." (MSF Staff Interviewee)*

Some community members stated their concerns about the process of referral to public health facilities, typically in reference to the pre-2019 strategy, where such referrals were supported and services at the public facilities were also MSF supported:

> *"It is there and happened, there were women who were in labor, and MSF took them to a place far away from their home and the women were neglected over there. Those women said the agency took them to a place which was far away from their houses and then they did nothing for them and MSF neglected them and they said, they don't know who MSF is. When we meet with the community while we are bringing information, our information will not be considered. When we want to mobilize the community, some of the community, whether they are children or the elderly, they will tell us that "MSF has taken our daughters while they were in labor and they have done nothing for them, so what are you mobilizing us for?"." (Community FGD Participant)*

> *"The agency carries out any emergencies. We say that the person was picked up by the agency and taken to a government hospital where he was left over there. MSF, so it happened. We wanted the person to be taken, examined, treated then brought back while the person recovered. We do not have that." (Community FGD Participant)*

In addition to concerns with continuity of care and the referral strategy, there were also concerns regarding diagnostic testing capacity that impacted quality of care at the mobile clinics. The diagnostics provided at mobile clinics were described by the MSF staff interviewed as very limited in scope, compared to the needs of the population. The diagnostic resources available to mobile clinic teams were limited to simple point-of-care tests and rapid diagnostic tests. No additional laboratory support was available and patients needing more complex laboratory diagnostics were referred to public health facilities. Patients are most often treated based on symptomatic diagnoses only. Although rapid diagnostic tests are used at the mobile clinics, they are available only for a few types of diseases – for example, rapid blood or urine tests are used for ANC monitoring. As one MSF nurse interviewee put it, the implication of this is that "*…sometimes, when a patient has an infection, we might not know what type of infection we are treating*".

These concerns were also reflected by community members:

> *"Some of them, when we consult, they ask for investigation, they expect ultrasound, chest x-ray, and higher investigations. But mostly we provide only primary health care. If they need higher investigations, we refer to other health care." (MSF Staff Interviewee)*

> *People have many illnesses, even the laboratory itself should be improved. We were looking for people to take urine samples, stools, blood samples, perform X-rays or to be performed by computers if they needed to be performed." (Community FGD Participant)*

Connection to the public-sector health system (connectedness)

The mobile clinic strategy was designed to integrate with health services provided by the public-sector health system, first in the clinic site selection and in decisions to open or close the sites, and second, in the strategy to provide only primary healthcare services and rely on the public-sector system for referrals. To avoid creating a parallel health system, sites were only opened in communities without public-sector health provision. If a public-sector health facility was opened, fully operational, and serving the same community served by a mobile clinic site, the site would be closed. Some MSF staff suggested that mobile clinics should be opened in communities with facilities that are not fully functional.

> *"I think we were struggling with opening more mobile clinics, because of issues already mentioned like security and vulnerability criteria. The vulnerability criteria we are using now includes they should not have health facility. Sometimes a village has health facilities but remains without health services for six–seven months because of no staff. The community is complaining because of lack of healthcare. MSF should open mobile clinics in locations where the health facility has been closed for a long time." (MSF Staff Interviewee)*

> *"Every year, RHB constructs more health facilities. Every year you will hear that where a mobile clinic used to work a new structure has been built. When we see a structure that has been built, we advocate for immediate deployment of staff and medical resources. When we see the staff and medicines are there, then we pull out." (MSF Staff Interviewee)*

Despite this strategy to avoid duplication or operation of a system parallel to the government health system, there was still evidence that mobile clinics diverted patients away from the RHB health facilities. This was partially due to the perceived higher quality of care at the mobile clinics.

> *"Some of them have fuel and a car, they come from far from the site. They fuel their car and collect a lot of people, and they come. Not bush people, but near town like Bokh, with a health center, even there they will come. They have a health center, but they don't have good services – no nurses, no ANC, if you go there, no one will even talk to you. They prefer to fuel their car and come with a lot of people, they will rent a car, and come from Bokh." (MSF Staff Interviewee)*

> *"They know at MSF they may get the drugs where at government health facilities they know they will not." (MSF Staff Interviewee)*

> *"When you go to the health centers to see attendance, you don't find the patients. That means the patients are going to the mobile clinics. We might think the health center is not functioning because there are no patients there, but that is not the reason – it is because of the quality of care that we are providing in the mobile clinics." (MSF Staff Interviewee)*

Discussion

This evaluation of mobile clinics in the Doolo zone, Ethiopia, has shown that mobile clinics can be an appropriate and effective mode of primary health care delivery to

pastoralist populations in the Somali region, Ethiopia. However, mobile clinics must be part of a broader health delivery strategy, as their appropriateness and effectiveness were limited by several factors, including the low frequency of clinic visits to communities, limited services, and limited integration with public-sector health services.

Appropriateness

While the mobile clinic strategy was aligned with regional MHNTs, patients and community members indicated the strategy and services to be of mixed appropriateness. That 51% of patient consultations were from pastoralists, while 37% of the population is estimated to be pastoralist [3], suggests the mobile clinics were at least similarly reaching pastoralist and non-pastoralist populations. However, both pastoralists and non-pastoralist patients indicated challenges in accessing the clinics related to distance, opening hours, and long wait times. The nutrition and surveillance services included in MSF mobile clinics were highlighted as key elements to integrate into mobile clinic modalities in humanitarian settings by a recent systematic review [10]. However, MSF mobile clinics didn't integrate comprehensive water, sanitation, and hygiene-related services in their package, and this may have limited their appropriateness [10].

Community feedback suggested that the limited services offered, and days of operation were not sufficiently appropriate to the population. There were often expectations of comprehensive healthcare services, including facilitation or support for referral services when necessary. One of the major points of dissatisfaction of the community with the continuity of care occurred when mobile clinics referred patients to public health facilities without support. This point has been described elsewhere among rural pastoralist populations as potentially related to the financial burden of transportation and accommodation associated with unsupported referrals [16]. These frustrations around access to and from, and quality of care at, referral sites were shared by MSF staff and community members alike and highlighted a need for a review of the referral policy. Similar feedback was shared by communities in an evaluation of mobile clinic services in similar settings, where dissatisfaction with continuity of care and frequency of mobile clinic visits were themes [17–19].

To address some of the appropriateness issues identified would require greater involvement of the communities served in designing and reviewing the mobile clinic strategy. The use of participatory methods to ensure acceptability has been highlighted elsewhere as a factor associated with successful healthcare interventions for pastoralist populations, along with integration of healthcare services with livestock interventions since animal health and human health are interconnected in pastoralist communities [20–23]. Oladeji et al. highlighted two additional approaches that could further enhance the appropriateness of mobile clinics for pastoralist populations: use of accessibility models to evaluate locations for future mobile clinics that maximize their access by the population and engagement with pastoralist leaders to help track population movements closer to real time using mobile phones [5].

Effectiveness

While the mobile clinic strategy effectively reached pastoralist populations in a low population density area with primary healthcare services, there were gaps in the perceived quality of care provided, and the strategy relied on a weak referral network for more advanced healthcare. Similar gaps in continuity of care were noted by other health services in Ethiopia, but to a lesser extent: while a ratio of 0.39 DTP/Hib/HepB vaccination third-to-first dose was seen in this study, a 2021 study showed ratios of 0.55 at RHB MHNTs and 0.81 at RHB fixed health facilities [5]. The effectiveness of mobile clinics was also limited by their poor diagnostic or laboratory capacity, a limitation that was identified in mobile clinics in Haiti and elsewhere in Ethiopia [9, 24].

The short duration of the mobile clinic visits combined with the regular large volumes of patients meant that health needs were often high and regularly went unmet. To address this gap, some locations may be better served by fixed-site health services, which could free up mobile clinics to have greater flexibility of movement and more closely follow the population movements. This finding is in line with a recent systematic review on guiding health service design for pastoralist populations and a recent study on MHNTs in the Somali region [5, 20]. The correlation between frequency of mobile clinic visits and effectiveness has also been shown in a recent modeling study, which showed that effectiveness at reducing pneumonia-specific mortality increased with increasing visit frequency [25].

Connectedness

The mobile clinic strategy in the Doolo zone during the evaluation period was aligned with the RHB 2004 initiative of deploying mobile and health nutrition teams across the Somali region [4]. In addition, the mobile clinic strategy was designed to avoid creating a health system parallel to the RHB health system. Nevertheless, there was still evidence that some patients preferred to seek treatment at the MSF mobile clinics, even when an RHB health facility may

have been closer. Due to a lack of published evidence of the connectedness of mobile clinics in humanitarian emergencies, we cannot report how common this finding may be [10], although similar concerns over 'competition' between mobile clinic services and fixed-site health services have been raised in other settings [26]. However, other studies found that mobile clinics reached patients who otherwise may not have attended a fixed-site health facility [6, 27], and, at a population scale, did not impact the volume of services provided at fixed-site health facilities serving the same population [28]. To address such a connectedness issue would require regular monitoring of patient volume at mobile clinics and fixed sites, the services available at each, and community satisfaction with services. Clear communication of clinic services available, schedules, and locations, between mobile-clinic services and fixed-site services, as well as with communities, would also help in addressing connectedness.

Limitations

This study has several limitations. First, the patient satisfaction survey was cross-sectional, sampling patients only at clinic sites active in July 2021, who may not have been representative of patients seen throughout the mobile clinic project's implementation. Second, the patient satisfaction survey targeted only patients of the mobile clinics, and therefore might have missed opinions from community members who may have been excluded from these services or may have been dissatisfied with past services and now sought care elsewhere. Third, the cessation of mobile clinics due to a critical security incident and subsequent closure of activities impacted data collection for the patient satisfaction surveys, key informant interviews of community members, and staff key informant interviews. Patient satisfaction surveys were completed at 12 of 14 mobile clinic sites, and FGDs were completed at four of 14 sites prior to suspension. Staff key informant interviews were cut short, and community key informant interviews had not yet started at the time of suspension. To mitigate this loss of access to key informants, community key informant interviews were substituted with community FGDs from a concurrent study on the same population, although the FGDs were not intended for this evaluation [8]. Fourth, the patient satisfaction survey was powered to detect the overall level of patient satisfaction with a precision of 10%. It is therefore underpowered to detect differences between pastoralist and non-pastoralist respondents (Tables 3 and 4), and the lack of statistical differences between these two groups should not be interpreted as evidence of similarity. Fifth, due to lack of available and reliable data on the Doolo zone demographics and health care provision from other sources, we were not able to adequately assess coverage or the proportion of the targeted populations – pastoralists and non-pastoralists who did not have access to primary healthcare – that was reached. Finally, the patient satisfaction survey, key informant interviews and FGDs may all have been impacted by social desirability bias [29], as the study team was part of the organization providing the mobile clinic services, which may have influenced participants to respond in ways they thought would be viewed favorably by the study team and organization.

Conclusions

This study highlighted several challenges to delivering appropriate and effective healthcare to pastoralist populations via mobile clinics including their limited opening hours, large patient volumes, weak referral processes and supply issues. These challenges are consistent with those faced by mobile clinics in other contexts, and the insights arising from this study contribute to the broader understanding of mobile clinic strategies and their impact. To enhance the effectiveness and appropriateness of mobile clinics for pastoralist populations, it is crucial to ensure greater collaboration between mobile and fixed-site healthcare services as well as with local authorities and communities in terms of co-designing and regularly reviewing the mobile clinics' locations, frequency, healthcare package and referral processes.

Supplementary Information

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Supplementary Material 1.

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Authors' contributions
All authors contributed to the conceptualization and design of this evaluation. BS, LB, and BAD collected data from key informant interviews (KII) and focus group discussions (FGDs). LB analyzed and interpreted health management information system, patient survey, KII and FGD data. BS, LB, and PK were major contributors in writing the manuscript. All authors read and approved the final manuscript.

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Data availability
The datasets supporting the conclusions of this article are available on request in accordance with MSF's data sharing policy. Requests for access to data should be made to oca.research@london.msf.org.

Declarations

Ethics approval and consent to participate

This study was approved by the MSF Ethics Review Board (ID 2125) and by the Regional Health Bureau of Somali Region, Ethiopia. Study information sheets were shared with participants of the key informant interviews and focus group discussions, and patient survey and verbal informed consent was taken for their participation.

Competing interests

The authors declare no competing interests.

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