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Barriers to accessing and using primary and secondary healthcare among children under-five in the Koutiala health district of Mali

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Abstract

Background A 2022 survey conducted in Koutiala suggested a modest increase in the mortality rate and low utilization of healthcare facilities among children under-five i.e., children less than five years old. This study aimed to identify and describe the barriers to accessing and using primary and secondary healthcare services for this population in Koutiala Health District.

Methods A survey, including cross-sectional and retrospective components, was conducted. In the cross-sectional phase, data were gathered through interviews with caregivers of children under-five and medical personnel at community health centers (Centres de Santé Communautaire, CSComs), as well as with guardians of children under-five at the household level, to explore challenges in accessing healthcare. In the retrospective phase, referrals from CSComs to the reference health center (*Centre de Santé de Reference*, CSRef) in 2022 and 2023 were reviewed using patients registers at both levels. Data collection was conducted electronically using KoBo, and analyses were primarily descriptive, performed in R.

Results A total of 460 caregivers were interviewed. Though over 96% of the caregivers were children's mothers, 86% required authorization to visit the hospital. Approximately 10% of patients did not receive care due to financial constraints or medication stockouts. At the household level, 60.9% of guardians said they would take an ill child to a CSCom as the first point of care, while 26.7% would opt for self-medication, and 12.4% for traditional medicine. Of 4667 patients referred from CSComs in 2022 and 2023, only 2744 (58.8%) reached the CSRef, indicating a referral failure rate greater than 41%. Referral completion varied by patient age. Healthcare staff cited transportation difficulties, financial constraints, social pressure, and long distances as key reasons for referral failure.

Conclusions Barriers to accessing care in Koutiala encompass issues with the healthcare delivery system (e.g., stock shortages, service fees, referral failure, distances to CSComs), patterns of service utilization (e.g., self-medication, traditional medicine) and sociocultural factors (e.g., household decision-making). The low referral completion rate is

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particularly concerning, as these children are high-risk for health deterioration and death and require urgent care. This may partially explain the elevated under-five mortality rate observed in the community.

Keywords Healthcare, Access, Utilization, under-five, Barriers, Referrals, Children, Health-seeking-behaviors

Introduction

In 2005, a severe nutritional crisis affected several Sahel countries [1]. The 2006 Demographic and Health survey in Mali reported a national global acute malnutrition (GAM) prevalence of 15%, stunting of 38%, and an under-five mortality rate of 191 deaths/1000/year [2]. The Sikasso region was among the most affected, with a GAM of 15.8%, severe acute malnutrition (SAM) of 6.6%, stunting of 45%, and an under-five mortality rate of 237 deaths/1000/year [2].

In 2009, Doctors Without Borders (*Médecins Sans Frontières*, MSF), in collaboration with local health authorities in the Sikasso region, launched a medico-nutritional initiative in Koutiala Health District to reduce infant and child mortality [3]. The program, which continues today, targets children under-five (i.e., children less than five years of age), providing free preventive and curative care for common pediatric illnesses, including SAM, as well as longitudinal nutritional monitoring from birth to five years. These activities are implemented at Community Health Centers (*Centre de Santé Communautaire*, CSComs) and at the district referral facility, the Koutiala Reference Health Center (*Centre de Santé de Reference*, CSRef) [3].

In addition to conducting operational research in collaboration with partners in Koutiala [4–10], MSF regularly carries out surveys to monitor key health indicators among children under-five and to assess the impact of its interventions [11]. Between 2010 and 2014, six cross-sectional surveys were conducted in Koutiala; they showed a declining trend in the under-five mortality rate and relatively stable prevalence of acute malnutrition [11]. Subsequent surveys in 2016 and 2022, however, showed a rising trend in the under-five mortality rate, while the prevalence of acute malnutrition remained similar to that observed in previous years [11]. In addition, the results of the 2022 survey revealed that more than 65% of under-five deaths occurred either at home or at a CSCom [11]. Among children who experienced an episode of illness in the two weeks preceding data collection, those living in remote areas were more likely to seek care at a CSCom and less likely to use secondary services at the CSRef, whereas the opposite pattern was observed in Koutiala city (an urban area) [11]. Despite MSF's provision of free healthcare for children under-five in the district, many caregivers who did not seek care during a child's illness reported financial constraints as a reason for not accessing services.

The exact reasons for the rising trend in under-five mortality rates in Koutiala are not well understood. Potential explanations include increased morbidity, possibly due to epidemics [12], or reduced access to quality healthcare services [13]. However, increased morbidity appears less likely, as admissions to the inpatient therapeutic feeding center (ITFC) and pediatric ward of the Koutiala CSRef have not increased in recent years. For clarity, access to healthcare refers to the ability of individuals to obtain timely, affordable, and appropriate healthcare services when needed [14]. Determinants of access to healthcare can be grouped into three categories: individual, structural, and systemic factors [15]. Individual factors include socioeconomic status, level of education, and health awareness. People with low socioeconomic status, limited education, or low health literacy may face significant barriers to accessing healthcare. Structural factors include the availability and accessibility of healthcare professionals and facilities. Geographic location, population density, and the distribution of healthcare resources within a given area can significantly affect the availability and accessibility of healthcare professionals and facilities. Systemic factors include government policies, healthcare financing, and the overall organization of healthcare systems [15]. Healthcare utilization, on the other hand, is defined as the extent to which an individual makes use of the health care services available in their community [16]. Access to healthcare and healthcare utilization are related but distinct concepts. Access refers to an individual's ability to position themselves to receive healthcare services. Utilization presumes access and includes the formulation of a healthcare plan during a healthcare encounter and its subsequent implementation [17]. Barriers to healthcare utilization can be physical, financial, cultural, and informational [18].

Given the increase in under-five mortality rates and relatively stable prevalence of malnutrition observed in community-based surveys, along with unchanged admission rates to nutrition programs and the pediatric ward at the hospital during the same period, we hypothesized that children face substantial barriers to healthcare access. In the absence of prior data on healthcare access in the district, this study sought to describe barriers to accessing and utilizing primary and secondary healthcare services among children under-five. The findings are intended to guide MSF interventions with the ultimate goal of reducing under-five mortality.

Materials and methods

Study design

Two complementary components comprised the study: (1) a cross-sectional survey conducted at both health facility and community levels, which included exit interviews with caregivers at health centers, interviews with health staff, and household interviews with guardians of children under-five; and (2) a retrospective review of patient referrals from CSComs to the CSRef between January 2022 and December 2023 to assess referral completion rates.

Study period and settings

Field data collection was conducted in March and April 2024 in Koutiala Health District. Exit interviews with caregivers were conducted in 16 MSF-supported CSComs during the study period. In contrast, interviews with health staff and the community survey covered the entire district, with the exception of four health areas excluded for security reasons. The retrospective review of referrals included all CSComs supported by MSF in 2022 and 2023 (39 CSComs + Koutiala CSRef) and covered a period from January 2022 to December 2023.

Koutiala is a health district that has functioned as its own administrative region since 2023, having previously been part of the Sikasso region of Mali. It has an estimated population of over one million inhabitants, with children under-five accounting for approximately 15% of the total population. Koutiala serves as a major road junction, agricultural hub, and agro-industrial cotton center in the southern part of the country. Mali's health system operates under the district health model proposed by the World Health Organization to African countries in 1987. Koutiala Health District is organized according to this structure and is comprised of 42 health areas.

Study population

The primary target population of the study was children under-five years of age. To obtain information on this group, data were collected at multiple levels, including from healthcare professionals, caregivers of under-five patients, guardians of under-five children at the household level, and patient's registers at CSComs and the CSRef. For all eligible participants, non-inclusion resulted either from refusal to provide consent or from being unreachable during the study period.

Sample size and sampling

For the exit survey conducted at CSComs, the required sample size was 588 caregivers of children under-five. This sample size estimate was calculated using the one-proportion sample size formula, assuming an expected proportion of patients paying for healthcare care of 50% to maximize the sample size in the absence of prior data). The calculation assumed a desired precision of 5%, a 95% confidence interval, and a design effect of 1.5. The design effect (cluster effect) was incorporated into the sample size calculation to account for potential homogeneity within a health center and heterogeneity between different health centers. During data collection, the survey team was stationed at each CSCom for five consecutive days. The team was positioned at an exit point determined in collaboration with the health center managers and located outside the care delivery area. All caregivers of eligible patients (children under-five exiting the facility during this period) were identified and interviewed. During this five-day period, all eligible patients were enrolled.

For the health staff interviews, survey teams visited all CSComs in Koutiala that were accessible during the data collection period. All eligible staff members—nurses or medical doctors responsible for consulting and treating children under-five—present at the CSComs during the data collection period were interviewed.

For the community component, a sample size of 542 child–guardian pairs were required. This sample size was calculated using a one-proportion sample size formula, assuming an expected proportion of children seeking care at CSComs of 64%, a desired precision of 5%, a 95% confidence interval, and a design effect of 1.5. Accounting for an estimated 2% non-response rate and the expectation that 85% of households would have children under-five (based on the 2022 Cluster Survey conducted by MSF in Koutiala), a total of 638 households were targeted to obtain a sample of 542 eligible households.

A standard two-stage cluster sampling method was used to select households in the community. In the first stage, clusters were randomly selected with probability proportional to the population size of neighborhood (primary sampling units) in Koutiala Health District, using population data from the district authority (unpublished) and ENA software. In the second stage, spatial sampling was applied: households (secondary sampling units) were randomly selected within each cluster based on a list of GPS coordinates of rooftops extracted from recent satellite imagery (OpenStreetMap).

Initially, 36 clusters were selected, and a preparatory step was conducted to define the area of interest for each cluster using one or more georeferenced polygons. All roofs within each cluster were identified, and GPS coordinates were extracted to create the sampling frame. Then, 19 GPS coordinates per cluster were randomly selected using GeoSampler to establish the households to be surveyed. Nineteen points were chosen with the expectation of obtaining approximately 17 eligible households per cluster, assuming that about 26% of roofs corresponded to unoccupied or ineligible households. Only households with at least one child under-five were interviewed.

Surveyors retrospectively reviewed patient and referral registers at all accessible CSComs for the period 2022–2023 to collect data on all patients referred out. Pediatric registers at the Koutiala CSRef were examined to document all patients referred in during the same period.

Data collection

The data collection tools for this survey were developed by investigators to address the study objectives. Supplementary File 1 presents the questionnaires/tools used at different levels. All data collection tools were pre-tested and refined prior to fieldwork.

Data for the cross-sectional components of the survey were collected through interviews using electronic questionnaires designed in KoBo Collect, including caregivers of children under-five at CSCom exit points, health staff at CSComs, and legal guardians of children at the community level. For the community component, survey teams used geolocation-enabled tablets (OsmAnd) to visit households identified through the selected rooftops; respondents were the children's legal guardians.

For the retrospective referral data, surveyors reviewed patient consultation and/or referral registers to identify all patients referred by CSComs between January 2022 and December 2023. Data were collected for each referred patient, including name, age, sex, village, and reason for consultation. This information was then cross-checked against the CSRef patient registers up to two months after the referral date to determine whether referrals had been completed. A referral was classified as not completed if the patient could not be identified in the CSRef register within two months of the referral date.

Data analysis

To ensure data quality, surveyors received standardized training, and all data collection tools were pre-tested and refined before fieldwork. Supervisors conducted daily checks on electronic submissions, and approximately 10% of interviews were randomly verified to ensure accuracy and inter-observer reliability.

Data were cleaned and analyzed using R software (v. 4.1.2). First, the proportion of completed referrals and the average time elapsed from the referring CSCom to arrival at the CSRef were estimated with 95% confidence intervals and stratified by patient and CSCom characteristics. A weekly referral trend curve was plotted to visualize changes in referral patterns over time. Potential factors associated with referral completion rates were assessed using multiple logistic regression. The dependent variable was the referral completion rate, while the independent variables included the age and gender of the patient, distance from the referring CSCom to the CSRef, primary diagnosis, and whether the CSCom was MSF-supported or not. Variables with a p-value < 0.20 in bivariate analyses were included in multivariable logistic regression models.

Since referral completion data were derived from register reviews and the variables collected for each patient consisted primarily of basic clinical parameters (age, sex, and primary diagnosis) that were routinely recorded by clinicians, no issues with missing data were encountered. Accordingly, no special methods for handling missing data were required.

Additionally, the proportion of patients who incurred expenses to access MSF interventions was calculated, along with the average amount spent per patient. The means of transportation used to reach CSComs, and the average travel time were also analyzed. Finally, the proportion of guardians of sick children under-five choosing CSComs, self-medication, or traditional medicine as their first recourse was calculated and stratified by the socio-demographic characteristics of patients and guardians. Table 1 summarizes the dependent and independent variables included in the analysis for each study component.

Clustering by CSComs and village was accounted for using a design-based approach, and analyses were weighted according to the sampling probability at each level.

Table 1 Description of variables included in the Community, Facility, and retrospective components

Study Component	Design	Dependent Variables	Independent Variables
Exit Survey	*Cross-sectional*	*Payment for care, facility visited*	*Child's age/sex, caregiver's education, distance from home to CSCom, transportation, perceived severity, relationship with child*
Community Survey	*Cross-sectional*	*First care choice, care utilization*	*Guardian's education/age/sex, Child's age/sex, relationship with child, distance from home to CSCom, cultural factors*
Referral Review	*Retrospective*	*Referral completion*	*Age, sex, diagnosis, MSF support, distance from CSCom to the CSRef*

Theoretical framework

The theoretical framework used in the interpretation of these findings is the Levesque's Conceptual Framework of Access to Healthcare introduced in 2013(19). This framework provides an interesting and comprehensive perspective on healthcare access through five dimensions of accessibility and five corresponding abilities of the population. Access is conceptualized as an opportunity to identify healthcare needs, seek healthcare services, to reach, to obtain or use healthcare services, and to have

a need for the fulfilled services (19). The five dimensions of accessibility include: approachability, acceptability, availability and accommodation, affordability, and appropriateness. In this framework, populations possess five corresponding abilities that interact with these dimensions to generate access: perceiving, seeking, reaching, paying, and engaging (19).

Results

Exit interview at CSCom

A total of 464 caregivers of patients under-five exiting the CSComs were approached; 460 (99.14%) agreed to participate and were interviewed. Male patients were slightly more represented, and children aged 0–11 months accounted for 62% of participants.

Table 2 presents the characteristics of the enrolled patients and their caregivers, as well as the services utilized during the visit. Approximately 45% of patients visited a CSCom for curative care, 47% for immunization, and 10% for the nutrition program. Among patients seeking curative care, 50.49% completed laboratory tests and 77.18% obtained medication from the pharmacy. Although over 96% of children were brought to a CSCom by a parent only 14% of respondents reported that they did not need authorization from a member of household to seek care.

Around 90% of respondents stated that their children received all medical services and medications needed from the CSCom. Only four (0.87%) reported that their children could not receive care because of financial constraints. On the other hand, 44 (9.56%) patients were unable to obtain the prescribed medications from the CSCom due to stockouts (see Table 3). Only three patients interviewed at exit were referred to the CSRef.

The average amount of money spent per patient at the CSCom was 295 FCFA for curative consultations, 272 FCFA for vaccinations, 100 FCFA for nutrition, 104 FCFA for laboratory tests, and 963 FCFA for medications purchased. Non-financial constraints to accessing care were reported by 4.8% of respondents, most of which (4.4%) was long wait time at the CSCom, with the remainder related to other concerns.

Perception of healthcare staff on referral system and access to care

A total of 108 healthcare staff were interviewed. The vast majority (107; 99.1%) reported that patients were responsible for arranging their own transportation in the event of a referral. Regarding follow-up practices, 35 (32.4%) indicated that they did not follow up on referred patients, whereas 55 (50.9%) reported conducting follow-up telephone calls or home visits, and 11 (10.2%) mentioned contacting the reference health center to confirm the arrival of specific patients. Anemia was the most commonly reported reason for referral, followed by coma or convulsions, respiratory distress, and SAM (see Fig. 1).

According to healthcare staff, an estimated 91% of referred patients under-five proceed to the CSRef. Among those who do not, the most frequently cited reasons were transportation constraints (47; 43.52%), financial constraints related to the cost of care (42; 38.89%), social pressure (32; 29.63%), and distance to the CSRef (11; 10.19%). Social pressure included traditional beliefs, limited health education, gender-related decision-making dynamics, prior negative experiences, trust and belief systems, primary livelihood activities, and economic hardship—all user-side factors that may lead people to rely on informal services. Other reasons mentioned by healthcare staff included patients dying on their way to CSRef, and the presence of alternative care options, such as traditional practices and nearby private clinics.

Perceptions and practices of guardians of children under-five at the household level

A total of 997 GPS points corresponding to rooftops were selected in 36 clusters and 834 (83.65%) were eligible households for the survey. Of the eligible households, 831 (99.64%) consented to participate in the survey.

Table 4 shows the guardians' preferred first choice of care when their child falls ill. In total, only 60.9% (95% CI: 51.58%–70.2%) of guardians would take their children to the CSCom, 26.7% (95%CI: 19.14%–34.29%) preferred self-medication, and 12.4% (95%CI: 7.94%–16.85%) preferred traditional medicine.

Among those who did not choose the CSCom as their first option, 67.0% felt they had made the best choice in terms of healthcare effectiveness, while 16% cited lower healthcare costs compared to the CSCom, and only 8% mentioned the long travel distance to reach the CSCom.

Retrospective review of patient referral completion rate

Data were collected from 35 CSComs. Between January 2022 and December 2023, a total of 4679 patients under the age of five years were referred by the CSComs, of whom 2752 (58.82%) arrived at the Koutiala CSRef. Figure 2 shows the weekly referral trends by the CSComs in Koutiala Health District for 2022 and 2023. Most referrals occurred between epidemiological weeks 35 and 45 each year, which corresponds to the peak malaria transmission season in the study area.

Figure 3 presents the weekly trends in referral completion rates, while Fig. 4 shows the average referral time (in days) from the date of referral to the date of arrival at the CSRef for the years 2022 and 2023. Although a modest decline in the referral completion rate is observed at the beginning of the year, referral completion rates remain relatively stable throughout the rest of the year. Among referrals who successfully reached the CSRef, the average

Table 2 Characteristics of patients and services utilized during their visit to a community health center

Characteristics	Total		Curative care		Vaccination		Malnutrition		Laboratory		Pharmacy	
	N	%	*n*	%	*n*	%	*n*	%	*n*	%*	*n*	%*
Gender of patients												
Girl	221	48.04	96	43.44	111	50.23	19	8.60	46	47.92	75	78.12
Boy	239	51.96	110	46.03	105	43.93	28	11.72	58	52.73	84	76.36
Age group of patients, months												
< 1	27	5.87	11	40.74	16	59.26	0	0.00	0	0.00	7	63.64
1–5	125	27.17	43	34.40	78	62.40	4	3.20	20	46.51	44	102.33
6–11	135	29.35	52	38.52	74	54.81	12	8.89	27	51.92	41	78.85
12–24	111	24.13	62	55.86	35	31.53	22	19.82	31	50.00	36	58.06
24–59	62	13.48	38	61.29	13	20.97	9	14.52	26	68.42	31	81.58
Gender of caregivers												
Woman	442	96.09	193	43.67	212	47.96	44	9.95	99	51.30	148	76.68
Man	18	3.91	13	72.22	4	22.22	3	16.67	5	38.46	11	84.62
Age group of caregivers, years												
18–24	183	39.78	79	43.17	92	50.27	14	7.65	42	53.16	61	77.22
25–34	203	44.13	88	43.35	96	47.29	20	9.85	41	46.59	70	79.55
35–44	69	15.00	37	53.62	27	39.13	10	14.49	19	51.35	26	70.27
> 44	5	1.09	2	40.00	1	20.00	3	60.00	2	100.00	2	100.00
Relationship between patients and caregivers												
Brother or sister	4	0.87	4	100.00	0	0.00	0	0.00	1	25.00	2	50.00
Grandparent	4	0.87	2	50.00	1	25.00	2	50.00	2	100.00	2	100.00
Uncle or aunt	8	1.74	5	62.50	0	0.00	3	37.50	3	60.00	5	100.00
Parent	444	96.52	195	43.92	215	48.42	42	9.46	98	50.26	150	76.92
Level of education of caregivers												
Secondary	44	9.57	16	36.36	23	52.27	1	2.27	6	37.50	18	112.50
Primary or did not attend school	414	90.00	188	45.41	193	46.62	46	11.11	97	51.60	140	74.47
University	2	0.43	2	100.00	0	0.00	0	0.00	1	50.00	1	50.00
Who authorized this visit?												
Compound matron	10	2.17	5	50.00	5	50.00	1	10.00	2	40.00	3	60.00
Head of compound	185	40.22	78	42.16	90	48.65	17	9.19	43	55.13	66	84.62
Head of family	197	42.83	101	51.27	78	39.59	26	13.20	47	46.53	72	71.29
The caregiver	65	14.13	21	32.31	42	64.62	2	3.08	11	52.38	17	80.95
Others	3	0.65	1	33.33	1	33.33	1	33.33	1	100.00	1	100.00
Time taken to arrive at the health facility from home												
One hour or less	339	73.70	115	33.92	196	57.82	33	9.73	53	46.09	88	76.52
More than one hour	121	26.30	91	75.21	20	16.53	14	11.57	51	56.04	71	78.02
Means of transportation from home to facility												
Public transportation (paid)	1	0.22	1	100.00	0	0.00	0	0.00	1	100.00	1	100.00
Walking	249	54.13	76	30.52	152	61.04	26	10.44	38	50.00	59	77.63

Table 2 (continued)

Characteristics	Total		Curative care		Vaccination		Malnutrition		Laboratory		Pharmacy	
	N	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%***	***n***	**%***
Motorized (unpaid)	210	45.65	129	61.43	64	30.48	21	10.00	65	50.39	99	76.74
Total	**460**	**100.00**	**206**	**44.78**	**216**	**46.96**	**47**	**10.22**	**104**	**50.49**	**159**	**77.18**

*The denominator is the number of patients coming for curative care

time between the date of referral and the date of arrival at the CSRef ranged from zero to three days, with an overall mean of 0.6 days. The average time between referral from a CSCom and arrival at a CSRef also remained relative stability throughout the year.

Table 5 shows the referral completion rate and the average time required to reach the CSRef after referral by the CSCom. It shows that there is no significant gender difference in referral completion rates. However, it appears that the referral completion rate for children aged 0–11 months is relatively low compared to children over 11 months of age.

Table 6 presents an analysis of factors potentially associated with referral completion rates. After adjusting the model, Referral completion rates were significantly associated with patient age.

Interestingly, Referral completion rates were lowest for CSComs located within a 0 to 15 km radius of the CSRef. Referral completion rates increased steadily with greater distance between the CSCom and CSRef, but declined slightly when the distance exceeded 44 km.

Discussion

This study aimed to describe access to and utilization of healthcare in children under the age of five years in Koutiala Health District in Mali. Access to healthcare refers to the ability of individuals to obtain timely, affordable, and appropriate healthcare services when needed [14]. Barriers to care may be physical, financial, cultural, and informational [18]. These findings revealed multiple barriers to care, which, for organizational purposes, are grouped into those related to healthcare service provision and those related to service utilization.

In terms of service provision, the study found that over 42% of caregivers/patients walked for more than one hour to reach the nearest health center, and 26% traveled considerable distances to access care. Distance from the home to a healthcare facility has been reported in several studies as a major barrier to healthcare access [19–22], reducing timely access to care and indirectly increasing the cost of care when patients must pay for transportation [22]. This may not only explain why some patients do not go to the CSCom for care, but it may partly explain why over 41% of patients under-five referred from CSComs in 2022 and 2023 did not reach the CSRef. Our findings suggest that patients referred from CSComs located more than 44 km from the CSRef were less likely to complete the referral process. Similar observations have been reported in a variety settings, where geographic proximity, among other factors, accounts for much of the gap in referral completion and the low utilization of services [23–27]. Paradoxically, our study also found low completion rates among patients referred from CSComs situated within 0–15 km of the CSRef.

Table 3 Unmet needs of patients as reported by respondents

		Did not receive service due to lack of money		Received needed services		Needed to return to CSCom* for medications		Needed to purchase medications elsewhere	
Age group, months	**#Patients**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
0–11	287	3	1.05	256	89.20	28	9.76	3	1.05
12–24	111	1	0.90	102	91.89	7	6.31	2	1.80
24–59	62	0	0.00	58	93.55	3	4.84	1	1.61
Total	460	4	0.87	416	90.43	38	8.26	6	1.30

**CSCom* Community health center

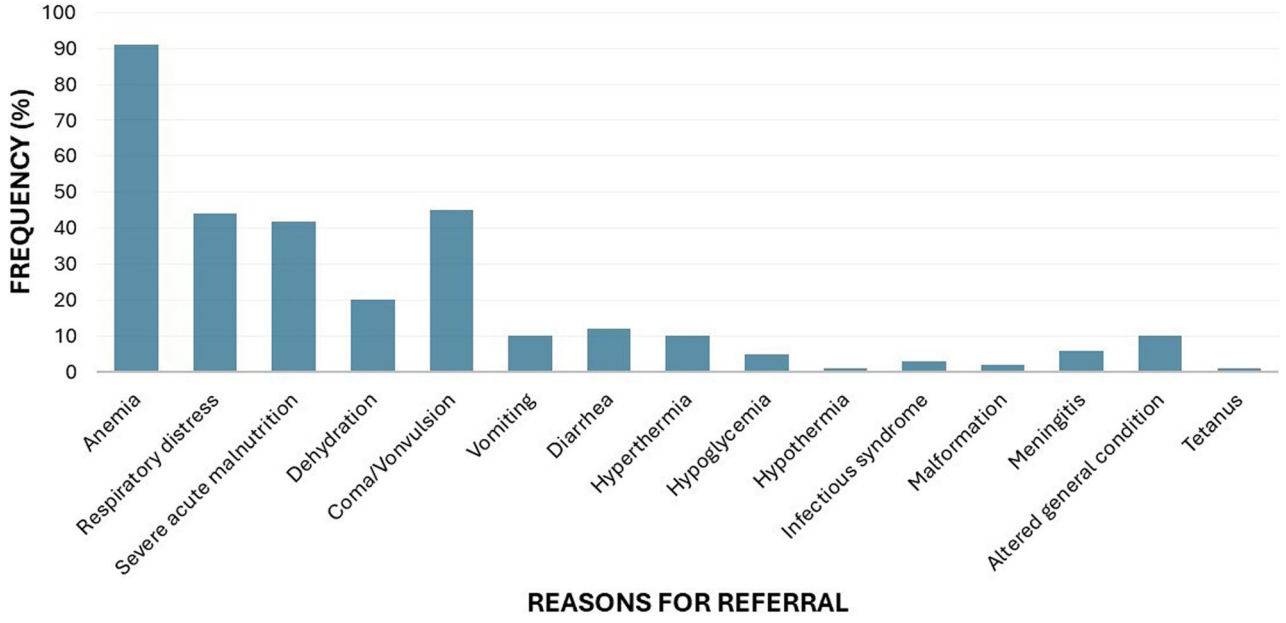

Fig. 1 Reasons for referring patients under-five to the reference health center for secondary healthcare as cited by the healthcare staff at community health centers in Koutiala Health District, Mali

According to healthcare staff, this may be explained by the high density of private clinics within 15 km of Koutiala town, offering patients a wider range of options, with some choosing private clinics over the CSRef. Expanding the healthcare infrastructure to ensure reasonable geographic access for every member of the population is a long-term endeavor, dependent on population growth and health system development in the country. In the interim, putting in place outreach and/or mobile clinics, as well as the use of trained community health workers to detect and treat common illnesses, while ensuring referral and providing transportation means to patients to health centers are commonly used to improve care utilization in humanitarian settings [28–30]. Though these approaches generally enhance access to care, our findings highlight the importance of coupling such interventions with regular evaluation to ensure their adaptation to local contexts and optimize their impact.

One of the main findings of this study is that more than 41% of patients under-five years of age referred from CSComs to the CSRef for secondary care failed to complete their referral. This represents a critical concern because most—if not all—of these patients require urgent care and hospitalization and remain at high risk of clinical deterioration or death. Although few studies explicitly quantify referral completion rates, several studies have reported that health care referral systems in Africa face several challenges [31–34]. In our study, referral completion rates were low for children under one year of age and even lower among those under one month. While the reasons for these patterns remain uncertain, findings from the community survey (presented in Table 4) suggest that health-seeking behaviors among children under-five vary according to the age of the child. Children under 6 months were more likely to self-medicate or rely on traditional remedies rather than seek care at a CSCom. According to interviewed health staff, the low referral completion rates observed in this study may be attributable to several factors, including the absence of ambulances, perceptions regarding the cost of care

Table 4 Characteristics of children according to care-seeking behaviors during illness in Koutiala, Mali

	Preferred first point of care during child illness						
		Health facility (CSCom)		Self-medication		Traditional medicine	
Characteristics	Freq (%)	%	95% CI	%	95% CI	%	95% CI
MSF support							
*MSF-supported CSCom**	31.36	66.15	[48.3–84.01.3.01]	25.00	[11.65–38.35]	8.85	[1.71–15.99]
CSCom not supported*	68.64	58.70	[48.37–69.03]	27.59	[18.77–36.41]	13.71	[8.29–19.13]
Gender of the child							
Girl	50.42	62.29	[52.7–71.88.7.88]	26.01	[18.91–33.12]	11.69	[7.26–16.13]
Boy	49.58	59.47	[49.34–69.59]	27.43	[18.56–36.3]	13.11	[7.4–18.81.4.81]
Age group of the child, months							
< 1	1.08	77.78	[48.35–107.2]	0.00	[0–0]	22.22	[−7.2–51.65]
1–5	6.02	44.00	[25.13–62.87]	40.00	[24.64–55.36]	16.00	[5.06–26.94]
6–11	8.06	55.22	[42.45–68.45]	37.31	[23.73–50.9]	7.46	[1.49–13.43]
12–23	18.53	61.04	[49.36–72.72]	24.03	[14.98–33.07]	14.94	[7.37–22.5]
24–59	66.31	62.79	[53.34–72.25]	25.41	[17.39–33.43]	11.80	[6.7–16.9]
Gender of the child's guardian							
Woman	68.47	57.29	[46.31–68.28]	31.99	[22.69–41.28]	10.72	[6.29–15.15]
Man	31.53	68.70	[59.01–78.39]	15.27	[7.27–23.26]	16.03	[8.01–24.05]
Age group of the child's guardian, years							
18–24	13.12	52.29	[36–68.58.58]	35.78	[22.44–49.12]	11.93	[3.63–20.23]
25–34	38.63	64.49	[52.81–76.16]	22.74	[13.59–31.9]	12.77	[7.67–17.88]
35–44	25.63	61.97	[48.45–75.49]	31.46	[19.23–43.68]	6.57	[1.38–11.77]
> 44	22.62	58.51	[47.52–69.5]	22.87	[13.7–32.05.7.05]	18.62	[9.19–28.04]
Level of education of the child's guardian							
Primary or some school	82.79	58.43	[47.58–69.28]	27.18	[18.53–35.83]	14.39	[9.26–19.52]
Secondary	16.37	73.53	[58.23–88.83]	23.53	[8.69–38.37]	2.94	[−1.83–7.71]
University	0.84	57.14	[0.77–113.52.77.52]	42.86	[−13.52–99.23]	0.00	[0.00–0.00]
Relationship of child to guardian							
Grandparent	14.68	57.38	[44.81–69.95]	29.51	[17.42–41.6]	13.11	[3.11–23.12]
Uncle/aunt	2.53	76.19	[53.26–99.12]	19.05	[−2.92–41.01]	4.76	[−4.74–14.26]
Biological parent	80.63	61.04	[50.91–71.18]	26.42	[17.99–34.84]	12.54	[8.09–16.98]
Brother/sister	2.17	61.11	[22.54–99.68]	27.78	[−4.65–60.2]	11.11	[−12.18–34.41]
Time to walk from home to CSCom*, hours							
> 1	42.24	59.26	[47.28–71.23]	24.22	[14.4–34.03.4.03]	16.52	[9.51–23.54]
< 1	57.76	62.08	[48.91–75.26]	28.54	[17.72–39.36]	9.38	[4.62–14.13]
Total	100.00	60.89	[51.58–70.2]	26.71	[19.14–34.29]	12.39	[7.94–16.85]

*CSCom Community health center

at the CSRef, the distance between the CSCom and the CSRef, limited transportation options, and the lack of a follow-up system for referred patients. Similar findings have been reported by healthcare workers in Nigeria and South Africa. In the context of Koutiala, MSF provided free care to all patients under-five referred to the CSRef; however, it remains unclear whether this information was correctly conveyed to caregivers. The interruption of care following initial treatment at a CSCom highlights shortcomings in health service delivery. Caregivers' decisions to seek care for their child at a CSCom demonstrates an intention to engage with the health system; however, their subsequent non-completion of the referral pathway is likely driven by other constraints that merit further investigation. Addressing this issue requires strengthening the referral system through measures such as putting in place an ambulance service, providing financial support or transportation for patients referred to the CSRef, and implementing a follow-up mechanism to monitor referred patients through coordinated contact between caregivers, CSComs, and the CSRef.

Still related to service provision, approximately 9% of patients who sought curative care during the survey did not receive the medicines prescribed to them due to drug unavailability and several patients reported out-of-pocket payments at various points of care. Stockouts of essential medicines are common in many countries [35–37] and healthcare in Africa is financed predominantly through out-of-pocket expenditure [38]. Stockouts of essential drugs encourage patients to purchase medicines from local vendors, thereby limiting healthcare access for poor families and increasing exposure to medications

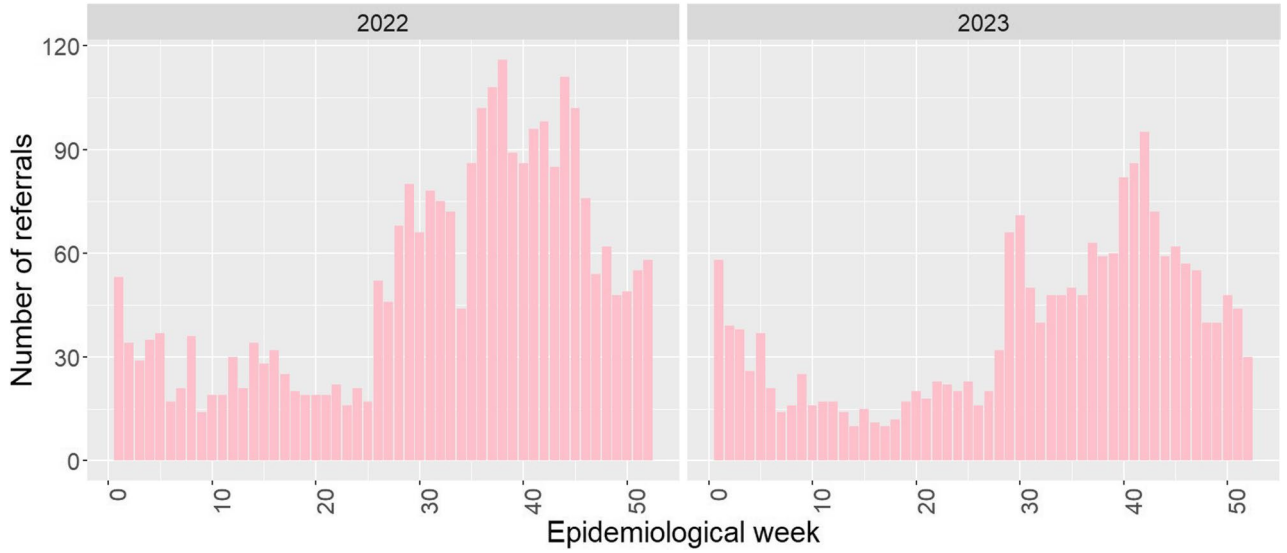

Fig. 2 Weekly trends in the number of children under-five referred by community health centers for secondary healthcare to the Koutiala reference health center in 2022 and 2023

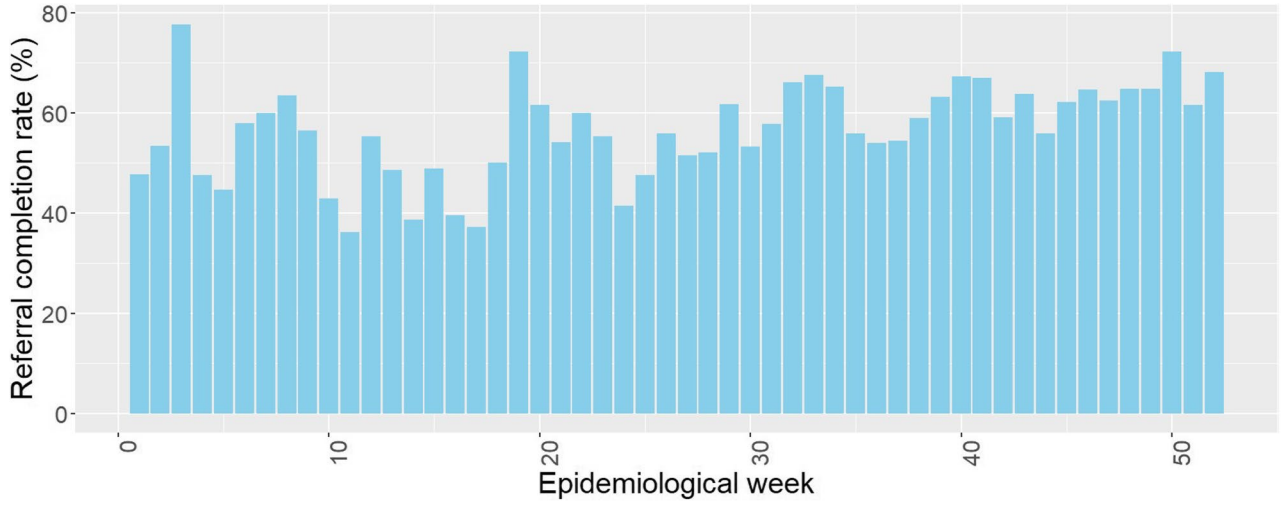

Fig. 3 Annual trends in referral completion rates for children under-five in Koutiala, Mali (2022–2023)

of unknown quality. For example, a study in Uganda reported that stockouts of anti-malaria drugs prompted less educated and poorer patients to drop out of the formal healthcare system altogether [39]. Addressing essential drug stockouts requires effective stock management, which can be achieved through proper training and supervision of health centers [40, 41]. Conversely, out-of-pocket payments for consultations appeared less burdensome for patients in this setting owing to the existence of a community-based insurance scheme. To benefit from this insurance scheme, each household was required to pay an annual registration fee of one thousand CFA francs, after which members of registered households pay only one hundred CFA francs per consultation. However, the present study could not assess the effectiveness of this insurance scheme in reducing financial barriers to care.

Barriers to service utilization were also shaped by the complexity of the decision-making process involved in taking a sick child to a health facility, as well as by caregivers' health-seeking behaviors. Although more than 96% of children were accompanied to the health center by their mothers, only 14% of them did not need permission from head of household to take the child to the CSCom. Given that caregivers were mostly the biological mothers of the children, this implies that in the absence of the head of household, care-seeking for a sick child may be delayed.

In addition, more than 39% of children's guardians at households reported that they would choose

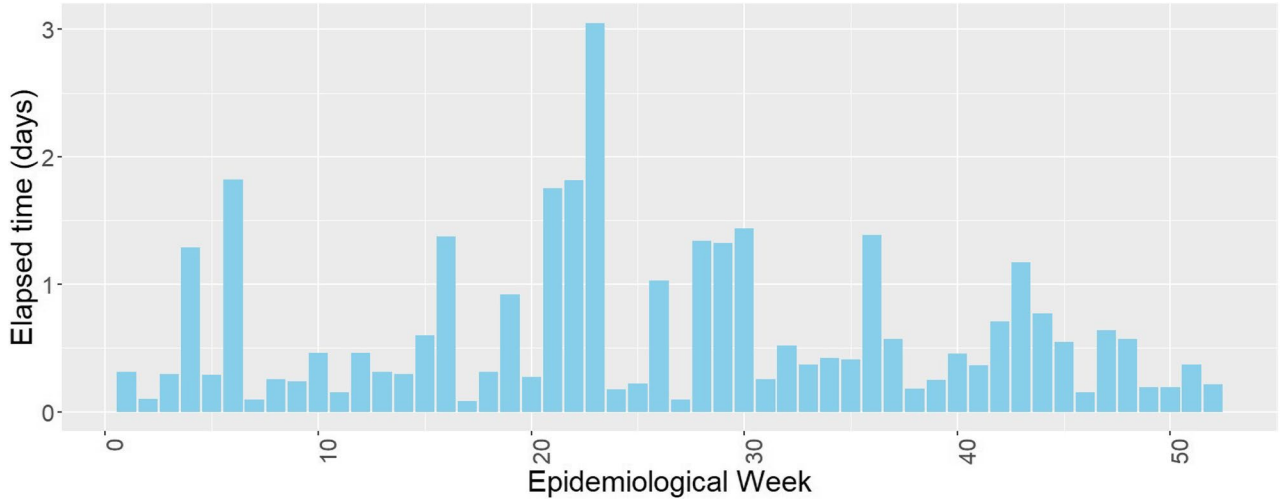

Fig. 4 Distribution of the elapsed time from the date of referral by the community health center to the date of arrival at the reference health center among patients under-five in Koutiala, Mali

Table 5 Factors associated with referral issuance by community health centers, referral completion, and the average time taken to reach the reference health center among patients under-five years of age, Koutiala, Mali

Characteristics	Referral issued			Referral completion			Time to reach CSRef, days	
	N	%	95% CI	n	%	95% CI	Mean	95% CI
MSF support								
CSCom supported	3182	68.01	[58.03–60.71]	1889	59.37	[57.66–61.08]	0.63	[0.53–0.73]
CSCom unsupported	1497	31.99	[56.31–58.99]	863	57.65	[55.15–60.15]	0.55	[0.41–0.69]
Year of reference								
2022	2699	57.68	[56.45–59.29]	1562	57.87	[56.01–59.73]	0.73	[0.61–0.85]
2023	1980	42.32	[58.68–61.52]	1190	60.10	[57.94–62.26]	0.44	[0.35–0.53]
Gender of patient								
Girl	2250	48.09	[58.04–60.9]	1338	59.47	[57.44–61.5]	0.58	[0.47–0.69]
Boy	2429	51.91	[56.78–59.64]	1414	58.21	[56.25–60.17]	0.63	[0.51–0.75]
Age of patient, months								
< 1	322	6.88	[37.78–39.24]	124	38.51	[33.19–43.83]	0.64	[0.36–0.92]
1–5	265	5.66	[57.45–58.77]	154	58.11	[52.17–64.05]	0.71	[0.35–1.07]
6–11	526	11.24	[53.08–54.9]	284	53.99	[49.73–58.25]	0.69	[0.44–0.94]
12–24	1059	22.63	[56.68–59.08]	613	57.88	[54.91–60.85]	0.61	[0.45–0.77]
24–59	2507	53.58	[61.47–64.33]	1577	62.90	[61.01–64.79]	0.58	[0.47–0.69]
Distance CSCom-CSRef, km								
0–15	311	6.65	[51.7–53.12.7.12]	163	52.41	[46.86–57.96]	0.43	[0.18–0.68]
15–29	641	13.70	[60.48–62.46]	394	61.47	[57.7–65.24.7.24]	0.84	[0.55–1.13]
30–44	967	20.67	[65.13–67.45]	641	66.29	[63.31–69.27]	0.33	[0.21–0.45]
> 44	2760	58.99	[54.89–57.71]	1554	56.30	[54.45–58.15]	0.68	[0.57–0.79]
Main diagnosis								
Accident/Trauma	9	0.19	[33.21–33.45]	3	33.33	[2.53–64.13]	0.00	[0.00–0.00]
Diarrhea	51	1.09	[60.48–61.08]	31	60.78	[47.38–74.18]	0.14	[0.06–0.22]
Respiratory infection	351	7.50	[52.24–53.74]	186	52.99	[47.77–58.21]	1.11	[0.07–1.52]
Malnutrition	774	16.54	[55.53–57.65]	438	56.59	[53.1–60.08.1.08]	0.35	[0.29–0.41]
Severe malaria	2861	61.15	[61.41–64.21]	1797	62.81	[61.04–64.58]	0.66	[0.54–0.78]
Unknown	30	0.64	[43.1–43.56.1.56]	13	43.33	[25.6–61.06.6.06]	0.69	[0.09–1.29]
Other	603	12.89	[46.14–48.06]	284	47.10	[43.12–51.08]	0.41	[0.28–0.54]
Total	**4679**	**100.00**	**[58.82–58.82]**	**2752**	**58.82**	**[57.4–60.2]**	**0.61**	**[0.5–0.7]**

CSCom Community health Center, *CSRef* Reference health center

Table 6 Factors associated with referral completion by community health centers (CSCom) to the reference health center (CSRef), among patients under-five in Koutiala, Mali in 2022 and 2023

Factors	Categories	RR	95% CI	*p*-value
Health center supported by MSF	No	1	Ref	Ref
	Yes	1.01	0.92–1.10	0.853
Year	*2022*	1	Ref	Ref
	2023	1.08	1.00–1.16	0.054
Sex of patient	*Girl*	1	Ref	Ref
	Boy	0.98	0.91–1.05	0.563
Age of patient, months	*< 1*	1	Ref	Ref
	1–5	1.45	1.12–1.87	0.004*
	6–11	1.27	1.01–1.61	0.044*
	12–24	1.35	1.08–1.68	0.008*
	24–59	1.43	1.16–1.77	0.001*
Distance (CSRef-CSCom), km	*0–15*	1	Ref	Ref
	15–29	1.14	0.95–1.39	0.165
	30–44	1.23	1.02–1.49	0.029*
	> 44	1.03	0.87–1.23	0.711
Main diagnosis	*Malaria*	1	Ref	Ref
	Malnutrition	0.90	0.80–1.00	0.051
	Respiratory infection	0.86	0.72–1.02	0.092
	Diarrhea	1.01	0.69–1.42	0.954
	Accident/trauma	0.54	0.13–1.41	0.291
	Others or unknown	0.83	0.72–0.96	**0.013***

RR Risk ratio

*Statistically significant

self-medication or traditional medicine rather than the CSCom as the first line of treatment when the child becomes ill. Self-medication and the use of traditional remedies are common practices among caregivers of children under-five in Africa [42–46] and these behaviors can contribute to poor health outcomes. A study conducted in India attributed such patterns of self-medication to multiple factors, including the desire for self-care, sympathy toward sick family members, inaccessible health services and unavailability of drugs, time and financial constraints, lack of awareness, misconceptions, extensive advertising, and the availability of medicines outside formal pharmacies [47]. On the other hand, a systematic review of several studies conducted in different parts of the world showed that the use of complementary and alternative medicines, including traditional medicine, was driven by expectations of benefit, dissatisfaction with conventional care, and perceptions of safety [48]. This exposes children to medicines of uncertain quality, toxicity, and efficacy, which may exacerbate their health condition [49]. Addressing challenges related to health-seeking behaviors and decision-making processes is inherently complex and requires sustained, long-term interventions with active community participation [50].

The aforementioned barriers operate synergistically and cohesively to limit or delay access to healthcare for children under-five. A study conducted in the USA reported that delays in medical care may be involuntary (arising from service provision and supply constraints) or patient-initiated (reflecting demand-side barriers) [51]. Another study reported that more than one-third of Nebraskans experience delayed care, primarily due to financial or transportation challenges, both of which are associated with indicators of low socio-economic status [52]. Similarly, a systematic review across six sub-Saharan Africa countries suggested that reducing the financial burden on patients increased access to primary healthcare [53]. In similar contexts in Mali and Benin, it was reported that living far away from health centers was associated with an increased likelihood of home deliveries [54]. Regardless of the underlying cause, delays in accessing care can exacerbate patients' conditions, resulting in hospitalizations that might otherwise have been managed on an outpatient basis, and are further associated with prolonged hospital stays and potentially poorer health outcomes [55].

This study has several limitations. First, there is potential for information bias due to the reliance on self-reported data and possible inaccuracies in patients' records. Selection bias may also have been introduced by the exclusion of insecure areas. Additionally, given the observational study design, causal relationships cannot be inferred.

For the retrospective analysis of referred patients, it was assumed that registration procedures were properly implemented in both the CSComs and the CSRef. Any irregularities or disproportionate registration across CSComs could introduce information bias. Furthermore, four health areas were excluded due to security concerns, meaning the findings may not reflect the situation in these areas. Consequently, the results cannot be generalized to the entire Koutiala district but apply only to the health areas included in the study.

It is important to highlight the originality of this study design. Comprehensive surveys of this nature remain rare in low-resource settings such as Koutiala. By integrating both cross-sectional and retrospective approaches, this study offers a robust framework for examining barriers to healthcare access among vulnerable populations. This innovative methodology not only enriches the existing literature but also underscores the value of conducting similar surveys in comparable contexts to inform health policies and interventions. Although causal relationships cannot be inferred, the findings provide critical insights for guiding future public health strategies and improving access to care. We recommend longitudinal studies to further explore referral completion rates and their determinants.

Viewed through Levesque's conceptual framework for access to healthcare, the findings highlight inequities across multiple dimensions of access — including approachability, availability, affordability, and acceptability. The requirement for authorization to seek care and the reliance on self-medication or traditional medicine highlight social and cultural barriers that disproportionately affect women and children, limiting both their ability to seek and to engage with healthcare services. Similarly, financial constraints, stockouts, and transportation difficulties reflect systemic inequities in the ability to reach and to pay for healthcare, particularly among the poorest households. Addressing these inequities requires integrated policies that strengthen both the supply and demand sides of the health system.

The findings also have important policy implications for health system strengthening in Mali. Addressing financial and logistical barriers through subsidized or free child health services, consistent drug supply, and community-based transportation support would improve service utilization and ensure timely access to care. Strengthening the referral system by implementing effective tracking mechanisms, establishing feedback loops between CSComs and CSRefs, and building capacity at peripheral health facilities can enhance continuity and quality of care. Moreover, empowering women in healthcare decision-making and promoting community engagement are essential for overcoming sociocultural barriers and achieving equitable access to child health services nationwide.

Conclusions

This study identifies key barriers limiting access to healthcare for children under-five in Koutiala Health District in Mali. Structural and behavioral challenges—including financial constraints, geographic inaccessibility, medication stockouts, and complex household decision-making—contribute to delays in care-seeking and treatment. The low referral completion rate is particularly concerning, as it affects high-risk patients for medical complications and death requiring urgent care.

Addressing these barriers demands a comprehensive strategy that improves drug availability, strengthens community-based service delivery, and reinforces referral systems through transportation support and effective follow-up mechanisms. Within Levesque's conceptual framework, the findings highlight inequities in the ability to seek, reach, and engage with care, especially among women and low-income households.

By identifying critical bottlenecks in healthcare access and utilization, this study generates actionable evidence to guide health system strengthening efforts. Targeted interventions that promote equity and continuity of care are essential for improving child health outcomes and reducing under-five mortality in Mali.

Abbreviations

CI	Confidence interval
CSCom	Community health center (centre de santé communautaire)
CSRef	Reference health center (centre de santé de référence)
ITFC	Inpatient therapeutic feeding center
GPS	Global positioning system
MSF	Médecins Sans Frontières
RR	Risk ratio

Supplementary Information

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Supplementary Material 1

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Authors' contributions

MNY designed the study, led field data collection and analysis, and drafted the manuscript. EG, EG, IK, MHK, YDS and FCG contributed to the design of the study, interpreted the data, and revised the manuscript. All authors read and approved the final manuscript.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the guidelines of the Council for International Organizations of Medical Sciences (CIOMS) [56], the International Ethical Guidelines for Health Research Involving Human Subjects [57], and the Declaration of Helsinki [58]. Ethical approval was obtained from the Médecins Sans Frontières Ethics Review Board(MSF ERB ID: 2377), and from the National Ethics Committee for Health and Life Sciences (CNESS) of the Ministry of Public Health and Hygiene of the Republic of Mali (decision no. 2024/003/MSDS-CNESS, issued on 14 February 2024). Written informed consent was obtained from all participating healthcare staff, and written parental/guardien consent was obtained for all children under-five years of age prior to enrollment. Retrospective data collection was based solely on register review and did not include personal identifiers.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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