

Improving Obstetric Referral and Counter-Referral Mechanisms in Northern Benin: Findings from a Single-Center Cross-Sectional Study Advocating a System-Level Approach

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Abstract

Background: An effective obstetric referral and counter-referral system is essential for ensuring timely access to comprehensive emergency obstetric care. In northern Benin, geographical barriers, transportation constraints and weaknesses in communication between health facilities may compromise the continuity and quality of care. **Objective:** This study sought to assess the quality of the obstetric referral and counter-referral system and identify factors associated with referral and counter-referral dysfunction among women referred to a referral hospital in northern Benin in 2022. **Methods:** We conducted a hospital-based cross-sectional study with prospective data collection from 1 January to 30 June 2022 at the obstetrics and gynecology emergency department of Borgou/Alibori University and Departmental Hospital Center (CHUD-B/A). All women referred or transferred from another health facility during the study period were consecutively included. Data were collected through patient or relative interviews and review of medical records, referral documents and hospital registers. Referral and counter-referral quality were assessed using predefined criteria based on national standards, with a 70% compliance threshold used to define dysfunction. Associations were assessed using bivariate and multivariable analyses, with adjusted prevalence ratios (aPRs) and 95% confidence intervals (CIs). **Results:** Of 1735 women admitted during the study

period, 919 (52.9%) were referred; 913 were included in the final analysis. The mean age was 26.8 ± 6.6 years. Although 91.8% had consented to referral and 81.7% had a referral form, only 17.6% of receiving facilities had been notified before transfer. Medicalized transport was used in 11.0% of cases and only 1.4% of women were accompanied by a health professional. Arrangements for reception were documented in 15.4% of cases, while 41.0% waited at least 10 minutes before initial management. Counter-referral was particularly weak: feedback to referring facilities was documented in 35.4% of cases and recommendations for continued care in only 4.2%. Referral dysfunction was associated with younger age, referral from a private facility, greater distance, rural origin and delayed initial management. Rural origin and greater distance were also associated with counter-referral dysfunction. **Conclusion:** Important weaknesses remain in the obstetric referral and counter-referral system in northern Benin, particularly regarding communication, transportation, reception and continuity of care. Strengthening coordination between facilities and improving referral and counter-referral procedures should be prioritized.

Keywords

Quality of Care Assessment, Referral System, Maternal Health, Obstetric Emergencies

1. Introduction

Maternal mortality remains a major public health concern, particularly in low- and middle-income countries, where timely access to skilled maternal and emergency obstetric care remains unequal. Although substantial progress has been made globally, preventable maternal deaths continue to occur, largely as a consequence of delayed access to appropriate and quality care [1] [2]. In Benin, maternal mortality has remained high despite national efforts to improve access to reproductive, maternal and neonatal health services. Strengthening emergency obstetric and neonatal care and improving referral systems have therefore been identified as important components of national strategies for reducing maternal and neonatal mortality [3] [4].

The referral system is a critical component of the continuum of obstetric care. Women who develop complications during pregnancy, labor, delivery or the postpartum period may require timely transfer from a peripheral health facility to a hospital with the human resources, equipment, blood products and surgical capacity necessary to provide comprehensive emergency obstetric care. An effective referral process requires more than physical transfer: it depends on early recognition of complications, appropriate initial stabilization, communication between facilities, adequate transportation, documentation, preparation for reception at the referral hospital and continuity of care after hospital management [5]. Delays occurring at different stages of this pathway can substantially affect maternal and fetal outcomes. The conceptual framework of the three delays distinguishes delays

in deciding to seek care, delays in reaching an appropriate health facility, and delays in receiving adequate care after arrival [6]. Distance, transportation difficulties, financial constraints, poor communication and inadequate organization of referral networks may contribute to delays in reaching or receiving appropriate care [7]. In the context of obstetric emergencies, these factors are particularly critical because some complications can progress rapidly and require immediate medical or surgical intervention.

Benin has developed national policies and operational guidelines aimed at improving the organization of maternal and neonatal care, including referral and counter-referral mechanisms [3] [5]. The national referral and counter-referral guidelines emphasize several components of a functional system, including appropriate decision-making, communication between health facilities, adequate documentation, pre-referral management, suitable transportation, accompaniment when required, preparation of the receiving facility and timely transmission of information back to the referring facility [5]. However, implementation of these standards may remain challenging, particularly in areas where geographical accessibility, transportation, communication infrastructure and health-system resources are limited.

Previous studies conducted in Benin and neighboring West African countries have documented important variations in the frequency and conditions of obstetric referrals. Studies from Parakou and other Beninese hospitals have highlighted the substantial contribution of obstetric emergencies to hospital activity [8] [9], while studies from Mali, Senegal and Burkina Faso have reported persistent challenges related to transportation, communication and the organization of obstetric evacuation systems [10]-[13]. In Benin, studies have also identified barriers to acceptance of obstetric referral and limitations in the implementation of referral pathways [14]. However, available evidence has mainly focused on referral patterns, clinical characteristics or maternal outcomes, while the quality of the entire referral and counter-referral pathway remains insufficiently documented, particularly in northern Benin. This gap is important because the referral process does not end when the woman reaches the referral hospital. Effective counter-referral is essential for maintaining continuity of care, communicating the diagnosis and treatment provided, transmitting recommendations and enabling the referring facility to participate in subsequent follow-up. Poorly functioning counter-referral may therefore weaken continuity of maternal care and limit the overall effectiveness of the referral network [5].

The northern regions of Benin present specific geographical and organizational challenges that may influence the performance of referral networks, including long distances between peripheral facilities and referral hospitals and unequal access to appropriate transportation and health-system resources. Despite these challenges, few studies have specifically evaluated the factors associated with dysfunction of both referral and counter-referral processes for obstetric emergencies in this setting [15]-[17].

We therefore conducted this study to assess the quality of the referral and counter-referral system for obstetric emergencies and to identify factors associated

with referral and counter-referral dysfunction among women referred to CHUD-B/A in northern Benin in 2022.

2. Methods

2.1. Study Design and Setting

We conducted a hospital-based cross-sectional study with prospective data collection and an analytical component at the obstetrics and gynecology emergency department of the Centre Hospitalier Universitaire Départemental du Borgou et de l'Alibori (CHUD-B/A), northern Benin. The study was conducted over a six-month period, from 1 January to 30 June 2022. The study population consisted of women presenting to the obstetrics and gynecology emergency department during the study period who had been referred or transferred from another health facility for obstetric emergency care. The CHUD-B/A is a referral hospital providing specialized obstetric and gynecological care and receiving patients referred from health facilities within the surrounding health zones.

2.2. Participants and Eligibility Criteria

All women referred or transferred to the obstetrics and gynecology emergency department of CHUD-B/A during the study period were eligible for inclusion.

Women were included if they:

- had been referred or transferred from another health facility;
- were admitted to the obstetrics and gynecology emergency department between 1 January and 30 June 2022;
- had provided consent to participate in the study.

Women whose records could not be completed because they were lost to follow-up or left the hospital before the necessary information could be collected were excluded from the final analysis.

2.3. Sampling and Sample Size

A census sampling approach was used. All eligible women referred or transferred to CHUD-B/A during the study period were consecutively enrolled. No a priori sample-size calculation was therefore performed, as the study aimed to include the entire accessible population during the predefined six-month period.

2.4. Study Variables and Outcomes

The primary outcomes were:

- referral dysfunction, defined as failure to meet the predefined quality criteria of the obstetric referral process; and
- counter-referral dysfunction, defined as failure to meet the predefined quality criteria of the counter-referral process.

The study also collected sociodemographic, geographical, organizational, clinical and process-related variables.

These included maternal age, occupation, area of residence, type of referring facility, distance between the referring facility and CHUD-B/A, consent to referral, availability and completeness of the referral form, venous access, pre-referral treatment, notification of the receiving hospital, means of transport, health-worker accompaniment, arrangements for reception, and time elapsed before initial management.

For counter-referral, variables included transmission of feedback to the referring facility, availability and completion of the counter-referral documentation, information on treatment provided and recommendations for subsequent management.

Definition and assessment of referral dysfunction: The assessment of referral quality was based on the national standards and procedures for referral and counter-referral applicable in Benin. The referral process was assessed using predefined criteria covering the main stages of the referral pathway: consent to referral; availability of a referral form; completeness of the referral form; pre-referral counseling; establishment of venous access; pre-referral stabilization; communication with the receiving facility; appropriate transport; accompaniment by a health professional when indicated; treatment during transfer; and preparation for reception and initial management at the referral hospital. For the purpose of this study, a criterion was considered adequately fulfilled when the predefined threshold of 70% was achieved. Failure to achieve this threshold was considered indicative of dysfunction for the corresponding referral component.

Definition and assessment of counter-referral dysfunction: The counter-referral process was assessed using the national referral and counter-referral standards. The following criteria were considered: availability of a counter-referral form; adequate completion of the counter-referral form; documentation of treatment provided; transmission of recommendations for continued management; and transmission of feedback to the referring facility within the expected timeframe. As for the referral process, a compliance threshold of 70% was used to identify dysfunction. Because the study evaluated several individual components of the referral pathway, the results are presented both for each criterion and for the overall assessment of referral and counter-referral dysfunction.

2.5. Data Collection

Data were collected prospectively using a structured data-collection questionnaire developed from the national referral and counter-referral standards. Information was obtained through interviews with the referred women or, when necessary, their accompanying relatives. The collected information was subsequently cross-checked and completed using the patients' medical records, referral documents, hospital registers and counter-referral records.

The data-collection process was supervised to improve completeness and consistency. Where information was unavailable, the corresponding variable was recorded as missing rather than inferred.

2.6. Statistical Analysis

Data were entered using EpiData version 3.1 and subsequently exported for analysis using Epi Info version 7.2 and Stata SE version 13.0.

Records with insufficient information to assess the main study outcomes were excluded from the final analytical population. For individual variables, missing information was retained as missing and was not replaced by an assumed value. The number of observations contributing to each analysis was reported when it differed from the total study population.

Categorical variables were summarized using frequencies and percentages. Quantitative variables were described using means and standard deviations when approximately normally distributed and, where appropriate, medians and inter-quartile ranges.

The prevalence of each referral and counter-referral quality indicator was calculated using the number of women for whom the relevant information was available as the denominator.

Bivariate analyses were performed to explore associations between potential explanatory variables and referral or counter-referral dysfunction. The Pearson χ^2 test or Fisher's exact test, as appropriate, was used for categorical variables.

Variables with a *p* value < 0.20 in the bivariate analysis were considered for inclusion in the multivariable model. Multivariable analysis was then performed to identify factors independently associated with referral and counter-referral dysfunction.

Because the outcomes were common in this study, associations were expressed as adjusted prevalence ratios (aPRs) with 95% confidence intervals (CIs) rather than odds ratios. Statistical significance was defined as a two-sided *p* value < 0.05.

2.7. Ethical Considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki and applicable national requirements for research involving human participants. Administrative authorization was obtained from the CHUD-B/A and the relevant hospital authorities. Written informed consent was obtained from eligible participants before enrolment. Confidentiality was maintained throughout the study. Data were collected and analyzed anonymously and were used exclusively for research purposes, in accordance with Law No. 2009-09 of 22 May 2009 on the protection of personal data in the Republic of Benin. The research proposal received approval from the administrative authorities of the Ordre de Malte hospital and from the local ethics committee of the University of Parakou, under reference: 0404/CLERB-UP/P/SP/R/SA.

3. Results

3.1. Study Population

Between 1 January and 30 June 2022, 1735 women were admitted to the obstetrics and gynecology emergency department of CHUD-B/A. Of these, 919 (52.9%)

were referred or transferred from another health facility. Six records were excluded because of incomplete information or incomplete follow-up, leaving 913 women in the final analytical population (**Figure 1**).

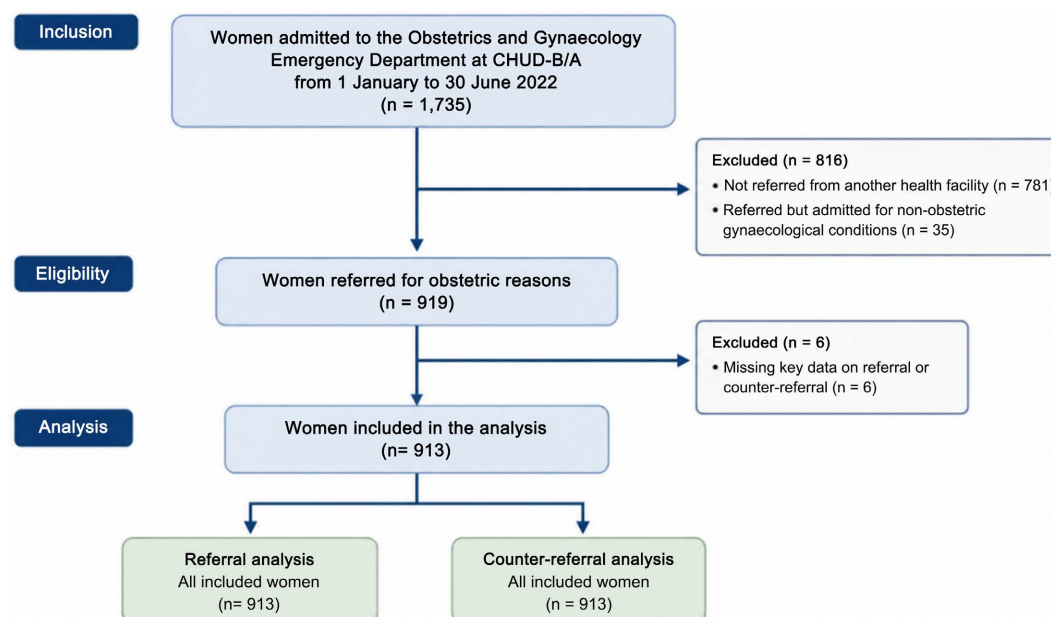


Figure 1. Flow diagram of women admitted, referred/transferred, excluded and included in the final analysis at CHUD-B/A, January-June 2022.

The mean age of the participants was 26.8 ± 6.6 years (range, 14 - 57 years). Women aged 20 - 29 years constituted the largest age group (483/913; 52.9%). Housewives were the most represented occupational group (405/913; 44.4%). Most women were referred from public health facilities (785/913; 86.0%) and from urban areas (580/913; 63.5%). The referring facility was located more than 10 km from CHUD-B/A for 336 women (36.8%).

Overall, 838 women (91.8%) had consented to referral. A referral form was available for 746 women (81.7%), while a standard Ministry of Health referral form was available for 404 (44.2%). Among women for whom a referral form was available, 633 (84.9%) had adequately completed documentation. The sociodemographic and referring-facility characteristics of the study population are presented in **Table 1**.

Table 1. Sociodemographic characteristics and characteristics of referring facilities among women referred to CHUD-B/A, 2022 (N = 913).

	n	%
Age group, years		
<20	126	13.8
20 - 29	483	52.9
30 - 39	245	26.8
≥40	59	6.5

Continued

Occupation		
Housewife	405	44.4
Student	174	19.1
Farmer	142	15.6
Trader	107	11.7
Other	85	9.3
Type of referring facility		
Public	785	86.0
Private	128	14.0
Area of origin		
Urban	580	63.5
Rural	333	36.5
Distance to CHUD-B/A		
<5 km	529	57.9
5 - 10 km	48	5.3
>10 km	336	36.8
Consent to referral		
Yes	838	91.8
No	75	8.2

3.2. Referral Process and Conditions of Transfer

Among the 913 referred women, 654 (71.6%) had venous access established before transfer. Only 63 (6.9%) had documented emergency treatment or stabilization during the pre-referral period or transfer. Most women were transferred using non-medicalized transport (813/913; 89.1%), while 100 (11.0%) benefited from medicalized transport. Motorcycles were the most frequently used means of transport (642/913; 70.3%), followed by ambulances (93/913; 10.2%) and taxis or tricycles (88/913; 9.6%). Only 13 women (1.4%) were accompanied by a health professional during transfer. Prior notification of CHUD-B/A was documented for only 161 women (17.6%), whereas 752 (82.4%) arrived without prior notification. Specific arrangements for receiving the patient had been made in 141 cases (15.4%). Among the 913 women, 539 (59.0%) received initial care within 10 minutes of arrival, while 374 (41.0%) waited at least 10 minutes before receiving initial care. The mean duration of stay at the referring facility before transfer was 1.82 ± 2.88 hours among women transferred within 24 hours, with a median of 1 hour. Among women transferred after 24 hours, the mean duration was 2.04 ± 2.23 days, with a median of 1 day. The distribution of the main conditions and quality indicators of the referral process is presented in **Table 2**.

Table 2. Conditions of transfer and compliance with predefined quality criteria for the referral process among women referred to CHUD-B/A, 2022 (N = 913).

	Category	n	%
Consent to referral (N = 913)	Yes	838	91.79
	No	75	8.21
Referral form available (N = 913)	Yes	746	81.71
	No	167	18.29
Standard referral form available (N = 913)	Yes	404	44.24
	No	509	55.76
Referral form adequately completed* (N = 746)	Yes	633	84.85
	No	113	15.15
Venous access established before transfer (N = 913)	Yes	654	71.63
	No	259	28.37
Pre-referral treatment provided (N = 913)	Yes	63	6.90
	No	850	93.10
Receiving hospital notified before transfer (N = 913)	Yes	161	17.63
	No	752	82.37
Type of transport (N = 913)	Medicalized	100	10.95
	Non-medicalized	813	89.05
Means of transport (N = 913)	Motorcycle	642	70.32
	Ambulance	93	10.19
	Taxi/tricycle	88	9.64
	Fire brigade vehicle	63	6.90
	Private vehicle	20	2.19
	SMUR	7	0.77
Health professional accompanying the patient (N = 913)	Yes	13	1.42
	No	900	98.58
Treatment during transfer (N = 913)	Yes	63	6.90
	No	850	93.10
Arrangements made for reception at CHUD-B/A (N = 913)	Yes	141	15.44
	No	772	84.56
Time before initial management (N = 913)	<10 min	539	59.04
	≥10 min	374	40.96

*Denominator: women for whom a referral form was available (n = 746).

The lowest levels of compliance concerned health-professional accompaniment (1.4%), documented treatment during transfer (6.9%), prior notification of the receiving hospital (17.6%), medicalized transport (11.0%), and arrangements for reception at the referral hospital (15.4%). In contrast, compliance was higher for consent to referral (91.8%), availability of a referral form (81.7%), adequate completion of the available referral form (84.9%), and establishment of venous access (71.6%) (**Figure 2**).

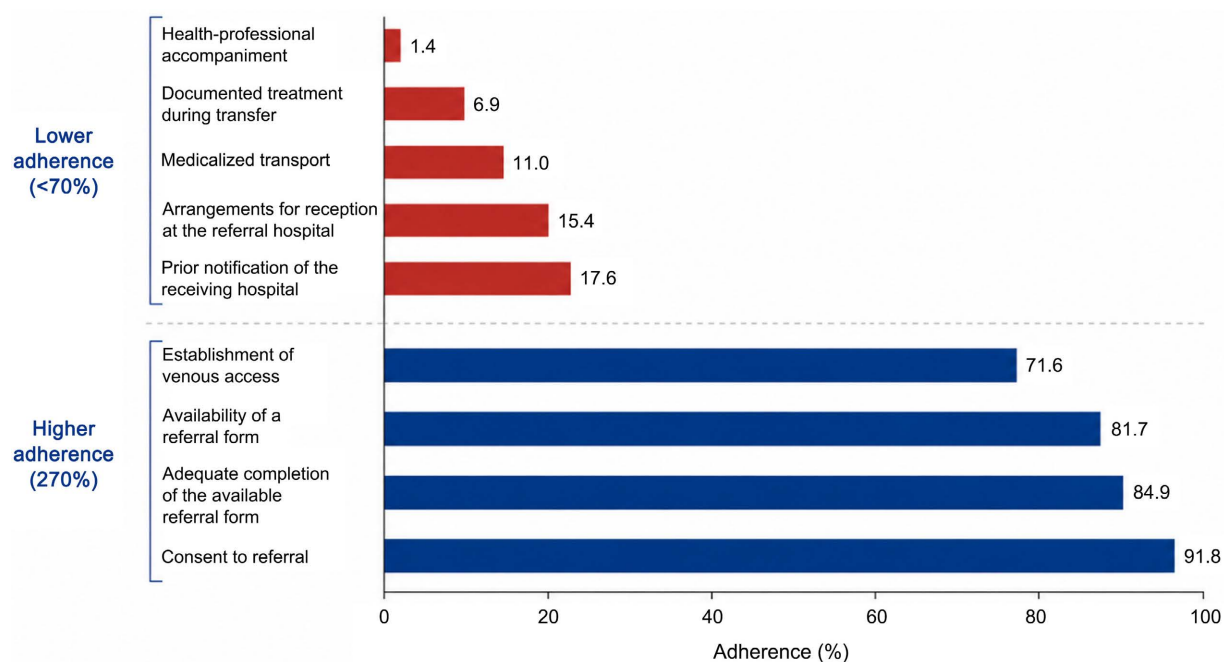


Figure 2. Adherence to key components of the obstetric referral system (N = 913).

3.3. Maternal Outcomes and Counter-Referral

Table 3. Maternal outcomes, duration of hospitalization and counter-referral indicators among women referred to CHUD-B/A, 2022 (N = 913).

	n	%
Maternal outcome		
Discharged alive	820	89.8
Discharged against medical advice	40	4.4
Absconded	16	1.8
Died	37	4.1
Duration of hospitalization		
<7 days	747	81.8
≥7 days	103	11.3
Not documented	63	6.9
Documented maternal complications*		
Sepsis	80	43.2
Hemorrhagic complications	45	24.3
Anemia	30	16.2
Other complications	30	16.2
Counter-referral		
Feedback sent to referring facility	323	35.4
Treatment information documented	298	32.6
Standard counter-referral form available	132	14.5
Recommendations documented	38	4.2

At the end of hospitalization, 820 women (89.8%) were discharged alive after clinical stabilization. Forty women (4.4%) left the hospital against medical advice, 16 (1.8%) absconded before formal discharge, and 37 (4.1%) died. Thus, the four recorded maternal outcomes accounted for the entire study population. The median duration of hospitalization was 4 days. Overall, 747 women (81.8%) were hospitalized for less than 7 days, while 103 (11.3%) remained hospitalized for 7 days or longer. Duration of hospitalization was not documented in 63 cases (6.9%). Among women with documented maternal complications, the most frequently reported complications were sepsis (43.2%), hemorrhagic complications (24.3%), and anemia (16.2%). The counter-referral process showed substantial deficiencies. Documented feedback to the referring facility was available for only 323 women (35.4%). Treatment information was documented for 298 women (32.6%), while a standard counter-referral form was available for 132 (14.5%). Specific recommendations for continued management at the referring facility were documented in only 38 women (4.2%). Maternal outcomes, duration of hospitalization and counter-referral indicators are presented in **Table 3**.

3.4. Factors Associated with Referral Dysfunction

In multivariable analysis, several characteristics were independently associated with referral dysfunction. Maternal age was significantly associated with referral dysfunction ($p = 0.035$), with a higher prevalence of dysfunction observed among younger women. The type of referring health facility was also associated with referral dysfunction ($p = 0.006$). Women referred from private facilities had a higher prevalence of referral dysfunction than those referred from public facilities (adjusted prevalence ratio [aPR] 1.14, 95% CI 1.06 - 1.24). Distance between the referring facility and CHUD-B/A was significantly associated with referral dysfunction ($p = 0.018$), with increasing distance associated with a higher prevalence of dysfunction. Rural origin was independently associated with referral dysfunction ($p = 0.033$); women originating from rural areas had a higher prevalence of referral dysfunction than those from urban areas (aPR 1.08, 95% CI 1.01 - 1.16). The time elapsed before initial management was also associated with referral dysfunction ($p = 0.004$). Women who waited at least 10 minutes before receiving initial care had a higher prevalence of referral dysfunction (aPR 1.11, 95% CI 1.04 - 1.19).

3.5. Factors Associated with Counter-Referral Dysfunction

Distance between the referring facility and CHUD-B/A was strongly associated with counter-referral dysfunction ($p < 0.001$), with longer distances associated with a higher prevalence of dysfunction. Rural origin was also associated with counter-referral dysfunction ($p = 0.002$). Women from rural areas had a higher prevalence of counter-referral dysfunction than those from urban areas (aPR 1.21, 95% CI 1.07 - 1.36). Maternal outcome was significantly associated with counter-referral dysfunction ($p < 0.001$). Counter-referral dysfunction was more frequent among women who died during hospitalization (aPR 1.79, 95% CI 1.62 - 1.98).

The complete multivariable analysis of factors associated with referral and counter-referral dysfunction is presented in **Table 4**.

Table 4. Factors independently associated with referral and counter-referral dysfunction among women referred to CHUD-B/A, 2022.

Factor	Referral	p value	Counter-referral	p value
	dysfunction aPR (95% CI)		dysfunction aPR (95% CI)	
Younger age	1.07 (1.01 - 1.14)	0.035	—	—
Private referring facility	1.14 (1.06 - 1.24)	0.006	—	—
Increasing referral distance	1.05 (1.01 - 1.10)	0.018	1.08 (1.04 - 1.13)	<0.001
Rural origin	1.08 (1.01 - 1.16)	0.033	1.21 (1.07 - 1.36)	0.002
Initial care $\geq$ 10 min	1.11 (1.04 - 1.19)	0.004	—	—
Maternal death	—	—	1.79 (1.62 - 1.98)	<0.001

4. Discussion

This study assessed the functioning of the obstetric referral and counter-referral system among women referred to CHUD-B/A in northern Benin. More than half of the women admitted to the obstetrics and gynecology emergency department had been referred from another health facility. Although some components of the referral process showed relatively high compliance, particularly consent to referral, availability of referral documentation and establishment of venous access, important deficiencies were observed in communication between facilities, medicalized transportation, health-worker accompaniment, preparation for reception at the referral hospital and continuity of information after hospital management. Counter-referral appeared particularly weak, with limited documentation of treatment and very low transmission of recommendations to referring facilities. Several factors were independently associated with referral dysfunction, including younger age, referral from a private facility, greater distance from the referral hospital, rural origin and delayed initial management. Distance and rural origin were also associated with counter-referral dysfunction, while maternal death was associated with a higher prevalence of counter-referral dysfunction.

4.1. Burden of Obstetric Referrals

In this study, referred or transferred women represented 52.9% of all women admitted to the obstetric and gynecological emergency department. This proportion is comparable to the 51.5% reported by Tchaou *et al.* among obstetric emergencies managed at the University Hospital of Parakou [8]. It is higher than proportions reported in several studies from West Africa, including those conducted in Mali, Senegal and Burkina Faso [9]-[11]. These differences may reflect variations in the organization of referral networks, the geographical distribution of health facilities, accessibility to emergency obstetric care and the criteria used to define a referral or evacuation. They may also reflect differences in the level of the receiving facility and in the populations served. Nevertheless, the high proportion of referred women

observed in the present study underlines the central role of CHUD-B/A within the regional obstetric care network. A high referral burden is not necessarily an indicator of poor performance. A functional referral system should enable women with complications that cannot be managed at peripheral facilities to reach an appropriate level of care. The critical issue is therefore not simply the proportion of women referred, but whether referral occurs in a timely, coordinated and clinically appropriate manner. This distinction is particularly important in obstetric emergencies, where delays may rapidly affect maternal and fetal outcomes [6] [7].

4.2. Quality of the Referral Process

The findings indicate substantial heterogeneity in the quality of the referral pathway. Consent to referral was obtained in 91.8% of cases and a referral form was available for 81.7%. These findings suggest that the formal decision to refer and basic referral documentation were relatively well established. However, other components of the referral process were considerably weaker. Only 17.6% of women had been announced to the receiving hospital before transfer, 15.4% had documented arrangements for reception, and only 1.4% were accompanied by a health professional. Medicalized transportation was also uncommon. These findings are consistent with the difficulties described in the national referral and counter-referral guidelines, which emphasize communication between facilities, appropriate transportation, pre-referral management and preparation of the receiving facility as essential components of an effective referral system [5]. The problem therefore appears less related to the formal decision to refer than to the operational coordination of the transfer.

The predominance of non-medicalized transportation is particularly important. In our study, almost nine out of ten women were transferred using non-medicalized transport, and motorcycles were the most common means of transportation. This contrasts with studies from settings where ambulance-based evacuation is more developed [13] [18]. For example, Traoré reported that more than half of obstetric referrals or evacuations in Mali were performed by ambulance, whereas health-worker accompaniment remained limited [2]. Other studies have also demonstrated substantial variability in the means of transportation used for obstetric evacuation [9] [10]. The predominance of motorcycles in the present study may partly reflect the geographical and socioeconomic context of northern Benin, where motorcycles are widely accessible and may be faster or more readily available than formal ambulance services. However, they provide limited capacity for monitoring, stabilization and emergency treatment during transfer. Thus, the accessibility advantage of motorcycles does not necessarily translate into a safe obstetric transfer.

4.3. Communication and Preparation for Reception

One of the most important findings was the low proportion of women for whom

CHUD-B/A had been notified before transfer. Only 17.6% of women were announced to the receiving facility, and arrangements for reception were documented in only 15.4%. This represents a critical weakness because referral is a process involving at least two facilities rather than a simple physical movement of a patient. Advance communication allows the receiving team to anticipate the patient's arrival, mobilize personnel and equipment and prepare for emergency interventions. The absence of such communication may contribute to delays after arrival, particularly when several emergency patients are simultaneously managed.

In the present study, 41.0% of women waited at least 10 minutes before receiving initial care. Although 10 minutes is a relatively short interval in comparison with total hospitalization time, it may be clinically relevant in women presenting with severe hemorrhage, eclampsia, sepsis or other rapidly progressive obstetric emergencies. The observed association between a waiting time of at least 10 minutes and referral dysfunction supports the importance of considering the entire referral pathway rather than focusing exclusively on the journey from the referring facility to the hospital. This finding is consistent with the third component of the three-delays framework, which concerns delays in receiving appropriate care after arrival at a health facility [6].

4.4. Geographical Accessibility and Rural Origin

Distance from the referring facility to CHUD-B/A was independently associated with referral dysfunction. Rural origin was also associated with both referral and counter-referral dysfunction. These findings are biologically and organizationally plausible. Greater distance increases travel time and exposes patients to a greater number of potential barriers, including poor road conditions, limited transportation availability and communication difficulties. The geographical dimension of access is particularly relevant in rural settings, where health facilities may have fewer qualified staff, fewer emergency resources and weaker transport links. Previous work has similarly demonstrated the importance of distance and accessibility in maternal healthcare utilization and referral outcomes [1] [7] [15] [17]. The three-delays framework also identifies the ability to reach an appropriate health facility as a major determinant of maternal outcome [6]. Importantly, distance itself cannot easily be modified in the short term. However, its consequences can be reduced through better organization of referral networks, decentralized emergency stabilization, reliable communication systems, strategically positioned ambulances, improved road access and clear protocols for rapid transfer. The national referral guidelines provide an organizational framework for these interventions [5]. The association between rural origin and counter-referral dysfunction is also noteworthy. A referral system may function reasonably well for transferring a woman towards a higher-level facility while failing to maintain communication with the original facility after discharge. This suggests that geographical barriers affect not only emergency transfer but also continuity of care.

4.5. Weaknesses of the Counter-Referral System

Counter-referral was the weakest component of the system assessed in this study. Only 35.4% of women had documented feedback to the referring facility, treatment information was documented in 32.6%, and recommendations for continued care were recorded in only 4.2%. These findings suggest that the referral pathway is largely unidirectional: peripheral facilities send patients to the referral hospital, but information does not consistently return to the referring facility. Such a system compromises continuity of care and limits opportunities for learning, follow-up and coordination between levels of the health system. The national referral and counter-referral guidelines explicitly recognize the need for feedback and appropriate documentation [5]. The deficiencies observed in the present study may therefore indicate an implementation gap rather than an absence of formal standards. Traoré's study in Mali reported that counter-referral documentation was returned to referring facilities within one to two months in most cases [2]. Although the health-system context differs, this comparison illustrates that counter-referral mechanisms can be operationalized even in resource-constrained settings. Several factors may contribute to the weakness observed in the present study, including the absence of a clearly designated person or unit responsible for counter-referral, insufficient staffing, competing clinical priorities, inadequate documentation practices and the absence of an efficient mechanism for transmitting information to peripheral facilities. Strengthening counter-referral should therefore involve not only the provision of forms but also clear responsibility, standardized procedures, monitoring indicators and reliable communication channels [19].

4.6. Factors Associated with Referral Dysfunction

Younger maternal age was associated with referral dysfunction. The original study interpretation suggested that younger women may be more dependent on partners or relatives when decisions involving referral and transportation costs must be made. Such an explanation is plausible, but the cross-sectional design does not allow this mechanism to be established directly. This finding should therefore be interpreted cautiously. Age may act as a marker for other social and economic factors, including parity, autonomy in healthcare decision-making, socioeconomic status or dependence on family members. Further studies incorporating these variables would be useful to clarify this association. Referral from a private facility was also associated with a higher prevalence of referral dysfunction. This finding may reflect differences in integration between private facilities and the formal referral network. Private facilities may have variable access to training, communication systems, referral protocols and institutional support. However, the present study did not directly measure these organizational characteristics, and therefore this explanation remains a hypothesis. The finding supports the need to ensure that referral standards apply consistently across both public and private health facilities. Training, supervision and integration of private providers into district referral networks may be particularly important.

4.7. Factors Associated with Counter-Referral Dysfunction and Maternal Death

Distance and rural origin were independently associated with counter-referral dysfunction, reinforcing the importance of geographical accessibility throughout the continuum of care. Maternal death was also strongly associated with counter-referral dysfunction. This association should be interpreted carefully because causality cannot be inferred from this cross-sectional analysis. In particular, counter-referral cannot logically be considered the cause of a death that occurred during the index hospitalization. Rather, the association may indicate that women who died had more severe complications, more complex care pathways or circumstances in which standard counter-referral procedures were not completed. This distinction is important because the observed association may reflect reverse causation or confounding by severity. Future studies should therefore examine whether characteristics of the referral process are associated with maternal death after adjustment for the severity and type of obstetric complication.

4.8. Implications for Health-System

Taken together, the findings suggest that improving obstetric referral in northern Benin requires a system-level approach rather than isolated interventions. First, communication between referring and receiving facilities should be strengthened through reliable and low-cost communication mechanisms. Second, pre-referral stabilization should be systematically implemented, with clear protocols for emergency treatment before transfer. Third, access to appropriate transportation should be improved, particularly for women living far from referral hospitals [19]. Fourth, receiving facilities should develop mechanisms for rapid identification and reception of referred women. Finally, counter-referral should be incorporated into routine quality monitoring. Indicators such as the proportion of patients for whom feedback is transmitted, the completeness of counter-referral documentation and the proportion receiving documented follow-up recommendations could be regularly monitored. These interventions are consistent with the national strategy for reducing maternal and neonatal mortality in Benin and with the national referral and counter-referral guidelines [3] [5] [20].

4.9. Study Limitations

In this study, the prospective data collection and exhaustive inclusion of eligible referred women during the study period reduced the risk of selection bias within the study population. The use of predefined referral and counter-referral criteria based on national standards also allowed the different components of the referral pathway to be assessed systematically. Several limitations should nevertheless be considered. First, this was a single-center, hospital-based cross-sectional study, which limits the generalizability of the findings to other health zones or referral hospitals in Benin. Second, some variables relied on information obtained from patients, relatives or referral documents and may therefore be subject to recall or

documentation bias. Third, the use of a 70% compliance threshold was operationally useful but does not necessarily reflect the clinical importance of each individual criterion; failure to meet one criterion may have very different consequences from failure to meet another. Fourth, the observational design prevents causal inference regarding the associations identified. In particular, the association between counter-referral dysfunction and maternal death should not be interpreted as evidence that poor counter-referral caused maternal death. Finally, some variables had missing information, although these were retained as missing rather than replaced by assumed values.

5. Conclusion

This study identified important weaknesses in the functioning of the obstetric referral and counter-referral system in northern Benin. While consent to referral and basic referral documentation were relatively well implemented, major deficiencies affected communication between facilities, transportation, health-worker accompaniment, preparation for reception and, particularly, counter-referral. Geographical accessibility and rural origin were important determinants of dysfunction, highlighting the need to strengthen the organization of referral networks beyond the receiving hospital. Improving communication, pre-referral stabilization, emergency transportation, reception procedures and systematic counter-referral could contribute to a more coordinated continuum of obstetric care and potentially reduce avoidable delays in emergency management.

Author Contributions

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Contributed to the interpretation of the findings, critically reviewed the manu-

script, approved the final version, and agreed to be accountable for all aspects of the work.

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Conflicts of Interest

The authors disclose not competing any conflict of interest.

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