

# Neonatal Transfer Situation Following Implementation of a Perinatal Network: An Analysis in Douala, Cameroon

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## Abstract

**Background:** Postnatal transfer (PT) is interhospital transport of care-needing newborns. In 2016, a perinatal network was implemented to facilitate PT in the town of Douala, Cameroon. The network was supposed to improve PT-related care standards. This study aimed at determining characteristics of PT five years following the implementation of this network. **Methods:** A cross-sectional study was carried out from February to May 2021 at neonatology wards of six hospitals in Douala. Medical records of newborns transferred to the hospitals were scrutinized to document their characteristics. Parents were contacted to obtain information on PT route and itinerary. Data were analyzed using Epi Info software and summarized as percentages, mean and odds ratio. **Results:** In total, 234 of the 1159 newborns admitted were transferred, giving a PT prevalence of 20.2% (95% CI 17.9% - 22.6%). Male-to-female ratio of the transferred newborns was 1.3. Neonatal infection (26.5%), prematurity (23.5%) and respiratory distress (15.4%) were the main reasons for transfer. Only 3% of the PT was medicalized while only 2% of the newborns were transferred through perinatal network. On admission, hypothermia and respiratory distress were found in 31% and 35% of the newborns, respectively. The mortality rate among babies was 20% and these had a two-fold risk of dying (95% CI 1.58 - 3.44,  $p < 0.0001$ ). **Conclusion:** PT and the perinatal network are lowly organized and implemented in Douala. Sensitization of medical staff on in utero transfer, creating center for coordination of the

network, and implementation of neonatal transport system could improve the quality of PT.

## Keywords

Postnatal Transfer, Perinatal Network, Characterization, Douala

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## 1. Introduction

According to the World Health Organization (WHO), neonatal period goes from birth to 28<sup>th</sup> day of life [1]. Postnatal transfer (PT) is greatly helpful for optimal management of newborns requiring to be transferred to health facilities with better quality healthcare services [2] [3]. Transfer relies on a gradation of care services and the main reasons for PT include prematurity, neonatal infections and surgical pathologies [3] [4]. Again, prematurity, neonatal infection and asphyxia account for the bulk of mortality cases in transferred babies, and are involved in 80% of neonatal deaths worldwide [5] [6].

In 2006, French Government released a circular on principles guiding the implementation of perinatal networks [7]. In Canada, ambulances allow newborns to be transported from local emergency medical services to intensive care units [8]. In 2019, prevalence of PT was 20% in Japan with perinatal network and medicalized transport used in 62% and 92 of the transfers, respectively [9]. In France, 20% of pre-term births were reported in health facilities (HF) with both no neonatology wards and requirement for PT [10].

In developing countries, PT patterns are contrasted. A study conducted in Tunisia reported prevalence of 6%, medicalized transport in 47% and mortality of 8% [11]. In Senegal, PT was performed using ambulances in 30% of the transferred newborns and mortality rate of 22% was found [12]. In The Democratic Republic of Congo, 13% of newborns were transported, among them 92% were transported through public transport means [13].

In 2016, it was reported that 53% of newborns underwent PT and 20% of them were deceased, in the town of Yaoundé, Cameroon [14]. In December 2016, a perinatal network was implemented in Yaoundé and Douala to improve PT conditions [15]. With the final aim to improve PT quality and perinatal network, we conducted a study to identify bottlenecks of PT and determine mortality risk of transferred newborns in the town of Douala.

## 2. Methods

### 2.1. Study Design and Sites

From 1<sup>st</sup> February to 31<sup>st</sup> May 2021, a cross-sectional study was conducted at neonatology wards of six Government reference HF in Douala, Littoral Region, Cameroon. Health system in the country is pyramidal and neonatology wards of various standards are included [16]. Reference hospitals included are described

as follows:

- Douala General Hospital (DGH) which is first category hospital endowed with neonatology unit offering resuscitation and intensive cares with 15 baby incubators, 6 cradles and 6 pediatricians;
- Douala Gyneco-Obstetrics and Pediatrics hospital (DGOPH) is also a first category health facility whose neonatology unit has 12 incubators and 10 cradles with a staff composed of four pediatricians and one neonatologist;
- Douala Laquintinie hospital (DLH) is a second category hospital with 8 baby incubators, 24 cradles and 4 pediatricians.

These three HF receive most of transferred newborns in Douala as they have the best and well-equipped maternities and neonatology services allowing for management of newborns in critical state.

Three fourth category District hospitals with facilities to manage pathologies and disorders commonly seen in neonatology were also included. These hospitals are important as they help in unclogging first and second category hospitals. These include:

- Bonassama District hospital (BDH) comprising 2 incubators, 8 cradles and 2 pediatricians;
- Nylon District hospital (NDH) with 2 incubators, 7 cradles and 2 pediatricians;
- Deido District hospital (DDH) having 4 incubators, 11 cradles and 2 pediatricians including 1 neonatologist.

## 2.2. Study Population

The study was focused on newborns transferred and admitted at neonatology wards of the above mentioned hospitals. We excluded newborns not transferred during the investigation, deceased during transport and those whose parents refused to take part in the study. Newborns were selected randomly and enrolled consecutively to avoid selection and information bias. The Minimum sample size of 200 newborns was required for the study based on Lorentz's formula by using a PT prevalence of 15.4% reported earlier [17],  $n = Z^2 \times p \times (1-p)/d^2$ , where  $n$  = the required sample size,  $Z$  = statistic for the desired confidence level ( $Z = 1.96$  for 95% confidence level),  $p$  = assumed PT prevalence, and  $d$  = accepted margin of error (5%).

## 2.3. Data Collection

Authorization and Ethical clearance were issued respectively by the manager of the health facility and ethical committee of the University of Douala. Thereafter, research project was submitted to caregiving staff. Eligible newborns were identified based on reviewing of admission forms and then informed consent was obtained from parents. Medical records of the included babies were scrutinized. Parents were asked on transport conditions and itinerary before admission at HF. Clinical examination of newborns was made on admission by a medical

doctor to obtain data including: reason of transfer, temperature and respiratory distress signs. Whether perinatal network was used for PT was also sought. A summary of data collected for each newborn is presented in **Table 1**.

## 2.4. Perinatal Network in Douala

This network was created in December 2016 in the town of Douala. It comprises of 121 members including 2 administrators whose activities are voluntary. Members dedicated in management of mothers and newborns are recruited in public, private and confessional HFs. Communications are made day and night through the WhatsApp social media and thus each member is requested to own android phone and internet connection. This network lacks a coordination central unit and does not own proper transport means that can facilitate PT. The network aims at 1) giving information on availability of places at HF, 2) ensuring communication between HFs during PT, and 3) sharing helpful information for neonatal and maternal health.

## 2.5. Operational Definitions

- Medicalized transport: Newborn is accompanied with a caregiver and transported using an ambulance.
- Non-medicalized transport: utilization of taxi, motorcycles or personal vehicle to transport newborns even a caregiver is present.
- Initial contact: Notification of the HF through direct phone call or perinatal

**Table 1.** Variables collected in the study.

Data	Types of variables	Sources
Perinatal data	<ul style="list-style-type: none"> <li>• Age</li> <li>• Gender</li> <li>• Gestational age</li> <li>• Route of delivery</li> <li>• Adaptation to birth</li> <li>• Birthweight</li> </ul>	Medical records
Transfer data	<ul style="list-style-type: none"> <li>• Reasons of transfer</li> <li>• Transfer conditions</li> <li>• Utilization of perinatal network</li> </ul>	Medical records, declaration of parent, declaration of medical staff
Clinical data on admission	<ul style="list-style-type: none"> <li>• Reasons of transfer</li> <li>• Temperature</li> <li>• Respiratory distress</li> </ul>	Medical records
Outcome data	<ul style="list-style-type: none"> <li>• Recovery</li> <li>• Discharge against medical advice</li> <li>• Death and mortality rate</li> <li>• Counter-reference</li> </ul>	Medical records

network for requirement of a PT.

- Transferred/Referred: The newborn is transferred from one HF to another one.
- Therapeutic itinerary: Number of HF attended after initiating PT and before admission for hospitalization.

## 2.6. Ethical Approval

Authorizations were obtained from ethical committees of each HF. In addition, ethical clearance was issued by the institutional review board of the University of Douala (N° 2664). Data were collected in accordance with standards of medical research in Cameroon.

## 2.7. Statistical Analysis

Data were keyed and analyzed using the Epi Info 7 software. Qualitative variables were presented as percentage while quantitative variables were summarized as mean  $\pm$  standard deviation (SD). Pearson's independence chi-square test was used to compare percentages. Mean were compared using unpaired t test. The risk of death among transferred newborns was determined by computing relative risk (RR), odds ratio (OR) along with confidence interval at 95% (95% CI) and probability value. Level of statistical significance was set at  $p$ -value  $< 0.05$ .

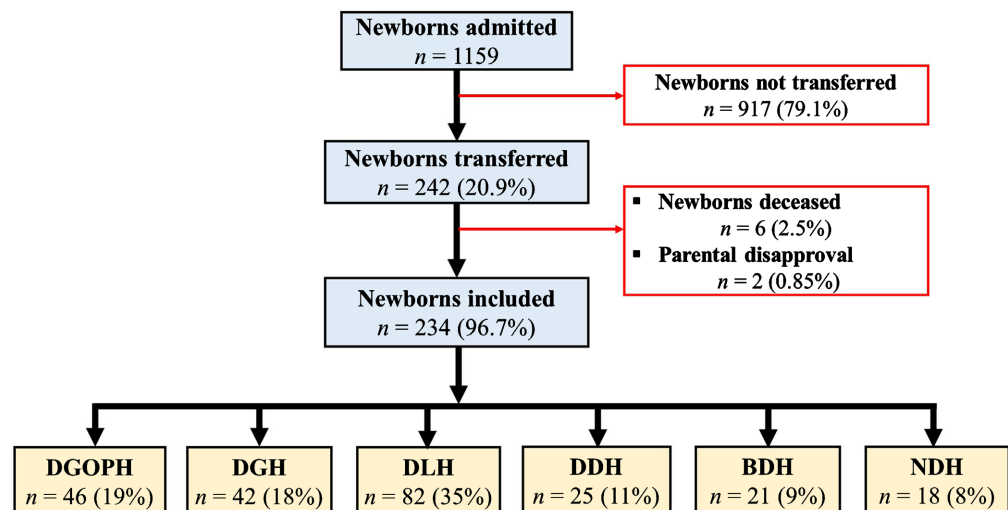
## 3. Results

### 3.1. Study Population

Out of the 1159 newborns admitted at the neonatology wards of study sites, 234 (20.2%) were transferred and thus included in the study (**Figure 1**).

### 3.2. Sociodemographic and Perinatal Characteristics

At the time of transfer, 137 (59%), 68 (29%) and 29 (12%) of newborns were



**Figure 1.** Flow diagram depicting the inclusion of newborns.

aged 1 - 7 days, <24 hours and >8 hours, respectively. Males accounted for 57% of the transferred babies, giving a male-to-female ratio of 1.3. Pre-term births represented 17% of all births while 39% and 26% of the transferred babies had APGAR score < 7 and birthweight comprised between 1500 and 2400 g (Figure 2).

### 3.3. Prevalence and Reasons of Postnatal Transfer

The overall prevalence of PT was 20.2% (95% CI 17.9% - 22.6%) across all the study sites. A total of 11 pathologies and disorders were causes of PT with mainly neonatal infection (26.5%,  $n = 62$ ), prematurity (23.5%,  $n = 55$ ) and respiratory distress (15.1%,  $n = 36$ ) (Figure 3).

### 3.4. Conditions of the Transfer and Clinical Status on Admission

Table 2 presents conditions of the PT and clinical evaluation of transferred newborns on admission at the study HFs. More than 90% of the transferred newborns were accompanied by their parents. About 78.63% of the newborns

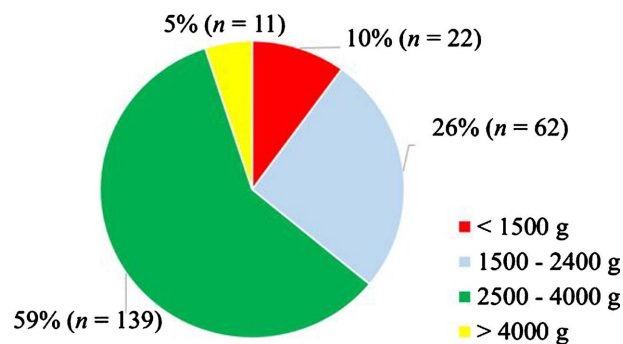


Figure 2. Birthweight distribution of the transferred newborns.

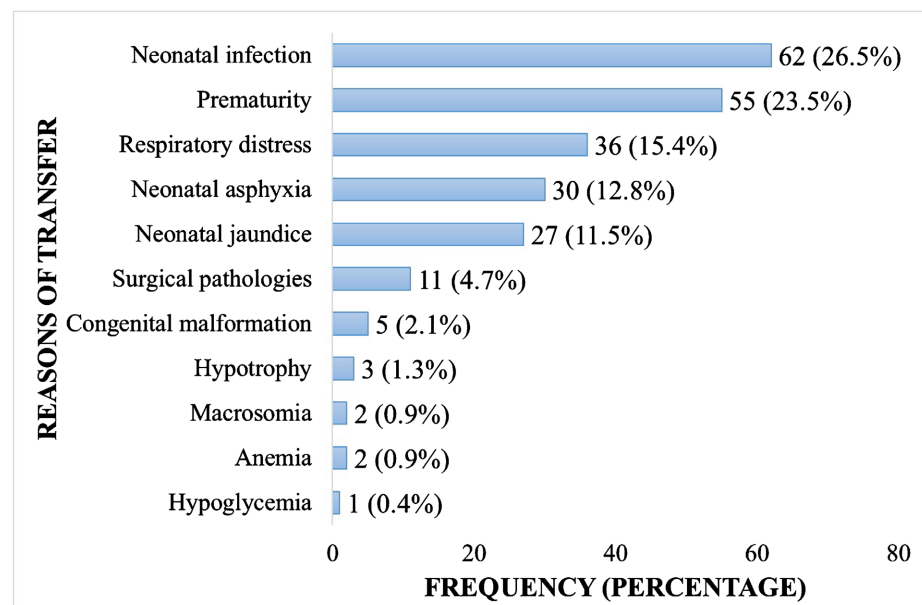


Figure 3. Reasons of postnatal transfer.

**Table 2.** Characteristics of transport and clinical details of the transferred newborns.

Variables	Categories	<i>n</i>	%
Resuscitation before transfer	Yes	63	26.9
	No	171	73.1
Initial contact before transfer	Yes	50	21.4
	No	184	78.6
Availability of transfer form	Yes	131	56.0
	No	103	44.0
Accompanier present during transfer	Medical staff	18	7.7
	Parents	216	92.3
Detour to another facility before admission	0	188	80.3
	1	39	16.7
	≥2	7	3.0
Communication during transfer	Yes	50	21.4
	No	184	78.6
Transport mode	Medicalized	6	2.6
	Non-medicalized	228	97.4
Respiratory distress	Yes	87	37.2
	No	147	62.8
Temperature on admission	Normothermia	104	44.4
	Hypothermia	70	29.9
	Hyperthermia	29	29.9

were not announced before transfer to HFs. About 16.7% of the newborns overcome a detour to another health facility before admission at the study sites. Transport was not medicalized in 97.4% of the babies, and 29.9% were suffering from hypothermia on admission. More than one third (37.2%) of babies were suffering from respiratory distress on admission.

### 3.5. Utilization of the Perinatal Network

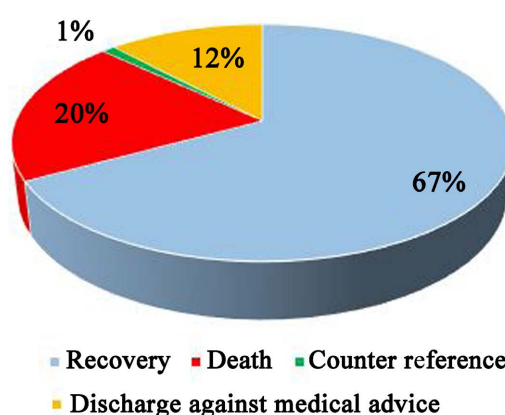
The perinatal network was lowly (2%) used and concerned DGOPH and DGH with rates of 8.7% and 2.3%, respectively (Table 3). The perinatal network was not used at the DLH, BDH, DDH and NDH facilities.

### 3.6. Outcome, Mortality Rate and Mortality Risk

Of the 234 newborns referred to the study HFs, 46 (20%) are deceased. Evolution of these babies was depicted in Figure 4. Based on logistic regression analysis, the odds of mortality were 2.33 times higher in transferred newborns compared to their counterparts who didn't need transfer (95% CI 1.58 – 3.11,  $p < 0.0001$ )

**Table 3.** Utilization frequency of the perinatal networks by study sites.

Study sites	Total number of transferred newborns	Perinatal network used	%
DGOPH	46	4	8.7
DGH	42	1	2.3
DLH	82	0	0.0
BDH	21	0	0.0
DDH	25	0	0.0
NDH	18	0	0.0
<b>Total</b>	<b>234</b>	<b>5</b>	<b>2.1</b>

**Figure 4.** Outcomes of the transferred newborns at study sites.**Table 4.** Mortality risk in transferred newborns.

Transferred newborn	N	Deaths n (%)	RR (95% CI)	p-value	OR (95% CI)	p-value
No	917	87 (8.49%)	1		1	
Yes	234	46 (19.6%)	2.07 (1.57 - 3.06)	< 0.0001*	2.33 (1.58 - 3.44)	< 0.0001*

RR: Relative risk, OR: Odds ratio, 95% CI: Confidence interval at 95%. \*Statistically significant at  $p$ -value less than 0.05.

(**Table 4**). Similar results were found based on computation of the RR for mortality (RR = 2.07,  $p < 0.0001$ ).

## 4. Discussion

### 4.1. Prevalence of Neonatal Transfer

The present study aimed at describing PT at selected Government hospitals in Douala, Cameroon. Prevalence of PT was 20.2% and this is consistent with that reported earlier by Katsuya *et al.* in Japan (20.5%) and Omoigberale *et al.* in Benin (15.4%) [9] [17]. In contrast, higher prevalence values were reported in Nigeria (50.9%) and Mali (71%) [18] [19]. The last one has been conducted in the



reference neonatology center in the town of Bamako (Mali), and this could explain the discrepancy between their results and ours.

#### 4.2. Gender Distribution of the Transferred Newborns

More than half of transferred newborns were males. Faye and colleagues also reported a predominance of males among transferred babies in Senegal [13]. Newborns aged < 24 hours accounted for 29% of transfers, and this finding is lower than that reported by Salomé *et al.* in Jamaica (62%) and Daussac *et al.* in France (50%) [20] [21]. Late transfer in our context is the result of financial constraints that hinder initiation and coordination of PT. Additional reasons could include instability of newborns, absence of transport means and/or adequate HF. Again, these factors likely increase the risk of neonatal death, and this study we found 2% of newborns were arrived dead at the study HFs.

#### 4.3. Reasons of the Transfer

Prematurity was found in 36% of transferred newborns and this is not in line with value (24%) reported in 2018 by Chioukh *et al.* in Tunisia [11]. In utero transfer is indicated for pre-term births when management of babies is not possible at birth place [22]. Furthermore, 24% of transferred newborns were born by caesarian. This point is crucial as neonatal risks should be carefully evaluated before making decisions for caesarian. To be noted, 37% of newborns had APGAR score < 7, and this poor adaption of newborns elicits a higher risk of death [23].

The predominance of neonatal infection among reasons for PT was also reported in Senegal where authors found neonatal infection was responsible for 35% of all PT causes. Neonatal infection is the main pathology encountered in clinical practice at neonatology wards, and the WHO estimated that it accounts for 20% of global neonatal mortality [24]. Prematurity (24%) and respiratory distress (15%) were the second and third reasons for PT in the study, and this is consistent with result found by Traoré *et al.* (2010) in Mali (29% and 14%), but lower than that found by Salomé *et al.* (2017) in Jamaica who reported > 50% of PT due to prematurity and respiratory distress [25] [26]. Jaundice was also a cause of PT with 12% and this is higher than value found in Nigeria (9%) and Jamaica (2%) [19] [20]. The lack of phototherapy facility could likely explain this high value in several low categories hospitals in our setting.

#### 4.4. Utilization of the Perinatal Network

Only 5 of the 234 newborns were transferred through perinatal network, giving a utilization percentage of 2%. This finding is particularly worrisome as compared with other settings such as Japan where a study reported a utilization percentage of 62% [9]. In this country, perinatal network disposes a coordination center in each town which first receives calls from facilities requiring PT and then provides human resource and equipment for PT. Regarding transfer conditions,

health facilities receiving transferred newborns had been contacted for 21% of them. This is consistent with that found in Senegal (27%) [12]. Whenever PT is decided, it is crucial to inform HF that supposed to receive newborns for a better management [27]. Transfer forms were missing for 44% of newborns. Such forms are important for better coordination between HFs and its utilization is recommended as a part of health norms and standards of the Ministry of Public Health in Cameroon [28].

#### 4.5. Itinerary and Conditions of Neonatal Transfer

On analysis of itinerary, we noted that detours were made by 17% of newborns before their admission at the study facilities. Previous studies reported rate of 56% in the town of Yaoundé, Cameroon [14]. Newborns are managed by medical staff during transport in 92% of cases which is contrary to national guidelines [28]. Transport was medicalized in 3% of newborns included in the study and this is consistent with report in The Democratic Republic of Congo, but contrasting with higher values found in Senegal (30%) and Japan (96%) [9] [12] [13]. Transport of newborns to adequate emergency unit necessitates surveillance and high quality care to limit risk of death [9].

To be noted, hypothermia was found in 30% of newborns admitted at the health facilities. This supports result of Faye and colleagues who reported 34% in Senegalese babies [12]. Transport conditions could likely explain the presence of hypothermia. Indeed, most of transports were non-medicalized and done through public means especially taxi. This fact was also found by Faye and colleagues [12]. Such inadequate transport means could explain why respiratory distress was found in more than one-third of the newborns at their admission, thereby suggesting that these transports could be a cause of respiratory distress in them.

#### 4.6. Mortality among the Newborns

Mortality rate was 19.6% in this study. Other studies found values of 20.5% in Cameroon, 22.3% in Senegal and 8.4% in Tunisia [11] [12] [14]. Mortality rate remained unchanged even after implementation of the perinatal network which was lowly used as above discussed. In addition, transport conditions were similar to those seen before the implementation of the network (*i.e.*, non-medicalized transport, detour before admission and hypothermia on admission) [29]. The risk of death was doubled in transferred newborns compared to their non-transferred counterparts. This could explain severity of the PT-driving pathology as well as complication of the pathology due to poor transport conditions.

#### 4.7. Limitations of the Study

Data were collected from Government HFs and this constitutes the main limitation of the study. However, we conducted the study in the HFs receiving the large proportion of newborns referred in Douala, thereby outlining findings re-

ported here are representative of the global scenario in Douala.

## 5. Recommendations

A set of key recommendations may be given based on the findings of the present study:

- The newborns were arrived at the HF with respiratory distress, and this should the need for information, education and communication campaigns, through seminars for instance, of the medical staff on in utero transfer;
- The PT network was largely underused by the HF included in the study. It is utmost importance of updating members of the utilization of this network along with creation of a center for its coordination. Again, a better communication between both low- and high quality care HFs is crucial in order to improve the chances of survival of newborns when decision for transfer is made;
- Finally, the Government of Cameroon should be allocated funds and transport means such as ambulances for improving the utilization of the postnatal network

## 6. Conclusion

This study outlined that newborns were transferred at late stage and main reasons of PT were neonatal infection, prematurity and respiratory distress. It also pinpointed the absence of medicalized transport in 9 of 10 newborns, the absence/lack of transfer form, the absence of notification of the HF receiving transferred newborns and the low utilization of the perinatal network. Based on these findings, it should be important to reduce neonatal mortality through sensitization of medical staff on in utero transfer, updating of the members of the perinatal network and creation of a center for coordination of this network.

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## Authors' Contribution

- **Conception and design:** Daniele Kedy Koum, Monique Carole Magnibou, Calixte Ida Penda.
- **Acquisition of data:** Monique Carole Magnibou, Diomedé Noukeu Njinkui, Daniele Kedy Koum.
- **Analysis and interpretation:** Daniele Kedy Koum, Loick Pradel Kojom Foko, Rhita Mbono.
- **Drafting/Revising the manuscript:** Daniele Kedy Koum, Diomedé Noukeu Njinkui, Loick Pradel Kojom Foko, Charlotte Eposse, Patricia Epée Eboum-

bou, Calixte Ida Penda.

- **Final approval of the version:** all the authors.
- **Agreement to be accountable for all aspects of the work:** Daniele Kedy Koum, Calixte Ida Penda.

All the authors of the manuscript have read and agreed to its content and are accountable for all aspects of the accuracy and integrity of the manuscript.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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## Abbreviations

BDH	Bonassama District Hospital
DDH	Deido District Hospital
DGH	Douala General Hospital
DGOPH	Douala Gyneco-Obstetrics and Pediatrics hospital
DLH	Douala Laquintinie Hospital
NDH	Nylon District Hospital
CI	Confidence Interval
HF	Health Facility
OR	Odds Ratio
PT	Postnatal transfer
RR	Relative Risk
WHO	World Health Organization