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# Socio-clinical correlates of the perinatal outcome of severe perinatal asphyxia among referred newborn babies in Sagamu

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**Abstract***: Background:* Most deliveries in the developing world take place outside the hospital with poor assistance for the newborn. This puts the babies at risk of severe intrapartum events such as perinatal asphyxia. Most newborn babies admitted in tertiary centres with severe asphyxia are referred.
*Objectives:* To determine the socio-demographic and clinical correlates of the perinatal outcome of neonates referred to a Nigerian tertiary facility on account of severe perinatal asphyxia.
*Methods:* A prospective cross-sectional study was conducted at the Children's Emergency Room and Neonatal Ward among newborn babies referred with severe asphyxia. Socio-demographic and clinical parameters were recorded and statistically analysed.
*Results:* A total of 72 mother-infant pairs were studied. Half of the babies were admitted after 24 hours of birth and 75.0% of the families belonged to the lower socio-economic classes. Only 62.5% of mothers received antenatal care at orthodox health facilities. Most of the deliveries took place at private hospitals (29; 40.3%) and Traditional Birth Homes (18; 25.0%). Hypoxic-Ischaemic encephalopathy (HIE) was diagnosed among 57 (79.2%) babies with 46 (80.7%) and 11 (19.3%) classified as Stages II and III HIE respectively. There were 15 (20.8%) early neonatal deaths giving a perinatal mortality rate of 208.3/1000 admissions. The poor perinatal outcome was associated with age at admission within 24 hours, poor intrapartum care-seeking behaviour and the commencement of feeding before admission.
*Conclusion:* The quality of antenatal care, intrapartum care, and delivery services appear to influence perinatal outcomes among referred babies with severe asphyxia.

**Keywords:** Asphyxia, Hypoxic-Ischaemic Encephalopathy, Intrapartum care, Perinatal mortality, Out-born

## Introduction

Perinatal Asphyxia is one of the leading perinatal morbidities and causes of perinatal mortality in the developing world, Nigeria inclusive.[1] Previous studies in south-western Nigeria have shown that perinatal asphyxia accounted for between 9% and 25% of neonatal admissions.[2-4] These prevalence rates are similar to reports from other parts of Nigeria: 27% in Benin-City,[5] and 30.1% in Gusau.[6] Also, these prevalence rates are comparable to reports from other parts of the world such as Nepal where birth asphyxia was reported to account for 15.9% of live births in one hospital, [7] and 17.3% of admissions into a neonatal Intensive Care Unit (NICU) in another facility. [8]

Perinatal asphyxia was previously reported to account for 25.1% of neonatal deaths in Sagamu with the following breakdown: 35.7% of deaths among in-born babies and 22.2% of deaths among out-born babies.[9] The relatively higher frequency of asphyxia deaths among in-born babies compared to out-born babies had been attributed to the status of the study location as a referral centre receiving many high-risk pregnancies which have frequently been compromised before admission. This view is supported by the findings in another study at the same centre which reported that a higher proportion of babies hospitalized with severe asphyxia (53.5% versus 46.5%) were out-born.[4] A community-based Ghanaian study had also shown that only 20% of mothers whose newborn babies died at home sought appropriate care. [10] This implies that the remaining 80% of the deaths could have been prevented if appropriate care was sought. In addition, institutional surveillance in India revealed low socioeconomic status, inadequate antenatal care, poor intrapartum care as major risk factors for intrapartum

causes of perinatal mortality. [11]
Severe intrapartum events such as stillbirths, perinatal asphyxia, and birth injuries are leading contributors to perinatal mortality in the resource-poor parts of the developing world. [1, 9] Therefore, studies of the contemporary trends in perinatal mortality have suggested that severe intrapartum events deserve more attention in the efforts at reducing the high perinatal mortality rates in these resource-poor parts of the world. [12]

There are suggestions that asphyxia remains a major contributor to these mortalities because most deliveries in Nigeria take place outside the hospital. [13] These out-of-hospital deliveries are characterized by a lack of skilled assistance for high-risk babies hence, the poor adaptation to the extra-uterine environment and the inability to sustain spontaneous breathing at birth. This puts such babies at risk of severe asphyxia and may explain why most of the babies hospitalized with asphyxia are out-born. [3, 4]

To reduce the burden of perinatal mortality as well as the contribution of perinatal asphyxia to perinatal mortality in the developing world, the population of babies delivered in the community and referred to the hospital following intrapartum asphyxia injury need to be specifically studied.

Therefore, it is essential to find out the factors which determine the events which characterize the perinatal period for babies with severe asphyxia, right from within the community up to the point of specialized care. The objective of the study was to determine the socio-demographic and clinical correlates of the perinatal outcomes of babies referred to the Olabisi Onabanjo University Teaching Hospital (OOUTH), Sagamu, Nigeria on account of severe perinatal asphyxia.

## Materials and methods

This was a descriptive cross-sectional survey conducted at the Children's Emergency Room (CHER) and Neonatal Ward of the Olabisi Onabanjo University Teaching Hospital, (OOUTH), Sagamu, Nigeria between March 2018 and December 2019. This hospital provides specialized paediatric care for babies born within the hospital as well as babies referred from other health facilities within and outside Sagamu. There are 10 beds in the CHER and 28 cot spaces in the neonatal ward with average annual admission rates of 350 and 450 respectively. All babies referred to this facility are received at the CHER where initial stabilization is carried out before transfer to the ward. The neonatal ward has the capacity for special neonatal care as facilities for intensive care are presently unavailable.

The subjects included neonates aged between birth and six days referred to OOUTH on account of severe perinatal asphyxia who were consecutively recruited using purposive sampling. Eligibility criteria included all neonates brought from the community on self-referral with features of severe perinatal asphyxia (absence of spontaneous cry or poor cry with inability to suckle) and neonates brought from other facilities in the community on official referral with the diagnosis of severe perinatal asphyxia (with documented APGAR scores less than seven at the fifth minute of life or the classical features of inability to cry, inability to suck and respiratory difficulties, in the absence of APGAR scores. [8]
Neonates brought from the community on account of "abandonment" by unknown parents were excluded from the study.

The calculated sample size was 135 using a known prevalence of 9.7% [3] with Cochran formula. [14] However, due to repeated industrial actions in the hospital during the study period, 72 babies who met the inclusion criteria were studied in order not to prolong the period of recruitment and to minimise the effects of frequent changes in social order on the local epidemiology of perinatal asphyxia as earlier reported. [3] Usually, admission rates in the hospital decline remarkably immediately after a period of industrial action.

*Data collection*

A self-designed interviewer-administrable questionnaire was used for the study. Referred neonates were received at CHER where pre-recruitment screening was carried out by resident doctors who doubled as research assistants. The questionnaire was administered on the parent/guardian of recruited babies immediately after the conclusion of the admission process.

The data recorded for each baby included socio-demographics such as the age (in hours) at the point of admission, sex, estimated gestational age at birth, body weight, intra-uterine growth status (appropriate for gestational age, small for gestational age and large for gestational age) [15] and the place of residence of the family. Hypoxic-Ischaemic Encephalopathy (HIE) was diagnosed and staged according to the Sarnat and Sarnat criteria. [16] The age, highest education, and present occupation of the parents, maternal parity, details of prenatal care, details of obstetric care during labour and delivery, including the place and mode of delivery were also recorded. Lack of formal education and primary education were classified as low education while secondary education and tertiary education were classified as high education. The socioeconomic status of the family was determined using the parental highest education and present occupation according to Ogunlesi's model. [17] The socio-economic classes were described as Classes I (the highest) to V (the least) with the classes I to III re-classified as the upper socio-economic class and classes IV and V re-classified as the lower socio-economic class. Details of clinical disorders prompting referral, details of care accessed before referral to OOUTH and outcome of hospitalization at the end of the first seven days of life were also recorded. Relevant laboratory and radiologic investigations were also conducted.

Every neonate with asphyxia was managed according to the standard protocol operating in the unit. The point of exit from the study was the seventh day of life or discharge or death before the seventh day of life.

*Data Management*

This was done with the SPSS version 21.0 statistical software using descriptive and inferential statistics. For this study, places, where antenatal care and delivery services were received, were classified into orthodox (Private Hospitals, General Hospitals, Primary Health Centres) and unorthodox (Resident Homes, Traditional Birth Homes, Spiritual Birth Homes/Churches). The quality of intrapartum care-seeking behaviour was classified into "Good" or "Poor" depending on two parameters: (i) use of the orthodox facility and (ii) the interval between the onset of painful uterine contractions and departure from home of fewer than 3 hours. The use of orthodox places of delivery characterized appropriate delivery services. Intervention for the babies after birth was classified into appropriate (bagging and suction) or inappropriate (beating, cold water dips, hot fomentation, injections). The perinatal outcome was classified as "Good" if the baby survived beyond the seventh day of life or "Poor" if the baby died within the first seven days of life. In the examination of the perinatal outcome of the babies, only the data of 61 babies (who died or survived) were analysed as the baby who was discharged against medical advice and ten babies with missing data were excluded.

The data were expressed as continuous or categorical variables. The former were summarised as means and standard deviations while the latter were summarised as proportions and percentages. Proportions were compared using the Pearson Chi-Square test, Odds Ratio (with 95% Confidence Interval) and Fisher's Exact test as necessary while mean values were compared using the Student's t-test. Multivariate analysis was conducted to determine the variables which predicted poor perinatal outcome using binary logistic regression. Statistical significance was determined by *P* values less than 0.05 or 95% Confidence Interval excluding unity.

*Ethical Considerations*

Written consent of the parents/guardians was obtained while ethical clearance was also obtained from the Health and Research Ethics Committee of OOUTH (Certificate Number OOUTH/HREC/188/2017).

## Results

A total of 72 mother-infant pairs were studied. The age of the babies on admission ranged from 2 hours to 96 hours with a mean of 32.0 ± 30.0 hours and a median of 24.5 hours. As shown in Table I, only 18 (25.0%) were admitted within 6 hours of birth while 36 (50.0%) were admitted after 24 hours of birth. The EGA also ranged from 28 to 42 weeks with a mean of 38.9 ± 2.2 weeks. The bulk of the babies (70; 97.2%) were delivered between 37 and 42 weeks of gestation. The mean body weight on admission was 2.8 ± 0.6 kg with a range of 1.0 – 4.2kg. Most of the babies (57; 79.1%) weighed at least 2.5kg. The babies comprised 27 (37.5%) females and 45 (62.5%) males with a male-to-female ratio of 1.7:1.

All the parents were married and lived together; 95.8% (69/72) of the families were monogamous and the family size was less than 5 in 63.9% (46/72) cases. Six (8.3%) mothers resided with the parents-in-law. Sixty-seven (93.1%) of the fathers were aged 40 years or less while 63 (87.5%) of the mothers were aged 20-35 years. The majority of the mothers were primiparous (42; 58.3%) and lived outside Sagamu metropolis (46; 63.9%) and had their last confinement in the preceding 12-59 months (33; 45.8%). As shown in Table I, 88.9% of the mothers and 90.3% of the fathers had at least secondary education while 75.0% of the families belonged to the lower socio-economic classes IV and V.

*Prenatal and Perinatal characteristics (Table 1)*

Sixty-two (86.1%) mothers booked the index pregnancies for antenatal care. Although 45 (62.5%) mothers received antenatal care at orthodox health facilities, only 8 (11.1%) received any form of prenatal counseling on perinatal asphyxia.

The mean duration of labour was 27.3 ± 16.6 Hours. Labour lasted more than 24 hours among 38 (52.8%). Except for four mothers who birthed their babies at home, the interval between the onset of painful uterine contractions and departure for the places of birth was less than 3 hours among 26 (38.2%) and at least 3 hours among 42 (61.8%) mothers. The places visited in labour after leaving home included private hospitals (22; 32.4%), Traditional Birth Homes (20; 29.4%), Spiritual Birth Homes/Churches (14; 20.6%), Primary Health Centres (7; 10.3%), General Hospitals (5; 7.3%). The quality of intrapartum care-seeking behaviour was classified as good or poor in 22.2% and 77.8% cases respectively.

Most of the deliveries took place at private hospitals (29; 40.3%) and Traditional Birth Homes (18; 25.0%). Half of the places of delivery were classified as orthodox or appropriate. Following the classification of maternity facilities as orthodox or unorthodox, there were consistencies in the usage of facilities for labour and delivery in 58 (80.6%) cases; these movements comprised orthodox to orthodox in 30 (41.7%) and unorthodox to unorthodox in 28 (38.9%) while unorthodox to orthodox occurred in 10 (13.8%) and orthodox to unorthodox in 4 (5.6%). The modes of delivery were spontaneous vertex (59; 81.9%) and by Caesarean section (13; 18.1%). The interventions administered to assist the babies at birth included beating (38; 52.8%), bagging (13; 18.0%), cold water dips (6; 8.3%), injections (3; 4.2%) and suction (1; 1.4%). Nothing was done for 11 (15.3%) babies who had perinatal asphyxia. The babies were kept at the various places of delivery for <6 hours,

6-12 hours and >12 hours in 21 (29.2%), 9 (12.5%) and 32 (44.4%) cases respectively. Following discharge from the various places of delivery, decisions to access care elsewhere were taken within 3 hours among 43 (59.7%) cases. After deciding to seek care elsewhere, 29 (40.3%) babies were brought to OOUTH while the remaining visited other facilities which included private hospitals (25; 33.3%), drug vendors (8; 11.1%), Spiritual Birth Homes/Churches (7; 9.7%) and General Hospital (4; 5.6%) before eventually coming to OOUTH. Thirty-three arrived OOUTH with written official referral letter (33; 45.8%) while 20 (27.8%) and 19 (26.4%) came on self-referral and verbal official referral respectively. Half of the babies had been commenced on some sort of feeding before arrival at OOUTH and these included direct suckling (12; 33.3%) and bottle feeding with glucose drinks (13; 36.1%), infant formula (8; 22.2%) and expressed breast milk (3; 3.6%).

**Table 1:** General characteristics of babies and families studied

| Characteristics | | Frequency | Percentage |
|---|---|---|---|
| Sex | Female | 27 | 37.5 |
| | Male | 45 | 62.5 |
| Intra-Uterine Growth Pattern | AGA a | 66 | 91.7 |
| | SGA b | 6 | 8.3 |
| Baby's Age | <6 Hours | 18 | 25.0 |
| | 6-12 Hours | 8 | 11.1 |
| | 13-24 Hours | 10 | 13.9 |
| | >24 Hours | 36 | 50.0 |
| Weight | 1.0-1.49kg | 2 | 2.8 |
| | 1.50-2.4kg | 13 | 18.1 |
| | 2.50-3.9kg | 50 | 69.4 |
| | >3.99kg | 7 | 9.7 |
| Estimated Gestational Age | <28 weeks | 0 | 0.0 |
| | 28-32 weeks | 2 | 2.8 |
| | 33-36 weeks | 0 | 0.0 |
| | 37-42 weeks | 70 | 97.2 |
| Socioeconomic Classes | II | 2 | 2.8 |
| | III | 16 | 22.2 |
| | IV | 50 | 69.4 |
| | V | 4 | 5.6 |
| Maternal Education | None | 1 | 1.4 |
| | Primary | 7 | 9.7 |
| | Secondary | 42 | 58.3 |
| | Tertiary | 22 | 30.6 |
| Paternal education | None | 2 | 2.8 |
| | Primary | 5 | 6.9 |
| | Secondary | 32 | 44.5 |
| | Tertiary | 33 | 45.8 |

a Appropriate for Gestational Age, b Small for Gestational Age

*Clinical presentations, complications, and outcome (Table 2)*

The babies mostly presented with inability to cry (46; 63.9%) and poor suck (34; 47.2%). Hypoxic-Ischaemic encephalopathy (HIE) was diagnosed among 57 (79.2%) babies with 46 (80.7%) and 11 (19.3%) classified as Stages II and III HIE respectively. Other complications were present among 60 (83.3%) babies and the leading complications included seizures (39; 54.1%), hypoglycaemia (33; 45.8%), hypothermia (24; 33.3%) hyperthermia (21; 29.2%) and apnea (16, 22.2%). Transfontanelle ultrasound scan was only done for 26 (36.1%) and the leading feature was intracranial haemorrhage (14; 53.8%) while the features were normal in 11 (42.3%) babies. Fifty-six (77.8%) babies survived beyond the first seven days of life while 1 (1.4%) was prematurely discharged against medical advice. There were 15 (20.8%) early neonatal deaths giving a perinatal mortality rate of 208.3/1000 admissions for referred babies with severe asphyxia. The mean duration of admission was significantly shorter for babies who died compared to the mean duration for survivors (67.8 ± 76.6 Hours vs 216.2 ± 68.2 Hours; $t = 7.284$, $p < 0.0001$). On the other hand, the mean duration of admission of babies with HIE or without HIE was comparable (184.1 ± 89.7 Hours vs 186.0 ± 98.6 Hours; $t = 0.083$, $p = 0.4669$).

**Table 2:** Antenatal, perinatal and postnatal characteristics

| Characteristics | | Frequency | Percentage |
|---|---|---|---|
| Place of antenatal care | Church | 16 | 22.2 |
| | General Hospitals | 8 | 11.1 |
| | OOUTH | 2 | 2.8 |
| | Primary Health Centre | 12 | 16.7 |
| | Private Hospitals | 23 | 31.9 |
| | Traditional Birth Homes | 11 | 15.3 |
| Places of delivery | Church | 10 | 13.9 |
| | General Hospitals | 7 | 9.7 |
| | Home | 4 | 5.6 |
| | Primary Health Centre | 4 | 5.6 |
| | Private Hospitals | 29 | 40.3 |
| | Traditional Birth Homes | 18 | 25.0 |
| Quality of delivery service | Appropriate | 36 | 50.0 |
| | Inappropriate | 36 | 50.0 |
| Type of Intervention | Appropriate | 14 | 19.4 |
| | Inappropriate | 58 | 80.6 |
| Symptoms* | Gasping | 12 | 16.7 |
| | Inability to cry | 46 | 63.9 |
| | Twitching | 31 | 43.1 |
| | Poor suck | 34 | 47.2 |
| TFU findings | Intracranial Haemorrhage | 14 | 53.8 |
| | Non-Communicating Hydrocephalus | 1 | 3.8 |
| | Normal | 11 | 42.3 |
| | Not done | 46 | 63.9 |
| Types of complications* | Seizures | 39 | 54.1 |
| | Hypoglycaemia | 33 | 45.8 |
| | Hypothermia | 24 | 33.3 |
| | Hyperthemia | 21 | 29.2 |
| | Anaemia | 20 | 27.8 |
| | Apnea | 16 | 22.2 |
| | Acute Kidney Injury | 11 | 15.3 |

*Some babies had multiple complications

*Bivariate analysis of factors associated with the quality of care-seeking in labour (Table 3)*

The proportions of babies whose mothers had good or poor intrapartum care-seeking behaviour were comparable concerning maternal age, maternal parity, paternal age, maternal education, paternal education and co-habitation with in-laws. However, all the mothers who lived with in-laws had poor intrapartum care-seeking behaviour, though without statistical significance. A significantly higher proportion of mothers who had good intrapartum care-seeking behaviour belonged to the upper socio-economic classes compared to those with poor behaviours ($p < 0.001$). On the contrary, a significantly lower proportion of mothers who had good care-seeking behaviour had received antenatal care at orthodox facilities ($p = 0.04$).

**Table 3:** Bivariate analysis of factors associated with the quality of intra-partum care-seeking behaviours

| Characteristics | | Good N = 16 | Poor N = 56 | Statistics |
|---|---|---|---|---|
| Maternal Age | >35 years | 2 (12.5) | 7(12.5) | $\chi^2 = 0.000$* |
| | < 35 years | 14 (87.5) | 49 (87.5) | P = 1.000 |
| Maternal Parity | 1 | 8 (50.0) | 22 (39.3) | $\chi^2 = 0.588$ |
| | >1 | 8 (50.0) | 34 (60.7) | P = 0.443 |
| Paternal Age | >40 years | 0 (0.0) | 5 (8.9) | Fisher's Exact |
| | ≤40 years | 16 (100.0) | 51 (91.1) | P = 0.580 |
| Maternal Education | High | 13 (81.2) | 51 (91.1) | $\chi^2 = 0.424$* |
| | Low | 3 (18.8) | 5 (8.9) | P = 0.515 |
| Paternal Education | High | 14 (87.5) | 51 (91.1) | $\chi^2 = 0.000$* |
| | Low | 2 (12.5) | 5 (8.9) | P = 1.000 |
| Socio-economic Classes | Upper | 9 (56.2) | 9 (16.1) | $\chi^2 = 10.714$ |
| | Lower | 7 (43.8) | 47 (88.9) | P < 0.001 |
| Living with In-laws | Yes | 0 (0.0) | 6 (10.7) | Fisher's Exact |
| | No | 16 (100.0) | 50 (89.3) | P = 0.327 |
| Antenatal Care | Orthodox | 14 (87.5) | 31 (55.4) | $\chi^2 = 4.200$* |
| | Unorthodox | 2 (12.5) | 25 (44.6) | P = 0.04 |

*Yate's Correction

*Bivariate analysis of factors associated with the quality of delivery services (Table 4)*

The proportions of babies whose mothers utilized good or poor delivery services were comparable for maternal age, maternal parity, paternal age, maternal education, paternal education and co-habitation with in-laws. A significantly higher proportion of mothers who utilized good delivery services belonged to the lower socio-economic classes ($p<0.001$). In addition, a significantly higher proportion of mothers who had appropriate delivery services had earlier received antenatal care at orthodox facilities ($p < 0.001$).

**Table 4:** Bivariate analysis of factors associated with the quality of delivery services

| Characteristics | | Appropriate | Inappropriate | Statistics |
|---|---|---|---|---|
| Maternal Age | >35 years | 3 (8.3) | 6 (16.7) | $\chi 2 = 0.508$* |
| | < 35 years | 33 (91.7) | 30 (83.3) | P = 0.476 |
| Maternal Parity | 1 | 21 (58.3) | 21 (58.3) | $\chi 2 = 0.000$ |
| | >1 | 15 (41.7) | 15 (41.7) | P = 1.00 |
| Paternal Age | >40 years | 1 (2.8) | 4 (11.1) | $\chi 2 = 0.860$* |
| | <40 years | 35 (97.2) | 32 (88.9) | P = 0.354 |
| Maternal Education | High | 31 (86.1) | 34 (94.4) | $\chi 2 = 0.141$ |
| | Low | 5 (13.9) | 2 (5.6) | P = 0.708 |
| Paternal Education | High | 31 (86.1) | 34 (94.4) | $\chi 2 = 0.633$* |
| | Low | 5 (13.9) | 2 (5.6) | P = 0.423 |
| Socio-economic Classes | Upper | 20 (55.6) | 34 (94.4) | $\chi 2 = 12.519$* |
| | Lower | 16 (44.4) | 2 (5.6) | P < 0.001 |
| Living with In-laws | Yes | 1 (2.8) | 5 (13.9) | $\chi 2 = 1.636$* |
| | No | 35 (97.2) | 31 (86.1) | P = 0.201 |
| Antenatal Care | Orthodox | 30 (83.3) | 15 (41.7) | $\chi 2 = 13.33$* |
| | Unorthodox | 6 (16.7) | 21 (58.3) | P < 0.001 |

* Yate's Correction

*Bivariate analysis of factors associated with poor perinatal outcome among babies with severe asphyxia (Table 5)*

The proportions of babies with poor or good perinatal outcome were comparable for age at presentation within the first 12 hours of life, sex, body weight less than 2.5kg, smallness for gestational age, unorthodox antenatal care, duration of labour greater than 24 hours, and interval between the onset of painful uterine contraction and departure from home less than 3 hours. Similarly comparable were the proportion of babies with good or poor perinatal outcome whose mothers utilized appropriate delivery services, were delivered by Caesarean section, who received inappropriate interventions after birth, who were kept at the various places of delivery for greater than 6 hours, who had HIE and those who had complications. On the other hand, a significantly higher proportion of babies aged 24 hours or less at presentation in OOUTH had poor perinatal outcome ($p = 0.04$). All the mothers of babies with poor perinatal outcome decided to seek care elsewhere less than 3 hours after childbirth ($p = 0.003$). A significantly higher proportion of the mothers of babies with good perinatal outcome visited other facilities before coming to OOUTH after leaving the place of delivery ($p = 0.002$). Similarly, a significantly higher proportion of babies with poor perinatal outcome had been commenced on feeding before presentation at OOUTH ($p = 0.014$).

**Table 5a:** Bivariate analysis of factors associated with type of perinatal outcome

| Characteristics | | Died N = 15 | Discharged N = 46 | Statistics |
|---|---|---|---|---|
| Age | <12 hours | 8 (53.3) | 16 (34.8) | $\chi$ 2 = 1.631 |
| | >12 hours | 7 (46.7) | 30 (65.2) | P = 0.202 |
| Age | <24 hours | 11 (73.3) | 20 (43.5) | $\chi$ 2 = 4.165* |
| | >24 hours | 4 (26.7) | 26 (56.5) | P = 0.04 |
| Sex | Female | 5 (33.3) | 14 (30.4) | $\chi$ 2 = 0.04 |
| | Male | 10 (66.7) | 32 (69.6) | P = 0.833 |
| Weight | <2.5kg | 2 (13.3) | 11 (23.9) | $\chi$ 2 = 0.256* |
| | >2.5kg | 13 (86.7) | 35 (76.1) | P = 0.613 |
| IUGP a | AGA | 13 (86.7) | 42 (91.3) | $\chi$ 2 = 0.01* |
| | SGA | 2 (13.3) | 4 (8.7) | P = 0.980 |
| Antenatal Care | Orthodox | 12 (80.0) | 25 (54.3) | $\chi$ 2 = 2.137* |
| | Unorthodox | 3 (20.0) | 21 (45.7) | P = 0.144 |
| Duration of labour | >24 hours | 6 (40.0) | 24 (52.2) | $\chi$ 2 = 0.671 |
| | <24 hours | 9 (60.0) | 22 (47.8) | P = 0.413 |
| Interval b | <3 hours | 9 (60.0) | 16 (34.8) | $\chi$ 2 = 2.974 |
| | >3 hours | 6 (40.0) | 30 (65.2) | P = 0.085 |
| Intra-partum care-seeking | Good | 7 (46.7) | 8 (17.4) | $\chi$ 2 = 5.228 |
| | Poor | 8 (53.3) | 38 (82.6) | P = 0.022 |

*Yates correction applied; a IUGP – Intrauterine Growth Pattern, AGA – Appropriate for Gestational Age, SGA – Small for Gestational Age
b Interval – Interval between the onset of painful uterine contractions and departure from home

**Table 5b:** Bivariate analysis of factors associated with type of perinatal outcome

| Characteristics | Died N = 15 | Discharged N = 46 | Statistics |
|---|---|---|---|
| *Quality of delivery care* | | | |
| Appropriate | 7 (46.7) | 24 (52.2) | $\chi$ 2 = 0.137 |
| Inappropriate | 8 (53.3) | 22 (47.8) | P = 0.711 |
| *Mode of delivery* | | | |
| CS a | 2 (13.3) | 9 (19.6) | $\chi$ 2 = 0.025* |
| SVD b | 13 (86.7) | 37 (80.4) | P = 0.874 |
| *Intervention at birth* | | | |
| Appropriate | 5 (33.3) | 8 (17.4) | $\chi$ 2 = 1.714 |
| Inappropriate | 10 (66.7) | 38 (82.6) | P = 0.190 |
| *Duration of stay at POD* | | | |
| <6 hours | 8 (53.3) | 13 (28.3) | $\chi$ 2 = 3.150 |
| >6 hours | 7 (46.7) | 33 (71.7) | P = 0.076 |
| *Decision to visit OOUTHc* | | | |
| <3 hours | 15 (100.0) | 27 (58.7) | Fisher's Exact |
| >3 hours | 0 (0.0) | 19 (41.3) | P = 0.003 |
| *Visit to other places after decision d* | | | |
| Yes | 5 (33.3) | 35 (76.1) | $\chi$ 2 = 9.159 |
| No | 10 (66.7) | 11 (23.9) | P = 0.002 |
| *Feeding commenced* | | | |
| Yes | 12 (80.0) | 18 (39.1) | $\chi$ 2 = 6.013* |
| No | 3 (20.0) | 28 (60.9) | P = 0.014 |
| *HIE e* | | | |
| Absent | 6 (40.0) | 20 (43.5) | $\chi$ 2 = 0.056 |
| Present | 9 (60.0) | 26 (56.5) | P = 0.814 |
| *Complications* | | | |
| Absent | 0 (0.0) | 9 (19.6) | Fisher's Exact |
| Present | 15 (100.0) | 37 (80.4) | P = 0.097 |

*Yate's correction applied; a Caesarean section, b Spontaneous Vertex Delivery, c Interval between discharge from place of delivery and the decision to seek care elsewhere, d Places visited after discharge from the places of delivery before getting to OOUTH, e Hypoxic-Ischaemic Encephalopathy

*Multivariate analysis of the determinants of poor perinatal outcome (Table 6)*

The five variables with statistical significance on bivariate analysis of perinatal outcome (age of baby 24 hours or less on admission, poor intrapartum care-seeking behaviour, decision to seek care elsewhere within 3 hours of discharge from place of birth, visit to other facilities before presenting to OOUTH and commencement of feeding before presentation at OOUTH) were entered into a binary logistic regression analysis model. Only poor intrapartum care-seeking behaviour was a significant determinant of poor perinatal outcomes (OR = 0.20; p = 0.049; 95%CI = 0.03-0.92).

**Table 6:** Multivariate analysis of predictors of poor perinatal outcome

| Variables | B | OR | P | 95%CI |
|---|---|---|---|---|
| Age of baby on admission <24 hours | -0.016 | 0.985 | 0.986 | 0.18 – 5.27 |
| Poor intra-partum care seeking behaviour | -1.606 | 0.201 | 0.049 | 0.03 – 0.92 |
| Decision to seek care elsewhere <3 hours | 20.981 | 525.86 | 0.998 | 0.000 |
| Visited other places after referral to OOUTH | -0.915 | 0.400 | 0.235 | 0.08 – 1.81 |
| Feeding commenced prior to coming to OOUTH | -1.233 | 0.292 | 0.510 | 0.05 – 1.57 |
| Constant | 2.348 | 10.463 | 0.008 | |

B – Coefficient of Regression; OR – Odd Ratio;
P = Significance; CI – Confidence Interval

## Discussion

This study examined the clinical and social characteristics of severe perinatal asphyxia as a perinatal problem for referred babies. Half of the babies in the study presented at the tertiary facility after 24 hours similar to previous reports from Enugu, south-east Nigeria,[18] where 53.9% of affected babies presented after 24 hours. Comparison with some other similar studies in terms of age at admission appears difficult because both inborn and out-born babies were included in such studies. [19, 20] The study from Bagalkot, India,[18] involving both in-born and out-born babies, reported that 72.3% of asphyxiated babies were admitted within 4 hours of birth while 10.4% were admitted between 24 and 72 hours. It is most plausible that inborn babies with severe asphyxia would have been admitted into the neonatal unit almost immediately after birth and only referred babies were likely to be admitted late. This brings up the problem posed by the delayed presentation at the specialist centre to the management of babies with severe asphyxia.

From the present study, 44.4% of babies with asphyxia were kept at the various places of delivery for more than 12 hours before discharge or referral and the decision to seek care elsewhere was taken after two hours in close to half of the cases. Even after discharge or referral, 59.7% of the babies were first taken to other facilities.

These observations suggest to a large extent, that the care of these babies might have been unduly delayed in most cases for the reasons highlighted.
Since two-thirds of the deliveries took place in private hospitals and traditional birth homes, it becomes imperative to embark on a change of practices at such level to encourage early referral when babies are asphyxiated. Introduction of practice guidelines and subsequent training may be required since Traditional Birth Attendants in the country are currently being trained on important aspects of Maternal and Child Health as earlier reported elsewhere.[21]

Although more than four-fifths of the mothers booked their pregnancies for antenatal care, only 62.5% utilized orthodox facilities while 37.5% utilized unorthodox facilities where the quality of antenatal care may be suboptimal. This disagrees with a previous Nigerian report where 72.9% of the mothers of asphyxiated babies were unbooked for antenatal care.[22] Also, this is in contrast to an Indian report where 95% of the mothers received orthodox antenatal care.[20] This shortfall in the coverage for prenatal care in this study may be related to inadequacy and lack of equity in the distribution of maternity services. Interestingly, only 11.1% of the mothers received counseling on perinatal asphyxia. This implies that most of the health care providers at the orthodox facilities did not counsel the expectant mothers on birth asphyxia. This agrees with the previous finding in the same population where most of the mothers who attended private hospitals and other primary and secondary facilities for antenatal care were not counseled on perinatal asphyxia.[23] This observation is important in the control of perinatal asphyxia as a public health challenge because expectant mothers could only seek appropriate intrapartum care if they have access to correct information. Counseling on the likely perinatal events needs to be added to the spectrum of health education delivered during antenatal clinic sessions by midwives.
Therefore, it is not unexpected that only about a quarter (22.2%) of the mothers had good intrapartum care. Characteristically, a lot of expectant mothers traverse private hospitals and Traditional Birth Homes during labour and they only seek specialised care when obstetric emergencies develop. The facilities patronised for intrapartum care are not different from what was previously reported in the same population.[24] Stringent attention may be required to ensure expectant mothers receive intrapartum care at orthodox facilities as a way of improving the quality of perinatal care in Nigeria.

The quality of intrapartum care-seeking behaviour was associated with the upper socio-economic status plausibly because families in the upper social strata are more likely to have access to appropriate health information guiding health-related decisions and are probably more likely to afford the cost of accessing quality care in orthodox facilities where such are not subsidized. For unclear reasons, the utilization of unorthodox facilities for antenatal care was also associated with good care-seeking during labour. It is plausible that care providers at unorthodox antenatal clinics realised the shortcomings in their skills and thus, raised alarm about the need to seek care promptly when labour begins. This suspicion needs to be confirmed using a larger, well-powered and controlled study.

In the same vein, the utilization of appropriate delivery services was unexpectedly associated with lower socio-economic status. The cost of some types of government-owned orthodox delivery care services may be subsidized, hence affordable for families in the lower socio-economic class. Similarly, the use of appropriate delivery services was also associated with the use of orthodox antenatal care services. The latter observation may be related to the fact that the place where antenatal care was received may directly influence the quality of delivery services utilized. This agrees with the observation in the same study that in 41.7% of cases, mothers who used orthodox facilities for antenatal care also used orthodox delivery facilities and *vice versa* for unorthodox facilities in 38.9% of cases. This is a cogent reason why expectant mothers should be encouraged to patronize orthodox maternity facilities for antenatal care, both for sound health services during pregnancy and to influence delivery services.

The case fatality rate in this population of babies was 20.8% similar to 20.2% reported from Enugu, south-east Nigeria.[18] This was unlike 15.6% and 40.6% reported from Nepal and India respectively.[19, 20] Poor perinatal outcomes was also associated with age at presentation 24 hours or less. This may reflect worse clinical states in the babies hence, the earlier presentation and higher risk of mortality. This explanation may also be relevant to the association between poor perinatal outcomes and the decision to seek care elsewhere within two hours of discharge from the places of delivery. The babies must have been very ill that the parents were eager to get the best care within the shortest possible time and that could have resulted in the poorer outcome in the babies. This observation implies that although, it is desirable that asphyxiated babies should be brought for specialized care within the shortest possible time, when babies with asphyxia arrive within two hours of life, prompt and detailed attention should be paid to their care, to minimise the risk of poor outcome.

The association between poor perinatal outcome and feeding before presentation is difficult to explain since the present study did not set out to unravel causal relationships between variables. However, the possibility of feed aspiration and the risk of necrotizing enterocolitis cannot be ruled out.[19] Perhaps, if the exit from the study had been longer than seven days, the latter complication could have been diagnosed with more certainty. In the same vein, the poor clinical state of the babies might have prevented mobility for chest radiographic examinations, in the absence of a mobile X-Ray machine in the centre.

The lack of association between HIE and the perinatal outcome may be explained by the fact that a large proportion of the babies had HIE but a bulk had Stage II

HIE which is reported to be associated with less risk of mortality compared to Stage III. [20, 22, 25]

The isolation of poor intrapartum care-seeking behaviour as the only determinant of a poor perinatal outcome on multivariate analysis agrees with the role of intrapartum events in the aetiology of severe asphyxia. When labour is complicated or poorly managed, it is associated with perinatal asphyxia.[24] Also, poor quality antenatal care has been reported to be associated with poor outcome in perinatal asphyxia.[26]

The small size of the study population is acknowledged as a limitation to the study but the methodology and findings in the study are helpful in planning a larger study in the future. A previous study in India used a smaller population size in a similar study and the findings were helpful.[25]

## Conclusion

Severe perinatal asphyxia among babies referred to a tertiary facility remains an important public health issue because of the associated social factors as well as the high mortality. The quality of antenatal care, intrapartum care, and delivery services appear to influence perinatal outcomes among referred babies with severe asphyxia. Emphasis should be put on improving the utilization of orthodox maternity services, prompt referral of asphyxiated babies and training of health care providers.

**Authors' Contributions**
OOB and OTA conceived and designed the study, analysed and interpreted the data, drafted the manuscript and approved the final version of the manuscript.
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