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Original article

Non-obstetric causes of severe maternal complications: a secondary analysis of the Nigeria Near-miss and Maternal Death Survey

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Objective To evaluate the burden, causes and outcomes of severe non-obstetric maternal complications in Nigerian public tertiary hospitals.

Design Secondary analysis of a nationwide cross-sectional study.

Setting Forty-two tertiary health facilities.

Population Women admitted with complications during pregnancy, childbirth or puerperium.

Methods All cases of severe maternal outcome (SMO: maternal near-miss or maternal death) due to non-obstetric causes were prospectively identified over a 1-year period. Maternal near-miss was defined using organ-system dysfunction (WHO), clinical, or management-based criteria.

Main outcome measures Causes and contributions of non-obstetric complications to SMO; fetal and neonatal outcomes; health service events associated with non-obstetric complications; and mortality index (% of maternal death/SMO).

Results Of 100 107 women admitted with complications, 9401 (9.4%) were for non-obstetric causes; and 4.0% (375/9401) suffered severe non-obstetric complications. Of the 375 cases of severe non-obstetric complications, 48.8% (183/375) were near-misses and 51.2% (192/375) were maternal deaths. Severe anaemia unrelated to haemorrhage contributed 61.2% of near-misses and 32.8% of maternal deaths. The highest mortality indices were observed for cancer (91.7%), hepatic diseases (81.8%) and HIV/AIDS/HIV wasting syndrome (80.4%). Fatality was significantly high with extremes of age and no formal education. Regarding organ dysfunctions, neurological (77.1%) and cardiovascular (75.0%) dysfunctions had the highest mortality indices. Perinatal mortality was 65.9%. Time from diagnosis of severe non-obstetric complications to review by senior medical personnel, and to definitive intervention was <30 minutes in 30.2% and 29.8% of women with SMO, respectively. However, over 240 minutes elapsed between diagnosis and definitive intervention in more than one-third of women with SMO.

Conclusion Non-obstetric complications are associated with poorer pregnancy outcomes and deserve attention similar to that accorded obstetric complications.

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Keywords Coincidental causes, indirect causes, maternal death, maternal near-miss, non-obstetric complications, severe maternal outcome.

Tweetable abstract Non-obstetric causes are important contributors to maternal deaths and life-threatening morbidities in Nigerian hospitals.

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Introduction

Maternal death was the yardstick for evaluating maternity services until the last decade when the 'maternal near-miss' concept was introduced, partly as a result of the rarity of maternal death in high-income countries.[1] Maternal deaths are significant obstetric events, but maternal near-misses also represent an important measure of quality of care even in low-income countries with a high burden of maternal death. Severe maternal outcome (SMO), a combination of both near-misses and maternal deaths, has been proposed as a useful indicator of care provided to women who suffered life-threatening maternal complications.

Globally, obstetric (or direct) causes of SMOs continue to receive attention from healthcare providers and policy-makers whereas non-obstetric causes, though an important emerging contributor, have not received similar attention. Non-obstetric causes of SMOs include indirect causes like medical disorders, nutritional anaemia, liver disorders, heart diseases, respiratory tract infections including tuberculosis and severe bronchial asthma, diabetes mellitus, chronic renal disease, cerebral diseases including epilepsy and malignancies associated with and that could be aggravated by pregnancy. They also include coincidental causes like violence, suicide and trauma.[2–8] Non-obstetric causes are important contributors to maternal death, particularly because they are associated with greater case fatality rates compared with obstetric causes.[3–5] Furthermore, non-obstetric critical illnesses in pregnancy significantly result in adverse fetal and neonatal outcomes in addition to their effects on the mother.[9]

Research and interventions to reduce SMOs in Nigeria have largely focused on obstetric causes to the neglect of the non-obstetric conditions. This study aimed to bridge this gap through a secondary analysis of a nationwide study of SMOs at the highest level of healthcare delivery in Nigeria. Specifically, we assessed the incidence of non-obstetric complications, their contributions to SMOs, associated fetal and neonatal outcomes, as well as health service events.

Methods

Design, setting and population

The study protocol and other methodological considerations have been published in detail previously.[10,11] Briefly, this study was a nationwide multicentre cross-sectional study involving women who suffered a near-miss or died following complications of pregnancy, labour or puerperium based on uniform identification criteria. A total of 42 public tertiary hospitals (University Teaching Hospitals and Federal Medical Centres) offering obstetric services across all six geo-political zones of the country participated in the study. All women admitted for delivery or pregnancy-related complications at the study sites were identified through a prospective surveillance of the study population and recruited into the study. The key findings of the study have been published previously.[10] This article presents the findings of a secondary analysis focused on non-obstetric complications that were recorded during the study.

For the purpose of this analysis, non-obstetric causes of SMO refer to all causes that were not directly of obstetric origin. These included indirect as well as coincidental causes. Indirect causes imply pregnancy-related deaths in a woman with a pre-existing or newly developed medical condition unrelated to the pregnancy. These included malaria, anaemia unrelated to haemorrhage, infections like tuberculosis, chronic medical disorders (diabetes mellitus, cardiac, renal, hepatic, haematological disorders, HIV/AIDS) as well as malignancies associated with and that could be exacerbated by pregnancy (choriocarcinoma and breast cancer). Coincidental causes included violence, trauma, suicide and ingestion of poisons.[12,13] The terminology 'non-obstetric causes' aims to capture important causes of SMOs other than those resulting from obstetric complications and does not imply conditions that are not of concern to the obstetric community. For this analysis, we defined 'maternal near-miss' using any one of organ-system dysfunction (WHO) criteria,[14] clinical criteria, or management-based criteria (see Supplementary material, Table S1). Maternal death was defined according to the International Classification of Diseases, 10th revision[15] and SMO was defined as all cases of maternal near-miss and maternal deaths.[14]

Study procedures

Data for the main study were collected at each participating hospital over a period of 12 months between June 2012 and August 2013. Through a daily surveillance of the obstetric ward, gynaecological/termination of pregnancy care unit, labour room, emergency and intensive care units, the local research team at each centre identified cases of SMOs and documented the health service events surrounding the management of each woman using a structured format. The completed information was regularly sent to a central coordinating centre throughout the study period. Data were collected by trained clinicians (resident doctors) from other departments outside obstetrics and gynaecology to avoid bias. Information of interest included sociodemographic and obstetric characteristics; admission history, possible organ dysfunction, primary complication and the service-related time intervals in the management. The time intervals were related to time lag from admission to review by a senior health personnel, i.e. the managing consultant. Outcomes of interest in the study include occurrence of maternal near-miss and maternal death, and fetal and

neonatal outcomes among women with non-obstetric complications. Data handling and management were undertaken by the data management unit of the Centre for Reproductive Health, Sagamu, Nigeria.

Data analysis

Analysis was performed with EPI INFO 7.1.4 (CDC, Atlanta, GA, USA). Analysed data included demographic characteristics, causes of non-obstetric complications and their regional distribution and are presented in tables with percentages. Categorical variables were compared with chi-square and odds ratio as appropriate. Observed differences were considered statistically significant when the *P*-value was < 0.05.

Results

Among the 100 107 women admitted for maternal complications during the study, 9401 (9.4%) experienced non-obstetric complications; 375 (4.0%) of these were severe while 9026 (96.0%) were nonsevere, non-obstetric complications. Among the 375 women with severe non-obstetric complications, 183 (48.8%) were maternal near-misses and 192 (51.2%) died. As shown in Table 1, the majority of women were between 20 and 35 years of age (296; 78.7%), 24.0% were carrying their first pregnancy, 80.5% belonged to low social class, 89.3% were admitted in critical condition and 63.4% presented to the hospital during the day.

As shown in Table 2, the common causes of maternal near-miss were severe anaemia (112; 61.2%), malaria (23; 12.6%) and cardiac diseases (21; 11.5%), whereas severe anaemia (63; 32.8%) was the most common cause of maternal death. Maternal mortality ratio was highest for severe anaemia (68.7/100 000 live birth), maternal near-miss to maternal death ratio was highest for malaria (1.92), the highest mortality indices were recorded for cancer (11/12; 91.7%), hepatic diseases (9/11; 81.8%) and HIV/AIDS/HIV wasting syndrome (41/51; 80.4%) whereas cause-specific fatality rate was considerably high for cardiac diseases (8.4), hepatic diseases (7.8) and severe anaemia (6.8).

Regional distribution of all non-obstetric complications recorded during the study period showed that HIV/AIDS/HIV wasting syndrome was highest in the southeast (601; 21.62%), malaria in the southwest (699; 23.47%), severe anaemia in the northeast (309; 33.3%), cardiac disease in the northwest (72; 30.25%), lung (65; 29.82%) and renal diseases (27; 27%) in the south-south, hepatic disease in the southeast (39; 33.9%) and cancers in the northwest (190; 36.26%) (see Supplementary material, Table S2).

Table 3 shows that maternal characteristics significantly associated with increased fatality were higher extreme of age, as well as primary and secondary education levels. The highest mortality indices based on organ-dysfunction were from neurological (77.08%), cardiovascular (75.0%), respiratory (71.27%), renal (67.65%) and hepatic (62.50%) dysfunctions (Table 4). Table 4 also shows that out of 173 women with delivery outcomes, 20.2% (35/173) had a fresh stillborn and 2.1% (21/173) had a macerated stillborn. Although 117 babies were born alive, perinatal mortality by day 7 after birth was 65.9% (114/173). Admission into a special care baby unit was 20.2% (35/173).

Table 1. Demographic characteristics of women with severe non-obstetric complications

Characteristics	MNM *N* = 183	MD *N* = 192	Total *N* = 375
Age			
<20 years	33 (18.03)	9 (4.69)	42 (11.20)
20–35	139 (75.96)	157 (81.77)	296 (78.93)
>35	11 (6.01)	26 (13.54)	37 (9.87)
Marital status			
Married	173 (94.54)	172 (89.58)	345 (92.00)
Not married	10 (5.46)	19 (9.90)	29 (7.73)
Data unavailable	0 (0.00)	1 (0.52)	1 (0.27)
Number of pregnancies			
1	51 (27.87)	39 (20.31)	90 (24.00)
2–5	83 (45.36)	106 (55.21)	189 (50.40)
>5	47 (25.68)	45 (23.44)	92 (24.53)
Data unavailable	2 (1.09)	2 (1.04)	4 (1.07)
Education level			
No formal education	108 (59.02)	59 (30.73)	167 (44.53)
Primary school	22 (12.02)	38 (19.79)	60 (16.00)
Secondary school	24 (13.11)	47 (24.48)	71 (18.93)
Post-secondary school	17 (9.29)	15 (7.81)	32 (8.53)
Data unavailable	12 (6.56)	33 (17.19)	45 (12.00)
Social class			
Low	155 (84.70)	147 (76.56)	302 (80.53)
Middle	17 (9.29)	25 (13.02)	42 (11.20)
High	3 (1.64)	3 (1.56)	6 (1.60)
Data unavailable	8 (4.37)	17 (8.85)	25 (6.67)
Place of residence			
<5 km	55 (30.05)	60 (31.25)	115 (30.67)
>5 km	127 (69.40)	128 (66.67)	255 (68.00)
Data unavailable	1 (0.55)	4 (2.08)	5 (1.33)
Registration status			
Booked	39 (21.31)	43 (22.40)	82 (21.87)
Unbooked	139 (75.96)	145 (75.52)	284 (75.73)
Data unavailable	5 (2.73)	4 (2.08)	9 (2.40)
Mode of admission			
Emergency	163 (89.07)	172 (89.58)	335 (89.33)
Regular	20 (10.93)	20 (10.42)	40 (10.67)
Time of admission			
8.00 a.m. to 6.00 p.m.	124 (67.76)	113 (58.85)	237 (63.20)
6.01 p.m. to 7.59 a.m.	57 (31.15)	76 (39.58)	133 (35.47)
Data unavailable	2 (1.09)	2 (1.56)	5 (1.33)

MD, maternal death; MNM, maternal near-miss.

Table 2. Prevalence of severe non-obstetric complications and near-miss indicators

Non-obstetric complications	MNM (*N* = 183)	MD (*N* = 192)	MNM ratio (per 1000 LB)	MMR (per 100 000 LB)	SMOR per 1000 LB	MNM:MD ratio	Mortality index (%)	Cause-specific CFR (%)
HIV/AIDS/HIV wasting syndrome	10 (5.5)	41 (21.3)	0.11	44.70	0.56	0.24	80.4	1.47
Malaria	23 (12.6)	12 (6.3)	0.25	13.08	0.38	1.92	34.3	0.40
Severe anaemia*	112 (61.2)	63 (32.8)	0.51	68.68	1.91	1.78	36.0	6.79
Cardiac disease	21 (11.5)	20 (10.4)	1.22	21.80	0.45	1.05	48.8	8.40
Lung disease	5 (2.7)	8 (4.2)	0.06	8.72	0.14	0.63	61.5	3.67
Renal disease	4 (2.2)	4 (2.1)	0.04	4.36	0.09	1.00	50.0	4.00
Hepatic disease	2 (1.1)	9 (4.7)	0.02	9.81	0.12	0.22	81.8	7.83
Cancer	1 (0.5)	11 (5.7)	0.01	11.99	0.13	0.09	91.7	2.10
Coincidental conditions/complications	5 (2.7)	24 (12.5)	0.06	26.2	0.32	0.21	82.8	17.78

CFR, case fatality rate; MD, maternal death; MMR, maternal mortality ratio; MNM, maternal 'near-miss'; SMOR, severe maternal outcome ratio.
*Unrelated to haemorrhage.

Table S3 (see Supplementary material) shows that the time between diagnosis of severe non-obstetric complications and institution of a definitive intervention was <30 minutes in 29.97% and a cumulative 64.69% of women with SMO by 240 minutes. It took over 240 minutes before a definitive intervention was instituted in 35.31% of the women. The time lag between diagnosis of severe non-obstetric complications and attention by senior personnel was <30 minutes in 30.23% and >240 minutes in 40.41% of women with SMO.

Discussion

Main findings

This analysis reveals that non-obstetric complications occurred in 9.4% of women admitted with maternal complications and 4.0% of these were severe. Affected women were generally young, uneducated, presented as emergencies and about half of them died. Severe anaemia (unrelated to haemorrhage) was the highest cause of maternal near-miss and maternal death with regional variations in the non-obstetric causes. Fatality was higher among older women, and neurological, cardiovascular, respiratory, renal and hepatic dysfunctions were the organ dysfunctions with the highest mortality indices. Fetal and neonatal outcomes were poor and delays were recorded between diagnosis of the SMO event and a senior physician's review or instituting definite intervention.

Strengths and limitations

The study represents the largest prospective evaluation of the contribution of non-obstetric maternal complications to SMO. Non-obstetric complications have not received attention compared with obstetric complications, hence the study represents an advocacy tool to address this knowledge gap. The nationwide spread, study design and data verification processes provided wide coverage across the highest level of health care delivery in Nigeria. However, there may be potential referral bias in our findings as the study included only referral centres that attend to critically ill women, hence with a higher potential for poor pregnancy outcomes. There have been concerns that the organ-system dysfunction (WHO criteria) alone may be too stringent to identify all cases that qualify as 'maternal near-miss' in low-income countries and may reflect on the maternal near-miss to maternal death ratio. This limitation was overcome in the study by using any of the organ-system dysfunction (WHO criteria), clinical or management-based (critical care) criteria for the diagnosis (see Supplementary material, Table S1).

Interpretations

Non-obstetric complications in this study were lower than previous reports of 15–26%[2–5,7,8,16,17] from low-income countries but higher than 3.8 per 1000 in a Scottish population.[18] The previous reports were smaller single-centre studies or evaluated critically ill obstetric women requiring intensive care with a bias for poorer outcome. This study is larger with the potential for a better description of the problem, and mortality was comparable to the 46.2% in a similar Indonesian study.[3] The sociodemography of non-obstetric complications was comparable to previous reports[1,3–5,15,19–21] suggesting the need to improve universal basic education, poverty alleviation and improved access to modern antenatal care services in low-income countries. Previously reported non-obstetric complications include anaemia, cardiac diseases, haemoglobinopathy, hepatitis, HIV/AIDS and cerebral diseases,[1–5,7,8,19,21–23] similar to this study's report.

Table 3. Association between maternal characteristics and fatality among women with severe non-obstetric complications

Characteristics	Severe non-obstetric complications *N* = 375	MD *N* = 192	MNM *N* = 183	Odds ratio, 95% CI MD vs MNM	*P*-value
Age					
<20 years	42 (11.20)	9 (4.69)	33 (18.03)	0.22, 0.10–0.48	<0.0001
20–35	296 (78.93)	157 (81.77)	139 (75.96)	1.42, 0.86–2.34	0.1675
>35	37 (9.87)	26 (13.54)	11 (6.01)	2.45, 1.17–5.12	0.0145
Marital status					
Married	345 (92.00)	172 (89.58)	173 (94.54)	0.50, 0.23–1.09	0.0772
Not married	29 (7.73)	19 (9.90)	10 (5.46)	1.90, 0.86–4.20	0.1083
Data unavailable	1 (0.27)	1 (0.52)	0 (0.00)	*	0.3282
Education level					
No formal education	167 (44.53)	59 (30.73)	108 (59.02)	0.31, 0.20–0.47	<0.0001
Primary school	60 (16.00)	38 (19.79)	22 (12.02)	1.81, 1.02–3.19	0.0402
Secondary school	71 (18.93)	47 (24.48)	24 (13.11)	2.15, 1.25–3.69	0.0050
Post-secondary school	32 (8.53)	15 (7.81)	17 (9.29)	0.83, 0.40–1.71	0.6088
Data unavailable	45 (12.00)	33 (17.19)	12 (6.56)	2.96, 1.48–5.93	0.0015
Social class					
Low	302 (80.53)	147 (76.56)	155 (84.70)	0.59, 0.35–0.99	0.0467
Middle	42 (11.20)	25 (13.02)	17 (9.29)	1.46, 0.76–2.81	0.2521
High	6 (1.60)	3 (1.56)	3 (1.64)	0.95, 0.13–7.20	1.0000
Data unavailable	25 (6.67)	17 (8.85)	8 (4.37)	2.13, 0.89–5.05	0.0820
Place of residence					
<5 km	115 (30.67)	60 (31.25)	55 (30.05)	0.88, 0.56–1.39	0.5858
>5 km	255 (68.00)	128 (66.67)	127 (69.40)	0.88, 0.57–1.36	0.5707
Data unavailable	5 (1.33)	4 (2.08)	1 (0.55)	3.87, 0.38–191.73	0.3724
Registration status					
Booked	82 (21.87)	43 (22.40)	39 (21.31)	1.07, 0.65–1.74	0.7995
Unbooked	284 (75.73)	145 (75.52)	139 (75.96)	0.98, 0.61–1.57	0.9217
Data unavailable	9 (2.40)	4 (2.08)	5 (2.73)	0.76, 0.15–3.58	0.7457
Admission time					
8.00 a.m. to 6.00 p.m.	237 (63.20)	113 (58.85)	124 (67.76)	0.68, 0.45–1.03	0.0738
6.01 p.m. to 7.59 a.m.	133 (35.47)	76 (39.58)	57 (31.15)	1.44, 0.95–2.22	0.0879
Data unavailable	5 (1.33)	3 (1.56)	2 (1.09)	1.44, 0.23–8.70	0.6919
Onset of labour					
Spontaneous	121 (32.27)	54 (28.13)	67 (36.61)	0.68, 0.44–1.05	0.0789
Induced	16 (4.27)	7 (3.65)	9 (4.92)	0.73, 0.27–2.10	0.5423
Caesarean section	36 (9.60)	21 (10.94)	15 (8.20)	1.38, 0.69–2.76	0.3678
Undocumented	202 (53.87)	110 (57.29)	92 (50.27)	1.32, 0.88–1.99	0.1729

MD, maternal death; MNM, maternal near-miss.
*Undefine.

Severe anaemia unrelated to haemorrhage remains the commonest pregnancy complication in sub-Saharan Africa with prevalence of 35–75%, and it has worsened following the advent of HIV/AIDS.[23] Anaesthesia-related complications were negligible in this study, presumably due to selection of consultant-supervised study sites.[17,20] Despite increasing screening coverage for HIV/AIDS in Nigeria, only 30.1% of women living-with-HIV requiring antiretrovirals for the prevention of mother-to-child transmission are using highly active antiretroviral therapy due to inadequate uptake, poor community participation and minimal male partner support.[24] This may explain the reason for HIV/AIDS/HIV wasting syndrome as a major cause of non-obstetric complications in this study.

This study shows regional variations in the non-obstetric causes of severe SMOs. In the north-central, hepatic diseases and HIV/AIDS/HIV wasting syndrome were commonest. A report from Jos, north-central Nigeria attributed the high occurrence of hepatitis to the consumption of locally brewed alcohol contaminated by hepato-toxic impurities.[19] The prominence of HIV/AIDS/HIV wasting syndrome in the region could partly be because the study sites in the region were HIV referral centres. Northeast Nigeria had the highest occurrence of severe anaemia unrelated to

Table 4. Mortality index according to organ dysfunctions, fetal and neonatal outcomes associated with severe non-obstetric complications

Organ dysfunction	Severe non-obstetric complications *N* = 375 (%)	MNM *N* = 183 (%)	MD *N* = 192 (%)	Mortality index (%)
Cardiovascular dysfunction	136 (36.27)	34 (18.85)	102 (53.13)	75.00
Respiratory dysfunction	181 (48.27)	52 (28.42)	129 (67.19)	71.27
Renal dysfunction	34 (9.07)	11 (6.01)	23 (11.98)	67.65
Coagulation dysfunction	37 (9.87)	24 (13.11)	13 (6.77)	35.14
Uterine dysfunction	2 (0.53)	1 (0.55)	1 (0.52)	50.00
Hepatic dysfunction	8 (2.13)	3 (1.64)	5 (2.60)	62.50
Neurological dysfunction	48 (12.8)	11 (6.01)	37 (19.27)	77.08
Fetal and neonatal outcomes		**MNM** *n* = 90	**MD** *n* = 83	**Total** *n* = 173
Women with delivery outcomes		90	83	173
Neonatal conditions at birth*				
Alive		62	55	117
Fresh stillborn		18	17	35
Macerated stillborn		10	11	21
Early neonatal death at hospital discharge or ≤ day 7		26	32	58
Perinatal mortality (stillborn + END at discharge or ≤ day 7		54	60	114
Newborn admission to SCBU		16	19	35

END, early neonatal death; SCBU, special care baby unit.
*Excluding second and high order fetuses.

haemorrhage, corroborating a previous report of high prevalence of anaemia in pregnancy in the region. In this secondary analysis, most cases of anaemia unrelated to haemorrhage were not due to malaria infection as expected. Possible explanations include poor birth spacing, pregnancies at the extremes of age, local taboos regarding nutrition during pregnancy and parasitic worm infestation.[25] However, categorisation of the causes of maternal near-miss was based on the primary cause that set up the cascade of events leading to the non-obstetric complication.

Cardiac diseases were the prominent non-obstetric complications in the northeast and northwest regions. Globally, the highest prevalence of peripartum cardiomyopathy was in Zaria, northwest Nigeria due to the traditional peripartum care requiring parturients to eat dry lake salt (*Kanwa*) and lie on a heated mud bed in a humid room with frequent hot baths for 40 days after birth in an attempt to stimulate lactation. The practice results in cardiac damage from excessive vasodilatation, oedema, hypervolaemia and hypertension.[26,27]

The hospitals from the southwest recorded the highest cases of malaria as non-obstetric complications. This is not unexpected because the region is in the rainforest belt with reports of up to 72% parasitaemia in pregnant women and 88.2% high parasite density.[28]

Higher mortality indices were observed for organ dysfunction, similar to previous reports on non-obstetric complications.[3–5] In one report, most maternal deaths followed coagulation and respiratory dysfunction;[10] however, most preventable maternal deaths were from obstetric complications.[1] Fatality in critically ill obstetric patients has been reported to depend on the clinical state at admission to intensive care.[29] Most women in low-resource countries present late without referral note and are transported in poor conditions[29] without provision for care in transit. Often, health facilities are poorly sited, 68% of women in this study live far from the facilities. In a report from Nigeria, 57.1% of maternal deaths occurred within 24 hours of arrival at the health facility,[23] suggesting limited availability and reduced opportunity to administer care effectively, when such services are available, because of late arrival. A study in Indonesia reported a large number of near-misses on arrival at the facility due to late presentations including home births.[3]

In this study, significant fetal and neonatal morbidity, prolonged special care baby unit admission and high perinatal mortality occurred among women with non-obstetric complications.

Time between diagnosis of severe non-obstetric complication and definitive intervention was <30 minutes in 29.97%, whereas time lag from diagnosis to attention by a senior personnel was <30 minutes in 30.23% and >240 minutes in 40.41%. This emphasises the poor health facility preparedness and response to non-obstetric complications. In a similar study in Nigeria, 8.9% of women with SMO were

attended to within 1 hour and a cumulative 57.1% within 24 hours of presentation.[21] This suggests the need for health facilities to develop protocols that guarantee complication readiness and prompt evaluation of women with SMO. Practical solutions may include accommodation of health personnel within or close to health facilities, ease of transport during call hours and provision of equipment for effective service delivery.

Conclusions

The study calls for an improved evaluation and management of women with non-obstetric disorders during pregnancy and puerperium. Multidisciplinary collaboration should be actively pursued to limit complications while further research attention should be explored to provide additional evidence. Non-obstetric complications are not uncommon; although of lesser frequency than obstetric complications, the proportionate mortality was higher. Hence, while addressing individual, economic, social, cultural and health facility challenges; complication-readiness and collaborative care should be prioritised to improve outcome.

Disclosure of interests

The authors declare no conflict of interest. Completed disclosure of interest forms are available to view online as supporting information.

Contribution to authorship

OTO conceived the main study, and ASA conceived this secondary analysis. Study implementation was a collaborative effort of hospital personnel and researchers from 42 tertiary hospitals across the six geo-political zones in Nigeria as part of the Nigeria Near-Miss and Maternal Death Surveillance Network. This secondary analysis was prepared with substantial contribution on all aspects from design, literature review, drafting of the article, review and final approval of the final article by ASA, ANO, DN, NA, BA, TO, ACU, APA and OTO, on behalf of the Nigeria Near-Miss and Maternal Death Surveillance Network.

Details of ethics approval

Ethical approval for the main study was obtained from the WHO Research Ethics Review Committee (WHO ERC) with protocol ID: A65745, version 4 (10 May 2011). In addition, the ethics review committee of each participating health facility approved the study before commencement.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1. Criteria for identification of maternal near-miss.

Table S2. Regional distribution of specific non-obstetric causes of severe maternal complications.

Table S3. Time between diagnosis of severe non-obstetric complications and intervention to avert maternal death and attention by senior personnel by severity of outcomes. ■

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