International Journal of Community Medicine and Public Health
Ndungu WD et al. Int J Community Med Public Health. 2023 Jul;10(7):2301-2308
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20231770

Original Research Article

Determinants of neonatal mortality in Margaret Kenyatta Mother Baby Wing at Nakuru level 5 hospital, Nakuru County, Kenya

Wainaina D. Ndungu[1]*, Dominic M. Mogere[1], Kerochi Atei[2]

[1]Department of Epidemiology and Biostatistics, School of Public Health, Mount Kenya University, Thika, Kenya
[2]Department of Community Health, School of Public Health, Mount Kenya University, Thika, Kenya

Received: 18 May 2023
Revised: 30 May 2023
Accepted: 02 June 2023

***Correspondence:**
Dr. Wainaina D. Ndungu,
E-mail: drdanielwainaina@gmail.com

ABSTRACT

Background: Nakuru county has 41.9 neonatal deaths per 1000 live births, more than double the national average of 19. This study examined Nakuru level 5 hospital neonatal mortality risk factors.
Methods: A retrospective mismatched case-control study was used. The 429 neonates (143 cases and 286 controls) were estimated assuming a 1:2 case-to-control ratio and 18% prevalence of exposure among controls. Binary logistic regression measured dependent-independent variable correlation.
Results: The study found that high parity, high number of stillbirths, positive HIV, HBsAg, syphilis, pregnancy-induced hypertension, antepartum hemorrhage, PROM 18hours, and maternal peri-partum increased the risk of neonatal. Similarly, mothers who had fewer ANC visits throughout their pregnancy had a higher risk of neonatal mortality compared to mothers who attended more than three ANC clinics, with mortality risk reducing by 69% and 59% for 1-2 visits and more than 3 visits, respectively, compared to non-attendance. Vaginal aided birth had an or of 2.188 and vaginal unassisted OR=4.533 compared to caesarian delivery. Antibiotics and prenatal dexamethasone decreased maternal mortality. Antibiotics lowered NMR or 0.381. Newborns admitted from referral facilities or labor wards had or 1.11 and or 6.220 death rates. Low birth weight, admission weight, gain weeks, and congenital defects increased mortality. In this study, birthweight decreased newborn mortality.
Conclusions: The study concluded that maternal characteristics, neonatal complications are key to improving neonatal outcomes. The study recommends regular training of staff working in the maternity and newborn unit on emergency care and neonatal resuscitation.

Keywords: Neonatal mortality, Maternal factors, Hospital factors, Neonatal factors

INTRODUCTION

Rift valley region which is the location of Nakuru county among others has a neonatal mortality rate of 20 deaths in 1000 live births and under 5 mortality rates of 45 deaths per 1000 live births.[1] The total number of deliveries registered in Nakuru County between October 2018 and September 2019 (one year duration) was 55,448 and neonatal deaths were 688 ministry of health.[2] This indicates that for every 100 mothers who delivered in Nakuru County at least one mother lost her baby during the first 28 days of live.[1] From the data, the hospital recorded a total of 12,757 deliveries which accounts for over 23% of the total deliveries in Nakuru County. The total number of babies born alive were 11610 and the total neonatal deaths were 394 for the same period which indicates a neonatal mortality rate of 34 per 1000 live births which is approximately twice the country neonatal mortality rate. This implies that 3% of mothers were discharged out of the hospital without their live babies. The Ministry of Health report shows that 2364 from a total of 11610 babies who were born alive were admitted in the new-born unit for various health problems which

accounted for 20% of the total babies born alive.[2] The report further reviews that 16% (394) of the total babies admitted at Nakuru level 5 hospital new-born unit died within the first 28 days of life.[2] The records from the facility shows that 18% of neonates who were discharged from the hospital after admission and 30% of those who died were born before 37 weeks of pregnancy. This study, therefore sought to assess factors that could be associated with neonatal mortality in Margaret Kenya Mother Baby Wing at Nakuru level 5 hospital. Comparing the trend in the decline of the under 5 mortality rate and neonatal mortality, this study denotes that the under 5 mortality rate records a higher rate of decline (55%, 115 in 2003 and 52 in 2014) against neonatal mortality rate of 33% (33 in 2003, 22 in 2014). According to KDHS, it is further argued that there should be more focus on the health of the new-borns in order to accelerate positive change in the survival of a child.[1]

Objectives

Objectives of the to assess the factors contributing to mortality of the new-born babies admitted to the Margaret Kenyatta Mother Baby Wing (MKMBW) at Nakuru level five hospital, in Nakuru County, to determine the prevalence of neonatal deaths at Margaret Kenyatta Mother Baby Wing, Nakuru level five hospital, to investigate maternal factors associated with neonatal deaths at Margaret Kenyatta Mother Baby Wing, Nakuru level five hospital, to investigate neonatal factors associated with neonatal deaths at Margaret Kenyatta Mother Baby Wing, Nakuru level five hospital and to investigate hospital factors associated with neonatal deaths at Margaret Kenyatta Mother Baby Wing, Nakuru level five hospital.

METHOD

The chapter describes study methodology including the design of the study, study setting, population targeted, sampling techniques, data collection tools and procedures and how data will be analysed and presented.

Study design

The study was an unmatched case control study design. Unmatched case control research design. Case control studies examine exposure and study outcomes.[3] Salvador states that the case control study helps establish the exposure link between individuals who express the result of interest (cases) and those who do not (controls).[3] The study investigated new-born fatalities at Margaret Kenyatta Mother Baby Wing (MKMBW) in Nakuru level 5 hospital. The MKMBW's new-born unit's deceased new-borns were the cases, while the survivors were the controls. Retrospective data was acquired from MKMBW's new-born unit's October 2018-September 2019 neonates. Epi Info version 7.3.2.1 was used to construct the sample of cases and controls, assuming preterm is the most prevalent risk factor with an 18% prevalence among controls.[1,2] The study used the odd ratio (2) to create a large sample. The lead investigator gathered complete patient records. The research covered all MKMBW new-born unit admissions.

Sample size determination

The study used double population proportion control method to calculate the sample size using Epi Info version 7.02 statistical package. The research assumed a confidence level of 95% (Zα/2= 1.96), a power of 80% (Zβ= 0.84), a case to control ratio of 1:2 (r=2), and an odds ratio of 2. The study adapted a prevalence of 18% as determined above. From factors associated with neonatal mortality, percent control exposed was held at 18% and proportion of cases with exposure 30.5% as determined. The formula for sample population determination is illustrated below.

$$n = \frac{\left(z_{q/2}\right)^2 \times \rho q}{d^2}$$

Where; n=sample size, p=percentage,

q=1-p

d=Desired degree of precision, z=Desired confidence level, usually 95%.

Using this formula, cases was determined to be 130 while controls were 260.

Accounting for a non-response rate of 10%, the maximum sample size was determined as illustrated in the diagram below:

$$\text{Cases}=130 + \frac{10}{100} \times 130=143$$

$$\text{Control}=260 + \frac{10}{100} \times 260=286$$

Total sample population=429

In addition, the study interviewed 11 key informants to provide data on the factors associated with neonatal mortality. The key informants were the medical superintendent, chief nursing officer, obstetrician and gynaecologist, paediatrician, medical officer maternity department, medical officer interns in the maternity and new-born unit, nursing officer in-charge of maternity and nursing officers in-charge of labour ward, post-natal ward and new-born unit.

Descriptive statistics

Procedure and methods of collecting data

This study used Nakuru level 5 hospital MKMBW patient files. Hospital records were tallied in excel. Appendix 4

depicts data collecting. The lead investigator collected data from neonates who died or survived during the study period using the study instrument. The new-born files were examined by the hospital health records officer, and patient data was extracted electronically from a dedicated room only accessible by approved research employees. Binomial logistic regression was used to determine how maternal and neonatal variables affected new-born mortality and survival following admission to the new-born ward. Risk factors were computed using odd ratios and confidence intervals. Hospital influences on new-born mortality were also examined. Multiple regression analysis was used to assess the independent variables' predictive power. The dependent variable was new-born outcomes (Dead or Alive) while the independent variables were maternal characteristics, maternal complications, healthcare factors, neonatal characteristics.

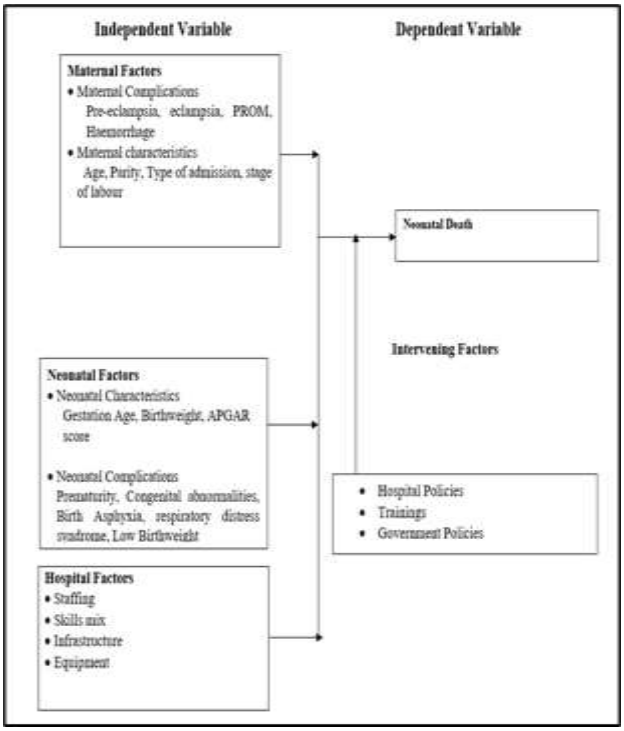

Figure 1: Conceptual model.

Inclusion and exclusion criteria

This study covered all neonates born alive at MKMB Wing of Nakuru level 5 hospital and admitted to the hospital New-born unit from October 2018 to September 2019. The study excluded babies born alive and healthy and released home but subsequently admitted and died in the hospital since the hospital isolates such patients to separate units rather than NBU. Due to probable bias and the fact that this was a retrospective analysis, the study did not include prenatal condition or socio-economic status. Prematurity kills most neonates, according to WHO.[4] This study excluded neonates born before 28 weeks and those with a birthweight of less than 1000 grams since the Kenya ministry of health rules state that foetal viability is below 10%. Due to the high risk of new-born unit admission and death, twin or multiple pregnancies were avoided.[5]

Ethical approval

Permission to carry out the study was sought from school of postgraduate studies of Mount Kenya University. National research permit was obtained from national council of science, technology, and innovation of Kenya (NACOSTI). Data was collected from the hospital records in the new-born and maternity unit in Nakuru level five hospital after requisite permission was granted by Nakuru County health department and introduction letter sent to the hospital medical superintendent. Informed consent was obtained before collecting data from the key informants. The research provided a detailed explanation of the study to the key informants before seeking consent for data collection. Patient information gathered from the hospital records, data collected from the key informants and the staff working in the new-born unit was coded and given anonymous identities in order to ensure that the provider/patient records remain confidential. The collection and use of personal data was in compliance to the data protection act of 2019, article 31(c) and (d) of the constitution, which regulates the processing of personal data, the rights of data subjects and obligations of data controllers and processors.

RESULTS

A total of 429 mothers with their respective new-borns (143 cases and 286 controls) were enrolled into the study. This chapter presents results on sociodemographic, maternal health and healthcare-related and neonatal determinants of mortality.

Prevalence

Prevalence refers to the probability that a specified portion of a population is exposed to a medical condition, usually, the unit of measure being a disease or a risk factor, within a specified period. In this research, the measure of interest is period prevalence for the study, that is, between October 2018 and September 2019, calculated as by the formula shown below.

$$\text{prevalence} = \frac{\text{Number of people in the sample with characteristic}}{\text{Total number of people in the sample}}$$

Abbreviated as; $\overline{P} = {}^{x}/_{n}$. The study established that there were 394 neonatal deaths out of 2364 neonates admitted in the new-born unit during the study period. This indicates that a proportion of 17% of the babies admitted to the new-born unit died during the period under study.

$$\overline{P} = {}^{x}/_{n} = \overline{P} = {}^{394}/_{2364} \text{ x } 100 = 17\%$$

Statistical 'weights' can be used to verify that a sample can be generalized to total population. The sample characteristics are quantitatively adjusted to fit the target

population by weighting the sample; this is expressed in the formula below.

$$SE\bar{P} \pm z\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

Substituting the value;

$$0.167 \pm 1.96\sqrt{\frac{0.167(1-0.167)}{2364}}$$

=0.167±1.96(0.007)=0.167±0.015

So, the 95% confidence interval (0.182, 0.152, p=0.007). Thus, we are 95% confident that neonatal mortality prevalence is between 18.2% and 15.2%.

Maternal factor

Findings from this study indicate that high parity increased NMR 1.87 times (COR=1.87, 1.046-3.342, and a p=0.035), 3.196 times (CI=1.745-5.851, and p=0.000, and 15.56 times (CI=7.95-30.471, p=0.000) for a parity of 2, 3 and 4 respectively compared to a parity of 1. The results also that mothers who were more educated had lower rates of neonatal mortality than those without education. Although not significant, mothers with primary school education have a 22% lower NMR (COR=0.771, CI=0.203-2.486 p=0.593). Similarly, neonates of mother with secondary, post-Secondary and university education were 0.03 times (COR=0.039, CI=0.011-0.132, p=0.928), 0.028 times (COR=0.028, CI=0.009-0.085, p=0.000) and 0.05 times (COR=0.057, CI=0.057-0.013, p=0.000) respectively less likely to die. Similar observation was made for age whereby increasing age coincided with decreasing mortality rates, but mortality rose at the extremes of age. While older age is protective as the findings indicate that neonates of maternal age 20-24 years were at 64% (COR=0.340, CI=0.187-0.619 and p=0.000) and 25-29 years 71% (COR=0.309, CI=0.172-0.554 and p=0.000) lower risk of mortality compared to neonates born to mothers between 15 and 20 years. Similarly, although not significant (p=0.172), neonates whose mothers maternal age is 30-34-29 are 21% (COR=0.787, CI=0.465-1.330) have lower risk levels compared to neonates born to mothers aged 15-20 years old. Although the data showed a decreasing rate of mortality with maternal age, and education, the data was not statistically significant in both cases. The results of the analysis are illustrated below.

Hospital factors

From the analysis, mortality risk reduced by 69% (COR=0.389, CI=0.250-0.606, p=0.000) and 59% (COR=0.418, CI=0.232-0.751, p=0.004) for 1-2 visit and more than 3 visits compared to none-attendance of ANCs. The findings in this research also suggest that PROM-18hours increased the risk of mortality by 2.61 times (OR=2.614, CI=1.412-4.839, p=0.002). From the data in this study, the mode of delivery affects the risk of mortality with vaginal assisted delivery having an OR=2.188, CI=1.406-3.405, p=0.001 while vaginal unassisted OR=4.533, CI=2.261-9.090, p=0.000. The finding in this study indicate that mother treatment with antibiotics (OR=0.658, CI=0.433-1.000, p=0.050) and mother treatment with antenatal dexamethasone (OR=0.578, CI=0.328-1.019, p=0.058) reduced the risk of mortality. The research also found that treatment with antibiotics reduced NMR by OR=0.381 (CI=0.251-0.577, p=0.000). While the research found a relationship between the origin of admission and neonatal mortality. Factors explaining the origin of this pattern were not explored. New-born admitted to the facility from a referral facility or labour ward had a higher risk of mortality of OR=1.113 (CI=0.696-1.781, p=0.655) and OR=6.220 (CI=3.319-11.653, p=0.000). The table below highlights the results of this analysis.

Neonatal factors

The findings indicate that increasing birthweight reduced the risk of neonatal mortality by; 1≥2 OR=0.247, CI=0.139-0.437, p=0.000, 2≥3 OR=0.170, CI=0.084-0.347, p=0.000, and 3≥4.5, OR=0.160, CI=0.085-0.301, p=0.000. Similarly, the age of admission to the NBU reduced to the risk of mortality by 1≥2, OR=0.836, CI=0.486-1.437, p=0.516, 2≥3 OR=0.236, CI=0.123-0.453, p=0.000, and 3≥4.5 50 OR 0.441, CI=0.242-0.804, p=0.007. The data also show that increasing gestation period reduced neonatal mortality by; 32>37 OR=0.401, CI=0.229-0.702, p=0.001, and 37>42 OR=0.227, CI=0.139-0.369, p=0.000. The analysis also show that congenital anomalies increased the risk of mortality by OR=1.857, (CI=1.082-3.187, p=0.025) while phototherapy treatment reduced NMR by OR=0.475, (CI=0.313-0.722, p=0.000). An observation was made in the case of number of foetuses whereby increasing number of foetuses increases the risk of mortality by an OR=1.215 at a CI=0.729-2.025 at a p=0.455. The table below highlights the results of this analysis.

Table 1: Maternal factors.

Variables	Case, n (%)		Control, n (%)		Crude odds ratio			P value	Adjusted odds ratio			P value
					OR	CI-95%			OR	CI-95%		
Maternal age (Years)												
15-19	63	44.1	75	26.3	1				1			
20-24	20	14	70	24.6	0.340	0.187	0.619	0.000	0.339	0.129	0.888	0.028
25-39	21	14.7	81	28.4	0.309	0.172	0.554	0.000	0.292	0.108	0.792	0.016
30-34	39	27.3	59	20.7	0.787	0.465	1.330	0.371	0.576	0.241	1.378	0.215

Continued.

Variables	Case, n (%)		Control, n (%)		Crude odds ratio			P value	Adjusted odds ratio			P value
					OR	CI-95%			OR	CI-95%		
Education level												
None	37	14	3	2	1				1			
Primary	74	29	5	4	0.771	0.203	2.486	0.593	0.986	0.209	4.653	0.986
Secondary	25	10	30	21	0.039	0.17	0.132	0.000	0.073	0.015	0.343	0.001
Post-secondary	88	34	101	72	0.028	0.009	0.085	0.000	0.032	0.008	0.129	0.000
University	32	13	2	1	0.057	0.013	0.234	0.000	0.141	0.022	0.885	0.037
Parity												
1	30	21	147	51.4	1				1			
2	29	20.3	76	26.6	1.87	1.046	3.342	0.035	1.623	0.668	3.941	0.285
3	30	21	46	16.1	3.196	1.745	5.851	0.000	3.119	1.243	7.824	0.015
4	54	37.8	17	5.9	15.56	7.95	30.471	0.000	21.96	7.711	62.59	0.000
Number of still births												
0	250	91	131	92	1				1			
1-2	20	7	10	7	11.60	6.302	21.351	0.000	8.399	3.519	20.04	0.000
≥3	4	1	2	1	19.24	8.096	45.838	0.000	17.15	5.135	57.31	0.000
HIV status												
Negative	215	87	106	95	1				1			
Positive	33	13	6	5	2.286	1.103	4.735	0.026	3.490	0.379	32.160	0.270
HBsAg status												
Negative	98	75	56	95	1				1			
Positive	33	25	3	5	5.656	2.239	14.289	0.000	2.557	0.272	24.005	0.411
Syphilis status												
Negative	118	80	38	95	1				1			
Positive	30	20	2	5	6.635	1.871	23.523	0.003	25.69	2.073	318.45	0.011
Gestational diabetes												
No	171	81	127	94	1				1			
Yes	41	19	8	6	3.384	1.733	6.609	0.000	0.293	0.019	4.531	0.379
Pregnancy induced hypertension												
No	184	72	119	85	1				1			
Yes	71	28	21	15	1.661	1.276	3.747	0.037	2.564	0.398	16.501	0.322
Antepartum haemorrhage												
No	204	78	126	89	1				1			
Yes	57	22	16	11	1.782	1.131	2.808	0.013	2.103	0.165	26.843	0.567
Maternal peri-partum fever												
Negative	212	83	124	93	1				1			
Confirmed	42	17	10	7	3.138	1.518	6.485	0.002	4.659	0.344	63.055	0.247

Table 2: Hospital factors.

Variables	Case, n (%)		Control, n (%)		Crude odds ratio			P value	Adjusted odds ratio			P value
					OR	CI-95%			OR	CI- 95%		
Number of ANC visits												
0	134	47	40	28	1				1			
1-2	110	38	73	51	0.389	0.250	0.606	0.000	0.373	0.181	0.770	0.008
≥3	42	15	30	21	0.151	0.240	0.847	0.013	0.137	0.040	0.468	0.002
Mother treated with antibiotics												
No	152	57	62	49	1				1			
Yes	113	43	64	51	0.658	0.433	1.000	0.050	0.442	0.087	2.257	0.327
Prophylactic antibiotics given												
No	161	58	59	41	1				1			
Yes	119	43	84	59	0.381	0.251	.577	0.000	0.240	0.116	0.498	0.000
Mother received antenatal dexamethasone												
No	218	84	112	83	1				1			
Yes	40	16	23	17	0.578	0.328	1.019	0.058	0.273	0.030	2.502	0.251
Mode of delivery												
CS	91	32	71	50	1				1			
Vaginal assisted	159	56	64	45	2.188	1.406	3.405	0.001	2.651	1.721	3.405	0.001
Vaginal unassisted	36	13	8	6	4.533	2.261	9.090	0.000	4.312	2.301	9.090	0.000

Continued.

Variables	Case, n (%)		Control, n (%)		Crude odds ratio			P value	Adjusted odds ratio			P value
					OR	CI-95%			OR	CI-95%		
Admitted to NBU from												
Home	106	37	73	51	1				1			0.000
Labour ward	100	35	60	42	1.113	0.696	1.781	0.655	2.347	1.176	4.683	0.015
Referral facility	80	28	10	7	6.220	3.319	11.65	0.000	27.674	8.754	87.488	0.000
Prom 18 hours												
No	213	82	130	93	1				1			
Yes	46	18	10	7	2.614	1.412	4.839	0.002	5.092	0.423	61.255	0.200

Table 3: Neonatal factors.

Variables	Case, n (%)		Control, n (%)		Crude odds ratio			P value	Adjusted odds ratio			P value
					OR	CI- 95%			OR	CI- 95%		
Birth weight (Kg)												
≤1	90	33	18	15	1				1			
1≥2	97	36	30	24	0.247	0.139	0.437	0.000	0.092	0.033	0.255	0.000
2≥3	38	14	35	28	0.170	0.084	0.347	0.000	0.041	0.003	0.494	0.012
3≥4.5	48	18	41	33	0.160	0.085	0.301	0.000	0.002	0.000	0.055	0.000
Weight on admission (Kg)												
≤1	84	30	16	11	1				1			
1≥2	102	36	33	23	0.836	0.486	1.437	0.516	0.025	0.001	0.746	0.033
2≥3	46	16	49	34	0.236	0.123	0.453	0.000	0.045	0.001	1.399	0.077
3≥4.5	50	18	45	31	0.441	0.242	0.804	0.007	0.032	0.003	0.391	0.007
Gestation period (weeks)												
28-32	144	52	34	24	1				1			0.000
32>37	58	21	29	21	0.401	0.229	0.702	0.001	0.239	0.094	0.607	0.003
37>42	77	28	77	55	0.227	0.139	0.369	0.000	0.154	0.066	0.362	0.000
Congenital anomalies												
No	215	76	123	86	1				1			
Yes	68	24	20	14	1.857	1.082	3.187	0.025	1.341	0.609	2.955	0.467
Photo therapy												
No	179	63	75	53	1				1			
Yes	103	37	66	47	0.475	0.313	0.722	0.000	0.092	0.037	0.229	0.000
Number of foetuses in the pregnancy												
1	228	80	129	91	1				1			
2	57	20	13	9	1.215	0.729	2.025	0.455	1.848	0.713	4.786	0.206

DISCUSSIONS

Prevalence

From results, hospital experiences a higher-than-average mortality rate. Higher-than-average rate of mortality is attributed to limits of study, that is, focus on NBU rather than general population. Results closely align with finding by Irimu et al involving 41 657 neonates admitted to NBUs across 16 hospitals.[2] The study reported that 4266/41 657 neonates died giving crude mortality rate of 10.2% (95% CI=9.97% to 10.55%), with 60% of these deaths occurring within 7 days of admission.

Maternal factors

Results from this research found that educated mothers had lower infant NMRs than those without education. Neonatal deaths 0.03 times, 0.028 times, and 0.05 times lower among mothers with secondary, post-secondary, and university education. Age decreased NMRs but increased at extreme ages. While older age is protective, neonates born to mothers aged 20-24 and 25-29 had 64% and 71% lower NMRs than those delivered to mothers aged 15-20. Although not significant, neonates born to mothers aged 20-30 had reduced risk than those born to mothers under 20. Previous research has also documented similar findings. In a study by Waldenström et al nulliparity was linked to obstructed labour, while high parity was linked to hypertension, uterine rupture, and placenta previa.[6] Waldenström et al also found that parity, mother age, and education affected infant mortality.[6] These findings verify this study's conclusions that high parity increased NMR by 1.87 to 15.56 times for parities 2, 3, and 4 compared to 1. Fonseca et al examined NMR and mother age and education; the research posited that inadequate education increased new-born mortality by 25%.[7] In agreement with the literature, this study found that younger mothers had a stronger independent effect on new-born mortality (OR=1.39) than older mothers (OR=1.16). Compared to women aged 20-34 and with a 4-year/advanced education, Fonseca et al found that children born to mothers at the extremes of age and lower education had a 1.7-fold higher risk of new-born death.[7]

The study also found a significant interaction between education and mother's age in new-born mortality only for women over 35, with age having modest statistical significance (p=0.06).

The data from this study show that that 1 stillbirth had an 11-fold chance of new-born death, while 3 had a 19-fold risk. The analysis also found higher NMR with positive HIV status, syphilis status, gestational hyperglycemia, pregnancy-induced hypertension, antepartum haemorrhage, and maternal peri-partum fever, supporting this research. Similar findings can be found in previous research. According to Boucheron et al direct neonatal infection caused increased NMR; HIV positivity increases mortality risk, while neonatal hepatitis B virus infection commonly occurs at birth and is asymptomatic, causing lethargy, jaundice, abdominal distention, and failure to grow.[8] CDC estimates that 70-90% of neonates born to HBsAg-positive mothers may get perinatal HBV, with 85%-90% becoming chronic HBV carriers.[9] Similar findings are documented whereby HBsAg positivity increased infant death by OR 5.656 while gestational diabetes increased the incidence of new-born death by 1.63 times.[10] Khanam et al found that pregnancy-induced hypertension (PI) was an OR=1.8 risk factor for early new-born mortality and an OR=1.5 contributor.[11]

Hospital factors

According to Gupta, PROM is a common cause of preterm labour and neonatal morbidity and death, it is also closely correlated to new-born infection. Premature labour and neonatal morbidity and death are often caused by PROM.[12] PROM highly correlated with new-born infection. Birth asphyxia and NMR were covariates of maternal fever in a rural Nepalese prospective community-based research.[13] The research also found that PROM-18 hours increased mortality by 2.61 times. Data from this study show similar results; pregnant women who visited fewer than three ANC clinics had a greater risk of neonatal mortality. ANC attendance reduced mortality risk by 69% for 1-2 visits and 59% for 3+ visits. In this study, parents who didn't have frequent ANC check-ups had 2.5 times the risk of those who did, maybe because maternity care improves women's knowledge, awareness, health, and risk monitoring.

Iyanda et al observed that caesareans reduce neonatal mortality by OR=0.996, p=0.05. Vaginal delivery increases new-born and mother mortality OR=1.005, (p=0.05), 1.002, p>0.05.[14] This study found 2.188 OR for vaginal assisted delivery and 4.533 for unassisted. Mother treatment affects neonatal mortality. Duby et al found community-based antibiotic treatment reduced infant mortality by OR=0.82 compared to hospital referral alone.[15] WHO action trials collaborators found high-risk mothers using dexamethasone decreased neonatal mortality, stillbirth without increasing bacterial infection.[6] Antibiotics and prenatal dexamethasone reduced maternal mortality, corroborating findings. Antibiotics reduced NMR OR=0.381. Admission origin affected new-born mortality. This pattern's origin needs further research.

Neonatal factors

Atif et al., found that suboptimal birth/admission weight and shorter gestational periods increased infant mortality by AOR=9.59, (4.41, 20.84) and AOR=5.13 (CI=2.19, 12.04), respectively. This study found that increasing birthweight decreased new-born mortality.[17] The NBU admission age lowered mortality risk. Increasing gestation duration also lowered new-born mortality. Multivariate research showed that both factors decreased new-born mortality. Congenital defects and other comorbidities including gestational diabetes and hypertension in women with underlying medical conditions increase mortality risk Liu et al. This analysis indicated that congenital abnormalities increased new-born death by OR=1.857, supporting the literature. Phototherapy lowered NMR OR=0.475 as reported by Olusanya, Kaplan and Hansen who noted that blue light phototherapy is needed to prevent morbidity and death from high levels of new-born jaundice.[18] Phototherapy absorbs and breaks bilirubin, allowing the new-born to remove it before it causes permanent kernicterus or death. With reference to number of foetuses and the mother's age, mother-foetus resource rivalry for nutrition and/or physical immaturity may contribute to poor new-born outcomes in young women and high NMR.[18] Number of foetuses increased death by OR=1.215.

Limitations

This study targeted neonatal deaths that had occurred between October 2018 and September 2019 at Nakuru level 5 hospital thereby limiting the dataset to a limited time period; expanding the length of study can therefore provide a more reliable data on the NMR patterns. The study was designed to audit patient data that was recorded for both the mothers who had delivered either through referral or booking in the facility, however, the results does not take into account the mediating factors that impact NRM during patient transfer. The study did not put into consideration the prevailing at the study setting and the ongoing state of care in the maternity and new-born unit but rather retrospectively analysed and attempted to understand the conditions surrounding deaths of neonates at hospital that had occurred in past.

CONCLUSION

From the discussions, mother age, education, parity, number of stillbirths, ANC visits, and number of foetuses in the pregnancy are the significant predictors of new-born death. Parity increased infant mortality while frequent ANC visits lowered NMR. Increasing number of foetuses in a pregnancy had increased NMR. The study found that educated mothers had reduced infant NMRs while extremes of ages presented the highest level of risk. The data revealed an increasing risk with stillbirths, but

they were not statistically significant and were not used for further study. Medical conditions such as positive HIV status, HBsAg, syphilis, gestational diabetes, pregnancy-induced hypertension, antepartum haemorrhage, prom 18 hours, and maternal peri-partum fever substantially increased NMR. Antibiotics and prenatal dexamethasone lowered NMR in mothers. Similarly, older NBU admissions lowered mortality while NMR decreased as gestation time increased. New-borns with referral or labour ward mothers had a higher NMR. Antibiotics and phototherapy lowered risk whereas congenital abnormalities raised NMR. Cases of dystocia-obstructed and protracted labour-was the most prevalent maternal problem. Haemorrhage and PET were other birth problems associated with high NMR. Similarly, new-born unit's neonates were most likely to die from prematurity and birth asphyxia. Other factors that contributed to high NMR include sepsis, RDS, and low birthweight were among new-born problems. Analysis of hospital factors shows that staffing, skills mix, and new-born unit capacity affected new-born outcomes. Problems such as the lack of neonatal resuscitation skills and emergency readiness for high-risk new-borns led to poor neonatal outcomes in the new-born unit.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Kenya Demographic and Health Survey Report. 2014.
2. Irimu G, Aluvaala J, Malla L, Omoke S, Ogero M, Mbevi G et al. Neonatal mortality in Kenyan hospitals: a multisite, retrospective, cohort study. BMJ Global Health. 2021;6(5):e004475.
3. Salvador JT. Exploring quantitative and qualitative methodologies: A guide to novice nursing researchers. Eur Scientific J. 2016;12(18).
4. World Health Organization. Preterm Birth. 2018. Available at: https://www.who.int/news-room/fact-sheets/detail/preterm-birth. Accessed on 1 May 2023
5. Owili PO, Muga MA, Chou YJ, Hsu YH, Huang N, Chien LY. Associations in the continuum of care for maternal, newborn and child health: a population-based study of 12 sub-Saharan Africa countries. BMC Publ Health. 2016;16(1):1-5.
6. Waldenström U, Cnattingius S, Vixner L, Norman M. Advanced maternal age increases the risk of very preterm birth, irrespective of parity: a population-based register study. Int J Obstetr Gynaecol. 2017;124(8):1235-44.
7. Fonseca SC, Flores PV, Camargo Jr KR, Pinheiro RS, Coeli CM. Maternal education and age: inequalities in neonatal death. Revista De Saude Publica. 2017;51:94.
8. Boucheron P, Lu Y, Yoshida K, Zhao T, Funk AL, Lunel-Fabiani F et al. Accuracy of HBeAg to identify pregnant women at risk of transmitting hepatitis B virus to their neonates: a systematic review and meta-analysis. Lancet Infect Dis. 2021;21(1):85-96.
9. Schillie S, Vellozzi C, Reingold A, Harris A, Haber P, Ward JW et al. Prevention of hepatitis B virus infection in the United States: recommendations of the Advisory Committee on Immunization Practices. MMWR Recommendations Rep. 2018;67(1):1.
10. Deryabina EG, Yakornova GV, Pestryaeva LA, Sandyreva ND. Perinatal outcome in pregnancies complicated with gestational diabetes mellitus and very preterm birth: case-control study. Gynecological Endocrinol. 2016;32(2):52-5.
11. Khanam R, Ahmed S, Creanga AA, Begum N, Koffi AK, Mahmud A et al. Antepartum complications and perinatal mortality in rural Bangladesh. BMC Pregnancy Childbirth. 2017;17(1):1-8.
12. Gupta S, Malik S, Gupta S. Neonatal complications in women with premature rupture of membranes (PROM) at term and near term and its correlation with time lapsed since PROM to delivery. Trop Doctor. 2020;50(1):8-11.
13. Aftab F, Ahmed I, Ahmed S, Ali SM, Amenga-Etego S, Ariff S et al. Direct maternal morbidity and the risk of pregnancy-related deaths, stillbirths, and neonatal deaths in South Asia and sub-Saharan Africa: A population-based prospective cohort study in 8 countries. PLoS Med. 2021;18(6):e1003644.
14. Iyanda AE, Osayomi T. Association between childbirth modes and neonatal and maternal deaths using a negative binomial model. Women's Reproductive Heal. 2019;6(2):128-40.
15. Duby J, Lassi ZS, Bhutta ZA. Community-based antibiotic delivery for possible serious bacterial infections in neonates in low-and middle-income countries. Cochrane Database Systematic Rev. 2019(4).
16. Atif M, Zia R, Malik I, Ahmad N, Sarwar S. Treatment outcomes, antibiotic use and its resistance pattern among neonatal sepsis patients attending Bahawal Victoria Hospital, Pakistan. PloS oOne. 2021;16(1):e0244866.
17. Olusanya BO, Kaplan M, Hansen TW. Neonatal hyperbilirubinaemia: a global perspective. Lancet Child Adolescent Health. 2018;2(8):610-20.
18. Hamese MH, Mashego MP, Shipalana N, Sutton C, Ntuli TS. Factors associated with preterm very low birthweight infant mortality at a tertiary hospital in Limpopo Province, South Africa. South African J Child Heal. 2020;14(1):10-4.

Cite this article as: Ndungu WD, Mogere DM, Atei K. Determinants of neonatal mortality in Margaret Kenyatta Mother Baby Wing at Nakuru level 5 hospital, Nakuru County, Kenya. Int J Community Med Public Health 2023;10:2301-8.