

Determinants of Adverse Pregnancy Outcomes among Women Attending Antenatal Care-Clinic in Public Health Facilities in Nyando Sub-County, Kenya

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Abstract:- Adverse pregnancy outcome (APO) refers to gestation results other than vaginal birth, which include premature birth, miscarriage and low birth weight which are main causes of maternal and neonatal illness and death. In Kenya, the maternal mortality ratio stands at 355 deaths per 100,000 live births. In Kisumu County maternal mortality rate stands at 495 per 100,000 live births per year and Nyando Sub-County has the second-worst record of adverse pregnancy outcomes. Therefore, the current study assessed the determinants of adverse pregnancy outcomes among women attending 4 selected public health facilities in Nyando Sub-County. In this multicenter hospital-based cross-sectional study, n=301 women who delivered at the 4 randomly selected hospitals Nyando Sub-County hospital and visited the ANC department at least twice were systematically randomly recruited from November 2022 to September 2023. Data was collected using pre-tested and structured questionnaire which consisted of sections of demographic and obstetric characteristics. Presence of at least one maternal complication was used to determine the presence of APO. SPSS version 27 was used for data analysis. Chi-square (χ^2) was used to compare proportions based on pregnancy outcomes as normal and adverse. Association between socioeconomic status and APO, obstetric factors and APO as well as ANC visits and APO were determine using Binary logistic regression. Of the 301 participants, 96 (31.9%) had normal pregnancy outcome (NPO) while 205 (68.1%) had APO. Woman's age, parity, marital status, family income and education were associated with APO $p=0.001$, $p=0.001$, $p=0.001$, $p=0.001$ and $p=0.04$ respectively. With regard to obstetric factors, women of between 16-35 years were less likely to develop APO [OR=0.410, 95% CI=0.260-0.670, $p=0.001$]. In terms of gestation period with 37 weeks as the reference group, women with 28-37 weeks of gestation are less likely to develop APO [OR=0.114, 95% CI=0.132-0.497, $p=0.001$].

The study did not find any association with the number of ANC visits [OR=0.39 95% CI=0.36-1.26, $p=0.314$] however, women visiting ANC in the second trimester less likely to develop APO [OR=0.221, 95% CI=0.142-0.927, $p=0.001$]. Therefore, both sociodemographic and obstetric factor affect pregnancy outcome and early ANC visit is associated with better or normal pregnancy outcome.

Keywords:- Pregnancy Outcomes, Women, Antenatal Clinic.

I. INTRODUCTION

Adverse pregnancy outcomes (APO) refer to gestation results other than vaginal birth, which include premature birth, miscarriage, and low birth weight, which are main causes of illness and death (1). Additional evidence has equally associated APO with long-lasting physical and mental problems in children (2). Elsewhere, adverse pregnancy outcome has also been define as any pregnancy outcome that diverges from normal live births (3). These outcomes are the main causes of both maternal and neonatal morbidity and mortality in both middle and low-income countries (4). APO may include small for gestational age infant, preeclampsia, gestational diabetes, post-partum hemorrhage, hypertensive disorders among others (4). Currently, adverse pregnancy outcomes are the most important vital statistics used assess maternal and child health programs and these outcomes may vary from one region to another especially in Low and middle-income countries (LMIC) (4).

Adverse pregnancy outcomes are multifaceted health problems that affects both the pregnancy and the baby (5, 6). Babies with one or more adverse birth outcomes face a higher risk of death and a diversity of health and growing problems (1, 3, 6). Features such as maternal age, diabetes, miscarriage history, gestational age, anemia, and maternal malnutrition predispose mothers to adverse outcomes (7).

Pregnancy typically takes about 40 weeks or approximately 9 months, from conception to birth (8) and in this study we hypothesizes that other than gestational age, other obstetric and sociodemographic factors which has an immense variation may influence the pregnancy outcome. We further postulate that modifiable sociodemographic factors like family income, marital status and family may vary from one region to another hence there is need to determine how they may influence pregnancy outcome. and these causes should be prevented by now. Additional evidence show that neonatal mortality rate occurred almost every 2 minutes globally and between the year 2002 and 2020, the maternal mortality rate (MMR) which is the number of maternal deaths per 100,000 live births dropped by approximately 34% globally (9). Nevertheless, in the year 2020, approximately 800 women still died from preventable causes related to pregnancy and child birth (9). The above reports therefore warrants more interventions to reduce the global maternal mortality which has been associated with adverse pregnancy outcomes.

In Kenya alone, maternal mortality rate (number of women dying during childbirth) is approximated to be 355 deaths per 100,000 live births (10) which in our opinion is still alarming. Considering the current number of births occurring each year, this means that approximately 5,000 women and girls die each year due to complications of pregnancy and birth (10). In Nyanza alone, there are approximately 1,300 to 2,000 deaths per 100,000 births which is above the national average(10). As authors, we believe that information necessary for mitigation of APO purely relies in understanding of its determinants however, this information still remains scarce. As such, in the current study, we assessed the determinants of adverse pregnancy outcomes among women attending antenatal care-clinic in public health facilities in Nyando Sub-County, Kenya.

II. METHODS

➤ *Study Site*

This study was conducted in Nyando Sub-County which is located within Kisumu County in Western Kenya. It covers an area of 1168.4 square kilometers and its larger part falls within the rural settings making it a suitable area for to explore determinants of APO due to diverse socioeconomic setting. According to 2019 census, the total population of Nyando Sub-County is approximately 161,508 ((11). This study was conducted in 4 randomly selected health facilities (Ahero County hospital, Rabuor Sub- County hospital, Muhoroni County hospital and Awasi Sub-County hospital) in Nyando Sub-County between November 2022 to September 2023. Pregnant women in this study area have been reported to experience major challenge, some of which have culminated to culminated to adverse pregnancy outcomes (10).

➤ *Study Design*

This study adopted a multicenter facility based cross-sectional study design involving 301 women who delivered in Nyando Sub-County.

➤ *Study Population*

The study population were mothers who delivered within Nyando Sub- County and visited ANC department once or more in the four selected Health facilities. The mothers selected from the facilities were those who have gone through the antenatal care program and were likely to have benefited. Our expectation was to acquire useful information from these mothers because of their experience with antenatal care services at one time or another which they actually did.

➤ *Sampling Techniques*

Of the 15 hospitals and 10 Health centers in Nyando (10), 4 Health facilities (Ahero County hospital, Rabuor Sub-county hospital, Awasi Sub-county hospital and Muhoroni county hospital) were selected using simple random sampling technique. Study participants were allocated proportionally to each selected health facility based on the number of pregnant women who came for ANC visit in these hospitals. In this study, women who met the inclusion criteria were selected using systematic random sampling until the calculated sample size of 301 was achieved.

➤ *Inclusion Criteria*

Pregnant women who had previously given birth to at least one of the selected facilities in Nyando Sub-County was included. Pregnant women who have visited ANC and consented to participate in the study were included.

➤ *Exclusion Criteria*

Pregnant Women who were too sick to participate or refused to provide a written consent were not included.

➤ *Data Collection Process*

Information was gathered by researcher and 2 assistants that help in administering the questionnaire, due to language barriers (Kiswahili and Luo), the maximum time for the questionnaire was lessened 30 minutes. The tools applied for data collection was questionnaire and interview that lasted over three weeks working days. The data collection instrument will be initially formulated in English language then translated into a local language Luo and the back to English with the help of a free language specialist. Data collection tool consisted of 3 sections: The first part consisted of sociodemographic characteristics of the participants, the second part consisted of the obstetric characteristics of the participants and the third part contained provider related factors to capture the factors that we hypothesized could determine APO. Data were collected using face-to-face interviews using structured and pre-tested questionnaires that lasted for about four weeks. Those collecting data explained the purpose study and the interview process by emphasizing privacy and confidentiality.

➤ *Quality Control and Quality Assurance of the Data*

Data collectors / research assistants constituted research assistants who underwent prior technical training before the actual data collection. Trained collectors were supervised during data collection by a senior midwife professional. A pre-test on 5% of the total sample size of (16 women) outside the four selected Health facilities within Nyando but with similar characteristics of the study population was conducted

to ensure quality of data. English questionnaire was translated into a local language for easy understanding then back to English by language expert for consistency checks. Each collected data was double-checked for completeness, accuracy and consistency after collection.

➤ *Evaluation of Adverse Maternal Outcomes (APO) and Normal Pregnancy Outcome (NPO)*

Presence of at least one obstetric complication such as APH, PPH, preeclampsia was used to determine the presence of APO. Absence of any obstetric complication was considered normal pregnancy outcome (NPO). This dichotomized outcome as either APO or NPO was the basis of comparison of the hypothesized determinants.

III. STATISTICAL ANALYSES

SPSS version 27 was used for data analysis. Chi-square (χ^2) was used to compare proportions based on pregnancy outcomes as normal and adverse. Association between socioeconomic status and APO using binary logistic regression. With normal birth outcome as the reference group, association between obstetric factors and APO was determined using Binary logistic regression. Association between antenatal visits and APO was also determine using Binary logistic regression. $p \leq 0.05$ was considered statistically significant.

IV. RESULTS

➤ *Sociodemographic Characteristics of Research Participants*

The study showed that 81.7% of the women attending the health facilities for maternal health services were aged between 16–35-year followed by those whose age were less than 15 years at 17% and minority were those women who

were more 35-year-old at 1.3%. With regards to parity, para 1-2, para 3-4 and para 5 and above were 75.1%, 15.3% and 9.6% respectively. Notably, para 1-2 had the highest number of adverse pregnancy outcome 66.4%. In terms of marital status, 66.8% of the study participants were single while 33.2% were married. Majority of single women 51.2% had adverse pregnancy outcome.

Considering family income per household, those whose family income ranged between Ksh 5,000-10,000 were 14% while those whose family income were above Ksh 10,000 were 86%. This analysis shows that majority of the household with better or normal obstetric outcome was that with above Kshs. 10,000 (higher) 31.9%. 50.8% of the respondents had gestation week of above 37 weeks, followed by 21.6% with gestation period of 28-37 weeks, then 19.3% had gestation 20-28 weeks and finally 8.3%. This means that, most of the women were above 37 weeks who attended ANC while minority were below 20 weeks. Majority of women with adverse pregnancy outcome 31.7% were 28-37 weeks of gestation. 65% of the respondents had attained secondary school and 30.9% had tertiary education. Only 3/301 (1%) were completely illiterate (Table 1).

➤ *Socio-Economic Status On Adverse Pregnancy Outcome In Women Visiting ANC Clinic*

With regard to marital status, married women were more likely to have better or normal pregnancy outcome [OR=5.32, 95% CI=03.240-8.760, $P=0.001$]. Using family income of Ksh. 5,000-10,000 as the reference group, in the binary regression model, families whose income were more than Ksh. 10,000 were 4.95 times more likely to have better or normal pregnancy outcome [OR=0.495, 95% CI=3.780-9.900, $P=0.001$]. Education was associated with normal or better pregnancy outcome relative to illiteracy [OR=0.583, 95% CI=0.050-0.675, $P=0.040$] (Table 1).

Table 1: Socio-Economic Status on Adverse Pregnancy Outcomes among Women Attending Antenatal Care Clinic

Characteristics	Pregnancy outcome		p value
	OR	95% CI	
Marital status			
Single	Ref	-	
Married	5.320	3.24-8.760	0.001^a
Family income			
Ksh.5000-10,000	Ref	-	-
Above Ksh.10,000	4.95	3.780-9.900	0.001^a
Education			
None	xxx	xxx	-
Primary	1.200	0.73-19.631	
Secondary	1.127	0.100-12.649	0.040^a
Tertiary	Ref	-	-

Participants (n=301) were grouped based on the obstetric outcome. ^a Statistical significance was determined by the Chi-square (χ^2) analysis. Odds ratios (OR) and 95% confidence intervals (CI) were determined between the groups using binary logistic regression model Statistically significant was set at $p < 0.05$. The reference groups in the regression were single for marital status, Ksh. 5000-10,000 for family income and tertiary for education level.

➤ *Obstetric Factors Influencing Adverse Pregnancy Outcomes of Women in Public Antenatal Care Hospitals*

Chi-square analysis showed that <15 years of age was associated with adverse pregnancy outcomes ($p=0.001$) (Table 1). Binary logistic regression demonstrated that pregnant women of age 16-35 were less likely to have adverse pregnancy outcomes [OR = 0.41, 95% CI = 0.260-0.670, $p = 0.001$]. The regression model further demonstrated that women with higher parity (para 5 and above) were more expected to experience adverse pregnancy outcomes [OR = 1.316, 95% CI = 0.606-2.990, $p = 0.080$]. In this case, the odds of negative pregnancy outcomes increased with parity though this was not statistically significant. Majority of the respondents featuring 50.8% had gestation week of above 37 weeks, followed by 21.6% gestation period of 28-37 weeks, then 19.3% gestation 20-28 weeks and finally 8.3%. Therefore, most of the women were above 37 weeks who attended antenatal while minority were below 20 weeks. Majority of women with adverse pregnancy outcome 31.7% were 28-37 weeks of gestation (Table 2).

Table 2: Obstetric Factors Influencing Adverse Pregnancy Outcomes of Women in Public Antenatal Care Hospitals

Characteristics	Pregnancy outcome		p-value
	OR	95% CI	
Age, (years)			
<15	xxx	xxx	
16-35	0.410	0.260-0.670	0.001 ^a
>35	Ref	-	-
Parity			
Para 1-2	Ref		
Para 3-4	1.053	0.540-2.050	
Para 5 and above	1.316	0.606-2.990	0.080 ^a
Gestation period			
< 20 Weeks	xxx	xxx	
Weeks 20-28	xxx	xxx	
Weeks 28-37	0.114	0.132-0.497	0.001 ^a
Above 37 Weeks	Ref	-	-
Family condition			
APH	Ref	-	-
Diabetes mellites	0.963	0.811-1.312	
Hypertension	0.81	0.661-0.108	0.064 ^a
PPH	xxx	xxx	
Others	xxx	xxx	

Participants (n=301) were grouped based on the obstetric outcome. ^a Statistical significance was determined by the Chi-square (χ^2) analysis. Odds ratios (OR) and 95% confidence intervals (CI) were determined between the groups using binary logistic regression model. Statistically significant was set at $p<0.05$. The reference groups in the regression analysis were age >35-years, parity; para 1-2, gestation period; >35 weeks, Family condition; APH for each obstetric factor. Abbreviations: APH Antepartum Hemorrhage, PPH Postpartum Hemorrhage, XXX; did not run in the regression model

➤ *The Influence of ANC Visit on Adverse Pregnancy Outcomes in Women Attending ANC Care Clinics*

With regard to visit of antenatal care clinic (second trimester), early visit was associated with the better or normal pregnancy outcome using chi square and odds ratio analyses ($\chi^2=62.17$, $p= 0.001$) and women attending antenatal as the first visit in the second trimester were 0.2 times less likely to develop adverse outcome as demonstrated by binary logistic regression (Table 3). According to WHO recommendations for appropriate ANC (4 or more visits) 2002 the current study compared the pregnancy outcome of 3 visits versus 4 visits to ANC. Using 3 visits as the reference group, the study did not find any association with the number of visits OR (0.36-1.26), $p=0.314$. Uptake of tetanus vaccine was not associated with normal or better pregnancy outcome ($\chi^2=3.408$, $p= 0.084$).

Table 3: Table of ANC visits on pregnancy outcome among women attending antenatal clinic

Characteristics	Pregnancy outcome		OR	95% CI	p-value
	Normal n=96	Adverse n=205			
First trimester	68 (70.8)	48 (23.4)	Ref	-	-
Second trimester	28 (29.2)	156 (76.1)	0.221	0.142-0.927	0.001 ^a
Third trimester	0 (0)	1 (0.5)	xxx	xxx	
Number of visits					
3 visits	0 (0)	3(1.5)	Ref		
4 visits (All)	96(100)	202 (98.5)	0.39	0.36-1.26	0.314 ^a
Tetanus vaccine					
Vaccinated	2 (1)	203 (99)	Ref	-	0.084 ^a
Not vaccinated	4 (13.8)	92 (95.8)	0.622	0.42-0.95	

Participants (n=301) were grouped based on the obstetric outcome. ^a Statistical significance was determined by the Chi-square (χ^2) analysis. Odds ratios (OR) and 95% confidence intervals (CI) were determined between the groups using binary logistic regression model. Statistically significant was set at $p < 0.05$. The reference groups in the regression were First visit for start of visit and 3 visits for the number of visits. *Abbreviation: XXX; did to run in the regression model table.*

V. DISCUSSION

The current study demonstrated that is a socio-economic factor that influence pregnancy outcome. According to this study, married women were 5.320 times more likely to have normal or better pregnancy outcome. This finding is attributable to financial and emotional support that the husband could provide to the spouse during pregnancy more so when the husband has some source of income.. Besides, child bearing is considered a blessing and during gestation period, there is a lot of anxiety from both spouses that comes with parenting after marriage in African tradition. This finding supports those of a previous study which showed that marital status is associated with better pregnancy outcome (12). However, this current finding opposes that of a previous retrospective case-control study that did not find any difference in the pregnancy outcome between the married and unmarried women (12).

With regards to family income, the current study demonstrated that family income is associated with better or normal pregnancy outcomes. This finding supports that of a prior study that demonstrated that income in an household is one of the better determinants to access to quality and adequate healthcare (13). The current finding corroborated that of Singh and colleagues which demonstrated Social Determinants of Health in the United States (14).

In evaluating the effect of education on pregnancy outcome, the current study found out the education significantly affect the pregnancy outcome. This finding is attributable to knowledge possessed by women of different levels of education such as primary, secondary and tertiary education based on the Kenyan 844 system. This knowledge has been shown to be beneficial in understanding the need of proper antenatal care such as ANC visits which has profound effect on pregnancy outcome (15).

Furthermore, education has been found to be one of the most important determinants of access to healthcare (13). Numerous surveys in developing and developed countries have shown that education of individuals from higher socio-economic classes are more likely to have access to adequate and quality healthcare (14). Higher education has also been link to increased chance of getting a well-paying job hence high income not only in Kenya but also in other parts of the world (13). Finally, previous studies have also shown that educated mothers are highly willing to engage in the health of their children and better appreciate the importance of antenatal care (16).

Adverse obstetric outcome has been over the decades considered a major public health concern (17). Various obstetric factors such as age of the mother, parity, gestation period and chronic conditions among others have been hypothesised to be associated with obstetric outcome. However, data supporting this hypothesis has remained very scare especially in developing countries. As such, the current study determined the influence of age, parity, gestation period and family chronic condition on the obstetric outcome among women attending antenatal care clinics in public health facilities at Nyando Sub-County Kisumu in Kenya.

The results of the current study finding revealed association between age of the mother and obstetric outcome. Furthermore, this study demonstrated that women between 16-35 years of age were 0.41 times less likely to develop adverse obstetric outcome relative to younger women of less 15 years old. This finding is in agreement with that of a previous study (18). This is attributable different extent in development of female reproductive organ relative to age towards child development. Additionally, the age bracket of 16-35 year falls within the active productive age where women actively give birth (15) and within 15-49 years (19).

This finding corroborates that of Dadras and colleagues which found out that women between the age 25-35 were associated with adequate ANC visits as opposed to women above 35 year who were less likely to have adequate ANC visits (18). This could ultimately impact on the better pregnancy outcome. This finding has been further reinforced by that of a review article by Heazell and colleagues and as well as other studies (20) determined that women of at least 35 years of age have increased risk of both maternal and foetal complications and these risks increase with increasing age. Conversely, maternal adolescent age has been found to be associated with preterm births among other complications (21).

In the current study, we considered parity as the number of times a woman has given birth to alive neonate (any gestation) or at 24 or more weeks regardless of whether the child or viable or still birth. Though the results generated was not statistically significant, the present study demonstrated that increase in parity was associated with adverse pregnancy outcome. This was based on specific prevalence for para1-2, para 3-4 and para 5 and above as 66.4%, 65.2% and 86.2 % relative to those women with normal pregnancy outcome for para1-2, para 3-4 and para 5 and above as 33.6%, 34.8% 13.8% respectively. This is attributed to possible inadequate prenatal care in resource limited settings as in the case of the present study area. This finding supports that of a previous study which determined grand multiparity is a risk factor and associated it with inadequate prenatal care (5). The current finding reinforces that of a study in Ghana which demonstrated that parity significantly influence adverse pregnancy outcome (22). The above mention study, showed that women with 3 or more children (assessed as a continuous variable) were more likely to experience an adverse outcome compared with women with <3 children ($p= 0.0112$). Additionally, another study demonstrated that women with higher parity were more likely para1-2, para 3-4 and para 5 and above to experience adverse pregnancy outcome (22). How parity affects birth outcomes is not well understood however has been attributed to placental and maternal age associated chromosomal anomalies (23). Influence of gestational age on pregnancy outcome was statistically significance as demonstrated in current study finding. Post-term births (after 42 weeks) have been associated with both increased complications in neonatal outcome and increased risk of labour complications, like a difficulty inducing labour or increased likelihood of caesarean section (24). Optimal term births (37 to 42 weeks) have been associated with normal or better pregnancy outcomes. With reference to Preterm Births (before 37 weeks), the risk of preterm birth is higher in pregnancies with certain risk factors, such as multiple pregnancies (twins or more), infections, maternal health conditions, and certain lifestyle factors. However, in the current study none of the participants has had multiple pregnancies. Based on individual variability, it is imperative to note that each pregnancy is unique, and the gestational period is just one factor. The overall health of the mother, access to prenatal care, lifestyle factors, and genetics also play a substantial role in determining pregnancy outcomes.

The present study equally evaluated chronic condition of the participants relatives or family member. Lack of association between the conditions evaluated (APH, Diabetes mellites, hypertension and PPH) with adverse pregnancy outcome as demonstrated in this study is attributable to the fact that there could be possible genetic variability among the study participants and their relatives. It worth noting that pregnant women with these conditions (APH, gestational Diabetes, hypertension and PPH) have been associated with adverse pregnancy outcome (25) hence this may require further explorations.

VI. CONCLUSION

Maternal age is associated with obstetric outcomes and maternal adolescent age is associated with preterm births among other complications. Additionally, increase in parity is associated with adverse pregnancy outcome. Higher family income is associated with better or normal pregnancy outcomes and education significantly affect the pregnancy outcome. According to the current study, majority of pregnant would prefer to start visiting the ANC in the first trimester as opposed to second and third trimester. Women attending ANC visit in the second trimester were 0.2 times less likely to develop adverse pregnancy outcome.

RECOMMENDATIONS

For better pregnancy outcome, women should start their ANC attendance as early as possible during pregnancy.

➤ Abbreviations

ANC: antenatal care, APO: adverse pregnancy outcomes, CDC: centers for disease control and prevention, GDM: gestational diabetes mellitus, HDP: hypertensive disorder of pregnancy, IUFD: intrauterine fetal death, KDHS: Kenya demographic health survey, LBW: low birth weight, LCHD: life course heart development, MMEIG: maternal mortality inter-agency working group, MOH: ministry of health, MPDSR: maternal and postnatal death surveillance response, MMR: maternal mortality ratio, NMHR: Nyando maternal health report, NBO: Normal birth outcome, PIH: pregnancy induce hypertension, PNC: postnatal care, PPH: postpartum hemorrhage, SDG: sustainable development goals, SIDS: sudden infant death syndrome, and WHO: world health organization.

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➤ Authors' Contributions

MK, EN and PO planned the study and participated in all the areas. MK, EN and PO oversaw the study process. PK conducted the data analysis and together with MK developed the manuscript. All the authors reviewed the final manuscript and approved it for submission.

➤ *Funding*

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➤ *Availability of Data and Materials*

The data are available upon reasonable request from the corresponding author.

➤ *Ethics Approval and Consent to Participate*

The study was approved by the Maseno University Scientific and Ethical Review Committee # MUSERC/01241/23. Authorization to conduct this research was obtained from National commission for science Technology and Innovation (NACOSTI) #NACOSTI/P/23/28619. All study participants provided written informed consent to participate in this study.

➤ *Consent for Publication*

Not applicable.

➤ *Competing Interests*

The authors have declared that no competing interests exist.

➤ *Author Details*

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