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Maternal danger signs in pregnancy: adoption of a four-delay model in healthcare in Matayos subcounty, Busia, Kenya

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Abstract

Background: Over 80% of maternal mortalities and complications can be prevented if women recognize danger signs during pregnancy and promptly seek healthcare. Despite the timely recognition of maternal danger signs during pregnancy, delays in seeking healthcare are still prevalent in many low-resource settings.

Objective: To assess the place and reasons for delays in seeking healthcare and their effect on the use of institutional delivery care by pregnant mothers with danger signs in Matayos subcounty, Busia, Kenya.

Methods: A mixed-methods approach employing an ethnographic survey was adopted to assess delays among pregnant mothers seeking healthcare in Matayos subcounty. A total of 348 postpartum women were selected using systematic random sampling. Purposive sampling was employed to select postpartum women for 16 in-depth interviews and seven focus group discussions. Qualitative data were analyzed thematically and presented in vignettes. Quantitative data were analyzed using descriptive and inferential statistics and presented in tables using STATA version 13. Statistical significance was set at $p<0.05$.

Results: The utilization rate of institutional delivery care was 68%. One in four, 25% (86) respondents experienced danger signs, of which more than half, 51.2% (44), reported delays. Travel to the hospital (type 3 delay) was the most common delay reported by 65.3%, followed by delayed decision-making at home (type 2 delay), delayed recognition at home (type 1 delay), and delays in hospitals (type 4 delay) at 30.7%, 1.7%, and 2.3% of all respondents, respectively. Delayed decision to initiate travel (30.7%) and distance to healthcare (30.7%), cost of travel (18.2%), and mode of travel (13.2%) were the reasons for delays in seeking healthcare.

Conclusion: Delayed decision-making rather than recognition of danger signs was associated with delays in healthcare. A four-delay model clearly distinguished between recognition and making the decision to initiate travel and should be adopted in low-resource settings.

Keywords: Busia, four-delay model, institutional delivery care, maternal danger signs, postpartum

Introduction

The current differences in maternal mortality rates between high and low-income countries are due to differences in the timely management of obstetric complications (1). Delays in receiving timely and appropriate care for pregnancy complications are significant determinants of maternal mortality (2). A delay is any shortcoming at any stage of obstetric care that prolongs the time to start management of obstetric complications. Common maternal danger signs such as severe vaginal bleeding, body swelling, blurred vision, and severe abdominal pain during pregnancy can be easily identified by non-clinical personnel, including patients, relatives, friends, and community health workers (3). This makes recognizing and decision-making on danger signs feasible steps in timely obstetric care (4). Maternal illness and mortality can be prevented if women and their families recognize the danger signs associated with pregnancy and promptly seek healthcare (5). However, this is not the case in many low and middle-income countries where delays in seeking healthcare are prevalent (6,7).

Maine and McCarthy proposed a three-delay framework to assess delays in obstetric care according to the place of delay: while at home, on the way to seek healthcare, and in health institutions (8). A four-delay model was proposed by Ghebrehiwet and Morrow in Eritrea, which considers both the location and reasons for delays (9). The four-delay model categorizes delays in access to obstetric care into four groups according to location and reasons for delays. Awareness or recognition of obstetric danger signs at home, a type 1 delay occurs before decision-making (9). This depends on the mother's knowledge and perceptions. On the other hand, decision-making at home, a type 2 delay, comes after the recognition of danger signs by the woman. Type 2 delays involve knowledge and interaction with the surroundings and are influenced by socioeconomic and cultural factors. Authors who use a three-delay model combine type 1 and 2 delays into one, making it difficult to distinguish between them (9,10). Type 3 delays (on the way to the hospital) relate to user-side factors such as transport costs, while type 4 delays (in health facilities) involve provider-side factors at the point of care. Information on both place and reasons for delays in maternal healthcare is essential for addressing the barriers women face during pregnancy and labor (11.12). This study sought to assess the place and reasons for delays in seeking healthcare and their effect on the use of institutional care for delivery by pregnant mothers with danger signs using a four-delay model.

Methods

Study design

A mixed-methods approach employing an ethnographic survey and cross-sectional descriptive quantitative and explorative qualitative research design was used in this study. The triangulation principle (13) was applied to ensure the validity and reliability of this study.

Study setting

The study setting was Matayos subcounty in Busia, Kenya. Matayos subcounty is comprised of five wards with an estimated population of 125 000. Each ward had at least one community health unit. The community health units are headed by one community health extension worker (CHEW) and served by 25 community health workers (CHWs) for an estimated population of 5 000.

Study population

The study population consisted of postpartum women who delivered within 12 months of their household visit. Mothers were eligible if they were between 18–49 years. The informants were chosen because of their experience of access to maternal and neonatal healthcare services.

Sample size calculation

The sample size for qualitative data was determined by the number required to achieve saturation and good variety, while that for the quantitative segment was determined using "the small sample technique" using the Krejcie and Morgan formula (14). Systematic random sampling was adopted to select 348 women for quantitative data, with purposive sampling for 16 in-depth interviews (IDIs) and seven focused group discussions (FGDs) to obtain qualitative data.

Data collection and management

Data were collected using interview guides and schedules. Respondents were asked whether they experienced delays in seeking healthcare, identifying places of delay, and providing underlying reasons.

Data analysis

Qualitative data analyses were derived thematically apriori from research objectives. Quantitative data were analyzed using STATA version 13. Categorical variables were compared using Pearson's Chi-Square test or Fisher's exact test. Logistic regression was used for multivariable analysis using odds ratios (ORs) and 95% confidence intervals (CIs). A p-value of <0.05 was considered statistically significant. The results were summarized as frequencies and percentages using tables for quantitative data and vignettes for qualitative data.

Ethical consideration

Ethical approval for this study was obtained from the Institutional Research and Ethics Committee of Moi University and Moi Teaching and Referral Hospital (registration number IREC 0001387).

Results

Most women were between 20-35 years (67%), married (87%), had attained a primary level of education (74%), Christians (92.3%), lived with their spouses (84.8%), and had 5-10 members in their households (50%). The main occupation of these women was farming (49%) with household earnings of Ksh 3000-10,000 (51%). Their spouses had attained a primary level of education (63%), were Christians (95%), and worked as casual laborers (43%) (**Table 1**).

The utilization of institutional delivery services (68.1%) and family planning services (75.6%) were relatively low for the same respondents compared with their utilization of antenatal, newborn and postnatal care services (99%). In the bivariate analysis the following factors were significant: residing in Matayos South ward ((crude odds ratio (COR)=0.2; 95% CI (0.0-0.6); p-value=0.001)), being of Luhya ((COR 0.2; 95% CI (0.0-0.9); p=0.03)) or Teso ((COR 0.2; 95% CI (0.1-0.9); p=0.04)) ethnicity, having attended secondary level of education and above ((COR 5.7, 95% (1.9-17.2); p=0.002), being employed in the informal sector ((COR 0.4, 95% CI (0.2-0.6); p<0.000), and earning a household income of less than Ksh 5000 (COR 0.1; 95% CI 0.0-0.6; p=0.01)). Mothers with fewer than four children had twice the odds of utilizing delivery services (COR 2.1, 95% CI (1.3-3.4); p=0.002). After adjusting for all other factors, employment of mothers in the informal sector ((adjusted odds ratio (AOR) 0.5 (0.3-0.95); p=0.035) was found to be significantly associated with utilization of delivery services (**Table 2**).

The critical, supportive and sometimes, veto role of the husband in access to health services in this study was reported in an in-depth interview.

> Question: "Who decides medical treatment during pregnancy and delivery" and in which way?"
> Answer: "My husband'; he pays the bills and hires the motor bike and I grow food for us to eat in the family."
>
> Question: "Is there any other help you get?"
> Answer: "He escorts me to the clinic so that he can decide what I do when I am asked."
> (IDI_ M_MNG-Dispensary_15-10-2015).

Table 1: Sociodemographic characteristics of study respondents in Matayos subcounty

Variable	Frequency (N=348)	Percent (%)
Maternal age		
<20 years	61	18
20-35 years	232	67
>35 years	55	15
Mother's education		
None	24	6.9
Primary	258	74
Secondary	59	17
Tertiary	7	2.0
Spouse's education		
None	47	14
Primary	219	63
Secondary	75	22
Tertiary	7	2.0
Level of education		
Have same education	238	68.3
Spouse has more education	48	13.7
Spouse has less education	22	6.2
Not sure	40	11.5
Spouse's religious affiliation		
Christian	323	92.3
Muslim	8	2.3
Traditionalists	17	4.8
Marital status		
Married	303	87
Single	37	11
Separated	8	2.3
Stays with spouse		
Yes	295	84.8
No	53	15.2
Household size		
Below 5	46	13
5-10	175	50
Above 10	127	37
Mother's occupation		
Farming (peasant) only	168	49
Business only	68	20
Casual jobs only	36	10
Formal employment	4	1.2
Farming and other	69	19.8
Spouse's occupation		
Casual jobs	150	43
Farming and other	80	23.5
Farming only	52	15
Business only	41	12
Not sure of spouse's occupation	18	5.2
Formal employment	7	2.0
Total monthly household income		
Not cash-dependent	68	20
Less than Ksh. 3000	46	13
Ksh 3,000-10,000	177	51
Above Ksh 10,000	57	16

Table 2: Association between "progress" factors and utilization of institutional delivery services in Matayos subcounty

Variable		N (%)	COR	P-value	AOR	P-value
Place of residence (P)	Busibwabo	51 (15)	0.4 (0.1-1.6)	0.19		
	Bukhayo West	96 (28)	0.4 (0.1-1.3)	0.13		
	Matayos South	113 (32)	0.2 (0.04-0.6)	0.01		
	Mayenje	63 (18)	0.3 (0.1-1.3)	0.11		
	Burumba	25 (7.2)	1			
Maternal ethnicity (R)	Luhya	251 (72)	0.2 (0.0-0.9)	0.03		
	Luo	46 (13)	0.4 (0.1-1.9)	0.24		
	Teso	30 (9)	0.2 (0.1-0.9)	0.04		
	Others	21 (6)	1			
Mothers occupation (O)	Formal	109 (31)	1		1	
	Informal	239 (69)	0.4 (0.2- 0.6)	0	0.5 (0.3-0.95)	0.04
Marital status (G)	Married	303 (87)	0.8 (0.4-1.7)	0.64		
	Single	45 (13)	1			
Religion(R)	Christian	340 (98)	-	-		
	Muslim	8 (2)	-	-		
Maternal education (E)	Primary	258 (74)	1.4 (0.6-3.2)	0.1		
	Secondary and above	67 (19)	5.7 (1.9-17.2)	0		
	None	23 (7)	1	1		
Household size (S)	Below 5	73 (21)	1.3 (0.6-2.6)	0.52		
	5-10	207 (59)	1.1 (0.6-1.9)	0.82		
	Above 10	68 (20)	1			
Number of children(S)	Below 4	235 (68)	2.1 (1.3-3.4)	0		
	Above 4	113 (32)	1			
Household income (S)	0-4999	229 (66)	0.1 (0.0-0.6)	0.01		
	5000-9999	97 (28)	0.5 (0.1-2.4)	0.39		
	>10000	22 (6.3)	1			

P: Place of residence; R: Race or Ethnicity; O: Occupation; G: Gender; R: Religious; E: Education level; 1st S: Social Capital, and S: Social Status. The eight factors were summarized as "progress" factors in this order. CI: confidence interval; P-value: probability value, COR: crude odds ratio, AOR: adjusted odds ratio. Religion was omitted from the calculation because it predicted failure perfectly.

Travel to health facilities (type 3 delay) was the commonest place of delay, reported by 65.3% of the respondents. Delayed decision-making to leave home (type 2 delay) was reported by 30.6% (54) compared

to only 2.3% (4) who reported delayed recognition (**Table 3**).

Table 3: Places of delay by three and four-delay models

A:3-Delay Model	Frequency (n=176)	Percent
Travel	115	65.3
Home	58	33
Health facility	3	1.7
B: 4-Delay model		
Travel	115	65.3
Home (Decision)	54	30.6
Home (Recognition)	4	2.3
Health facility	3	1.7

Delay in decision-making and delay in travel (30.2 versus 30.7%) were the most common reasons for delay (**Table 4**).

Table 4: Reasons for delay

Variable	Frequency (n=176)	Percent
Distance to the hospital (Travel)	54	30.2
Delayed decision (Home)	54	30.7
No fare (Travel)	32	18.2
Slow transport (Travel)	24	13.6
Difficult terrain (Travel)	5	2.8
Delayed recognition (Home)	3	1.7
Slow service (Health Facility)	2	1.1
No staff (Health Facility)	2	1.1

Dispensaries were closed at night, and patients had to go to hospitals situated far away or delivered at home. As reported in three focused group discussions (FDGs), night travel was linked with insecurity and lack of public transport.

> "Labor pains started at night when my husband was not around; the hospital was far away. I, therefore, could not do anything but to deliver in the home."
> (FGD_MYJ_15-10-2015).

> "Sometimes when I want to deliver, I just take a decision. I just decide and choose to deliver at home."
> (FGD_NSW_14-10-2015).

> "The reason I always deliver at home is that there is always lack of transport and insecurity in the village when labor pains start at night."
> (FGD_MYJ_15-10-2015).

Type 1 delays (awareness) were very few in the study. However, all focused group discussions featured type 4 delays such as "harsh nurses" and disrespectful care at delivery in health facilities.

> "Hospital nurses are normally very harsh, they could even slap someone."
> (FGD_MYJ_15-10-2015).

Focus group discussions also illustrated how different respondents dealt with danger signs associated with pregnancy.

> "When we reached hospital with my expectant sister to deliver in hospital, the nurses sent us away .....I was forced to call a traditional attendant who delivered her. Since that day, I decided not to go to hospital; nurses don't attend to expectant mothers."
> (FGD_NSW_14-10-2015).

> "I was given boiled water then taken to hospital..... I was treated, and bleeding stopped."
> (FGD_MYJ_15-10-2015)

One in four mothers, 25% (86) experienced danger signs. Forty percent (35) reported severe backache as a danger sign, while 24.4% (21) reported vaginal bleeding. Others reported danger signs were abdominal pains 18.7% (16) and severe headaches 16.3% (14). More than half, 51.2% (44) of the respondents reported delays. Having fewer children was associated with two-fold increased odds of utilizing delivery services (p=0.005). Absence of delay due to travel (OR=2.8; 95% CI (1.4-5.5); p-value=0.003), or delay without specific reasons at all (OR=6.7; 95% CI (3.4-13.3); p-value<0.001) were associated with 2.6 and 6.8 times increased utilization of institutional services, respectively compared to lack of decision to leave home. In the absence of any delay, the use of services increased by about seven times (**Table 5**).

Discussion

Distance to hospital and delayed decision-making at home were the commonest types of delay. In the absence of delays to health facilities, the use of services increased by up to seven times. When a four-delay model was adopted, type 1 and 4 delays were

Table 5: Association between individual clinical factors and use of delivery services

Individual and obstetric factors		N (%)	COR (95%CI)	P-value	AOR (95% CI)	P-Value
Have you lost any pregnancy before	Yes	68 (20%)	1			
	No	280 (80%)	0.9 (0.5-1.7)	0.84		
Have you ever lost a newborn	Yes	19 (5%)	1			
	No	329 (95%)	1.6 (0.6-4.1)	0.33		
Have you ever lost a mother during delivery in your area	Yes	31 (9%)	1			
	No	317 (91%)	0.7 (0.3-1.7)	0.45		
Number of children	Below 4	235 (68%)	2.1 (1.3-3.4)	0	2.0 (1.2-3.4)	0.01
	Above 4	113 (32%)	1		1	
While pregnant, were you able to recognize the danger signs	Yes	86 (25%)	1			
	No	262 (75%)	0.9 (0.5-1.5)	0.7		
Source of delay	Home	52 (15%)	1			
	Travel	118 (34%)	2.6 (1.3-5.1)	0.01	2.8 (1.4-5.5)	0
	None	178 (51%)	6.8 (3.5-13.3)	0	6.7 (3.4-13.3)	0

CI: confidence interval; P-value: probability value, COR: crude odds ratio, AOR: adjusted odds ratio

minimal in health facilities. This was similar to an Eritrean study that identified poor decision-making as an avoidable factor in 42% of cases, with 25% delaying reaching care and another 25% receiving poor quality service in healthcare facilities (15). This could be attributed to weak health systems, including an inadequate health workforce and poor infrastructure affecting healthcare in low-resource settings (16). Low-resource settings have similar cultures, with women traditionally having less decision-making capacity than their husbands, as evident in focused group discussions in this study.

During in-depth interviews, mothers cited nurses as "very harsh and unreceptive" to patients. Fear of disrespectful maternity care and poor quality of care in health facilities were the underlying reasons for women delaying to decide, being delivered by traditional attendants at home, or deciding not to deliver in hospitals. This may offer a clear link between delayed decisions to leave home to the hospital (type 2 delay) and fear of treatment in health facilities (type 4 delay). It explains why many women arrived late in health facilities with more severe illnesses only to die before treatment. The three-delay framework combines recognition and decision-making when they occur at home (8) and could easily mask delayed decision-making as a major determinant of maternal mortality. The demand for maternal and newborn services at points of care was 99%. However, the utilization of institutional delivery services was relatively low at 68.1% for the same respondents. This decreased demand for services was also reported in the 2014 Kenya Demographic and Health Survey (KDHS), where the utilization of the first antenatal care was high at 96%; however, the skilled birth attendance was 62% (17). This could be due to poor quality of care in health facilities, such as "harsh nurses" and the unavailability of supplies at points of care, as reported in this study and elsewhere (18).

One in four mothers experienced danger signs, yet most of them experienced delays to healthcare in this study. The World Health Organization (WHO) estimated that while approximately 30% of pregnant women develop complications in pregnancy, they still account for more than 80% of maternal deaths globally (19-21). This could be attributed to delayed decision-making at home, as revealed by adopting a four-delay model. This indicates that decision-making, dictated by culture, is a significant determinant of the utilization of maternal and newborn health services in low-resource settings (22).

This study identified the place of residence (P), ethnicity or race (R), occupation (O), gender (G), religion (R), educational level (E), social status (S), and social capital (S) of respondents, to be significant sociocultural determinants of utilization of maternal and newborn health services. The eight factors have been summarized by the acronym "progress" factors (23). These factors influence access to resources and affect the use of healthcare (24).

The place of residence, being of Teso ethnicity, informal occupation, higher education levels, and lower parity were significantly associated with institutional delivery care. Specifically, maternal education and occupation positively influenced the utilization of institutional delivery. Mothers with limited education and informal occupations did not utilize institutional delivery services. Most women in Matayos subcounty were marginalized despite the provisions of the Kenyan laws, which empowered daughters as heirs to family wealth (25). This is due to a lack of decision-making capacity, common in patriarchal societies, as noted in this study. Some women had shared beliefs, community traditions, and cultural practices that promote refusal or delay to use conventional health facilities for delivery (26,27). This study identified specific shared beliefs, community traditions, and cultural practices that hindered community access to healthcare. For instance, one woman, believing that she could deliver herself at home, chased the husband away to create space to define her natural courage and true womanhood dictated by cultural beliefs and preferences.

Study strengths and limitations

The mixed-methods approach ensured validity and reliability of study findings by applying triangulation. Adopting an explorative qualitative research design to study delayed decision-making enabled critical insight into this all-important sociocultural phenomenon common in low-resource settings. However, the data were cross-sectional and cannot, therefore, be used to draw 'causal' connections between outcome and predictor variables.

Conclusion

Delayed decision-making rather than recognition of danger signs was associated with delays in healthcare. A four-delay model clearly distinguished between recognition and making the decision to initiate travel and should be adopted in low-resource settings.

Recommendations

More studies are needed to confirm the findings of this study. Culturally sensitive tailored interventions are required to influence shared beliefs and practices to empower women to access and utilize maternal and newborn healthcare with sufficient ease in low-resource settings.

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Conflict of interests

The authors declare no conflicts of interest.

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