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Analytical Review of the Association between Maternal Health Outcomes and Cost of Ambulance Referral Network in Wajir County, Kenya

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Abstract:

Worldwide, every year more than half million women die in childbirth. About 99% of these maternal mortalities occur in Sub-Saharan. Majority of these deaths are attributed to delay in accessing maternal health care. In Kenya, ambulance referral services have been provided to reduce the delay in accessing maternal health care. However, their performance remains largely unevaluated. Therefore, this study was undertaken to perform analytical review of the association between maternal health outcomes and cost of ambulance referral network interventions in Wajir County, Kenya. This was a longitudinal retro-prospective time series study, specifically to determine the cost and effectiveness of ambulance referral networks on maternal health outcomes. Data was collected from ambulance logbooks, patient registers, logistics records, and maternal death surveillance records. A population of 623 records had used ambulance during referral within the county was achieved during sourcing data for this study from records. Thus, secondary data contains both quantitative and qualitative data. Data was analysed using both descriptive and inferential statistics. Percentages, frequency, and mean. Inferential statistics used was chi-square. To determine effects of total ambulance cost on maternal health outcomes, multinomial regression analysis was employed. Results were presented in tables and figures. The results indicate that total ambulance cost, had significant effect at 5% level of significant. Cost of fuel per referral, and cost of equipment's were found to affect all maternal health outcomes significantly at $p < 0.05$. Therefore, to reduce infant and maternal mortality rate in Wajir County, the county should provide enough budget for ambulance referral networks.

Keywords: Cost, Ambulance, maternal health outcome, logistic records, referral network

1. Introduction

Nearly 99% of these deaths occur in developing countries with sub-Saharan Africa accounting for over 50% of global death³. An estimated 73% of these maternal deaths are due to direct obstetric causes while 27.5% are due to indirect cause [4]. Despite the attention experts have given to safe motherhood, the number of women who die in childbirth has changed little in the last 20 years since the 1987 Safe Motherhood Conference in Nairobi, Kenya. In Kenya, maternal mortality remains high at 488 maternal deaths per 100,000 live births [3]. Community ambulance transport to a health facility reduces the 2nd delay [6]. While inter-facility ambulatory transfers to emergency obstetric care facilities reduces the 3rd delay [6]. Most developing countries are restructuring ambulance emergency services but they are limited by budget [5], justifying the need for cost effective analysis of ambulance referral services. A study in a remote setting in Uganda demonstrated that motor vehicle ambulance services within a comprehensive intervention for reproductive health is highly cost-effective [7]. while a study in rural Burundi proved that, within the framework of reproductive health, a motor vehicle ambulance service is cost-ineffective [5]. Kenya has a population of about 44.9 million of which 39.1% are unemployed while 48.3% are females of the reproductive age of 15-49 years with total fertility rate of 3.9 live births per woman [8-9]. The Gross Domestic Product (GDP) per Capita in Kenya is \$1,420, equivalent to 9 percent of the world's average [10]. Despite low per capita income in Kenya (\$1,420), the government has conventionally provided funding for personnel and operating costs at public hospitals. Kenya's total health expenditure in the fiscal year 2012/13 accounted for 6.8% of gross domestic product (GDP) while government health expenditure as a proportion of total health

expenditure was recorded at 33.5% in the same timeframe¹⁰. Following the adoption of the 2010 constitution, the Government of Kenya (GOK) devolved its health system resulting in a 57% increase in county health budget allocation from fiscal years 2013/14 to 2014/15 [10-11]. Out-of-pocket expenditures as a proportion of total health expenditure was approximated at 29.9% for fiscal year 2012/13¹¹ hence Kenya suffers catastrophic health expenditure [12]. In the years 2011 to 2013, a cross-sectional survey reported that nearly 50% of households in Kenya borrow money outside families and from money lenders or even selling household property to pay for maternity care [11]. In the view of catastrophic health expenditure, the government of Kenya abolished all user fees in public dispensaries and health centers, and provided nearly US\$7million for compensation to lower-level facilities in 2013¹⁰. In addition, the government of Kenya implemented a free maternity care policy, committing approximately US\$38 and US\$40 million for free maternal health services in fiscal year 2013/14 and 2014/15, respectively (MOH, 2015a). Despite increased domestic and government contributions to health, Kenya is still dependent on donors, with 57% of the fiscal year 2014/15 development health budget estimated to be funded by development partners [10]. The cost of care-seeking includes costs of transportation, medications and supplies, official and unofficial provider fees as well as the opportunity costs of travel time and waiting time lost from productive activities. Traditional birth attendants (TBAs) are usually considered affordable for poor families since their payment is negotiable in terms of amount and timing and can be in kind [12]. On the other hand, a drastic increase in hospital births was observed after introduction of delivery care user fee exemption [13]. Costs discourage poor women from using health facility delivery services, while they play a lesser role in case of complications [14]. In Tanzania, women with better economic status were three times more likely than the poorest woman to have institutional delivery [15]. Therefore, cost influences decision in seeking care but severity of complication overrides cost as a barrier in accessing health care. Economic status of women influences their ability to access maternal care. Socio-economic status in women was significantly associated with institutional delivery despite the existence of delivery user fee exemptions [15-16]. A study in Ethiopia showed that women residents of slums are likely to deliver in public hospitals compared to non-slum residents suggesting that poverty limits access to quality care [17]. Women with low economic status are associated with non-institutional (home) delivery [18]. Maternal near miss is associated with poor socio-economic conditions of woman [19]. Suggesting that poverty exceedingly expose women to hard and heavy workloads associated with adverse pregnancy outcome [20]. High maternal mortality and morbidity occurs in women living in poor remote regions with limited health facilities [21].

2. Research Problem

Pregnant women experience delay in accessing maternal health care services, thus, seriously affecting their conditions resulting in higher rates of mortality and morbidity [3]. One of the main barriers associated with delay is being the demographic characteristics of the mother. To reduce this problem, ambulance transport has been provided to improve maternal health care coverage [17]. The main concern low income for these mothers in Wajir County in Kenya hence the need to provide a clear directive of the interventions of improving maternal health based on the standards of the income status of these mothers within the County. According to a 2009 analysis of census data, the highest maternal mortality was reported in North Eastern Province (2,014 per 100,000 live births) Wajir County being one of them, followed by Nyanza Province (546 per 100,000 live births) while the lowest was in Nairobi Province (212 per 100,000 live births) (NCPD. and UNFPA, 2013). Wajir County is one of the county's that is contributing to the high maternal mortality in Kenya. Its maternal mortality is estimated to be over 1600 maternal deaths per 100,000 live births in the country [21]. Therefore, this study will determine the effect of cost of ambulance referral on maternal health outcomes in Wajir County, Kenya.

3. Methods

The study adopted analytical longitudinal study design; quantitative data was collected. This study retrospectively reviewed demographic records related to ambulance services and maternal records collected between July 2016 and June 2019. The study was conducted in Wajir county, Kenya, which has about 661,941 inhabitants unevenly distributed over 55,840.6 km square [8]. The data collected was secondary data and it involved looking at the 623 records of mothers who had delivered within the period of the study and they had used public ambulance services during delivery. The results were processed and presented in frequency tables and charts. Multinomial regression analysis was the preferred choice with the aim of establishing the relationship between demographic characteristics and maternal health outcome in Wajir County. Correlation analysis was carried out to establish the relationship between variables and to describe the effect of the relationships.

4. Results

4.1. Distance to Pick the Mother

From Figure 1, more distance was covered in 2016 where the ambulance covers a total of 3057 kilometres. Distance covered on point location to pick the mother to the hospital was also determined. Results were as follows

Figure 1: Distance Ambulance Covered

4.2. Fuel and Cost of Fuel Used for Referral

From figure 2, the total cost of fuel used to refer the mother was classified in to fuel used per referral, average cost of fuel per litre and total cost of fuel per referral. Results were as follows

Figure 2 Fuel and Cost of Fuel

4.3. Health Outcome of Ambulance Maternal Referrals

The health outcome of ambulance maternal referrals was determined from July 2016 to June 2019 in Wajir County. The data was analysed and displayed in the table 1.

Health Outcomes	Frequency	Percentage
Mother alive, infant dead	73	11.66
Mother dead, infant dead	3	0.48
Mother and infant alive	541	86.42
Mother and tweens alive	4	0.64
Mother and tweens dead	2	0.32

Table 1: Maternal Health Outcomes

Majority of the pregnancy outcome were for mother and infant alive which accounted for 86.42% of the mothers and infants in this study. They were followed by mothers alive and infant dead which was 11.66% of the targeted mothers, 0.64% was for mother and tweens alive, 0.48% was for mother and infant dead and 0.32% was for mother and tweens dead.

4.4. Indirect Costs

The indirect costs included allowances, communication cost vehicle costs per referrals, maintenance costs and insurance cost of the vehicles. This amount was in Ksh. The results were displayed in table 2

Year	Total Allowances (Ksh)	Total Communication (Ksh)	Total Vehicle cost/Referral (Ksh)	Total Maintenance cost(Ksh)	Total Insurance Cost (Ksh)
2016	368,200	747.50	15,040,808	946,252.60	752,040.40
2017	316,400	2432.50	30,373,428	1,516,597.50	1,518,671.30
2018	190,400	3640	4,772,777	283,374.10	238,638.80
2019	0	2065.0	9,384,080	736,765.80	469,204.00

Table 2: Indirect Costs

4.5. Direct Costs

These costs are expected to vary with the number of referrals within Wajir County. For this study they were gross salary, equipment and stationary costs. They were analysed per years and were displayed as shown in the table 3

Year	Gross Salary (Ksh.)	Equipment & Stationery (Ksh.)
2016	2,439,594.40	0.00
2017	5,245,048.10	72,598.89
2018	929,711.30	16,717.12
2019	2,062,005.80	91,332.59

Table 3: Direct Costs

4.6. Total Ambulance Cost

The total ambulance cost was the sum of direct and indirect cost. This was processed and displayed in the figure 3 based on the years of operation.

Figure 3: Total Ambulance Cost

4.7. Effect Of Ambulance Cost On Maternal Health Outcomes

From table 4, the influence of ambulance cost on maternal health outcomes in Wajir County, Kenya was studied using multinomial logit regression analysis. The results of the data were analysed and displayed as follows

	Coefficient	Std. Error	z	p-value	
Mother Alive, Infant Dead (2)					
const	-3.05521	1.19711	-2.5521	0.01071	**
CostoffFuelperr~	-0.04832	0.000234597	-0.1286	0.00771	***
ReferralAllowa~	-0.004515	0.036392	-0.5575	0.03912	**
Communicationc~	0.67818	0.00684254	0.0000	0.9456	
Vehiclecostapp~	-2.27304	0.0143571	0.3173	0.75100	
maintenancecos~	-1.82937	0.0684425	-0.0618	0.95071	
Insurancecosts~	-2.93782	1.19218	-0.3308	0.74082	
GrossSalary	1.60108	2.59996	0.0602	0.95200	
Equipment, drugs & stationary	-14.5491	0.00471	-0.0595	0.00253	***
Mothers Dead, Infant Alive (3)					
const	-5.43715	0.70209	-0.0000	1.00000	
CostoffFuelperr~	0.0426553	0.032367	1.3315	0.00304	***
ReferralAllowa~	-0.0374185	0.0436392	-0.8575	0.01209	**
Communicationc~	0.0678418	0.005440	0.0000	0.76343	
Vehiclecostapp~	4.47247	0.0942	0.3173	0.75100	
maintenancecos~	-1.82937	0.5965	-0.0618	0.95071	
Insurancecosts~	-9.3782	0.29	-0.3308	0.74082	
GrossSalary	2.16018	0.5999	0.0602	0.95200	
Equipment, drugs & stationary	-16.5194	0.47154	-0.0595	0.05253	*
Mother and Infant Alive (4)					
const	2.12830	1.08178	0.0003	0.09972	
CostoffFuelperr~	-0.085962	0.459465	-1.2753	0.00220	***
ReferralAllowa~	-0.09573	0.43071	-1.0789	0.02806	**
Communicationc~	-1.11565	0.4568	-0.0003	0.99976	
Vehiclecostapp~	-1.95845	2.36678	-0.8275	0.40797	
maintenancecos~	0.09596	0.00752314	1.2769	0.00165	***
Insurancecosts~	39.1712	0.3355	0.8275	0.40794	
GrossSalary	-0.002872	0.00212342	-1.3397	0.01035	**
Equipment, drugs & stationary	0.005395	0.00225703	1.2645	0.00606	**

	Coefficient	Std. Error	z	p-value	
Mother and Infant Tweens Alive (5)					
const	-3.00571	0.294036	-0.0000	0.99999	
CostoffFuelperr~	-0.00472	0.0196943	-0.2400	0.01031	**
ReferralAllowa~	-0.00052	0.000597	-0.8723	0.00306	***
Communicationc~	0.024641	16802.1	0.0000	0.87623	
Vehiclecostapp~	-3.08369	9.5522	-0.3228	0.74683	
maintenancecos~	-0.039678	1.73719	-0.0228	0.98178	
Insurancecosts~	61.664	191.042	0.3228	0.74686	
GrossSalary	0.013689	0.592676	0.0231	0.98157	
Equipment, drugs & stationary	0.0846823	2.96386	0.0286	0.034782	**
Mother and Infant Tweens Dead (6)					
const	-3.72551	416117	-0.0000	0.99999	
CostoffFuelperr~	0.068853	0.05455	1.2261	0.02016	**
ReferralAllowa~	-0.0007	0.00098	-0.7684	0.04223	
Communicationc~	-0.135572	0.12457	-0.0000	1.00000	
Vehiclecostapp~	50.7094	0.8882	1.3384	0.01077	**
maintenancecos~	-0.111768	0.5305	-0.2107	0.83314	
Insurancecosts~	-1014.28	0.7530	-1.3385	0.18072	
GrossSalary	0.05505	0.37045	0.1262	0.89956	
Equipment, drugs & stationary	-0.264188	0.12791	-0.0640	0.04897	**

Table 4: Ambulance Cost Effect on Maternal Health Outcomes
Likelihood Ratio Test: Chi-Square (40) = 30.5003 [P-Value=0.0425]

5. Discussion

There is considerable evidence in this study that the cost of ambulance referral services had a significant effect on all the possible maternal outcomes. Free ambulance referral services can significantly contribute to positive maternal health outcomes during delivery or else they will start considering cheaper ways like use of traditional birth attendants (TBA) which can increase the maternal and infant mortality rates for the county or negative maternal health outcome this study agrees with the study by [13]. That found out that traditional birth attendants (TBAs) are usually considered affordable for mothers from poor families since their payment is negotiable in terms of amount and timing. On the other hand, a drastic increase in hospital births was observed after introduction of delivery care user fee exemption [14]. A lack of equipment and supplies for health facilities perpetuated by poor management and organization of the available resources including ambulance referral services plagues most regions of the developing world. Difficulty in obtaining blood for transfusion for pregnant mothers during delivery delays the provision of adequate care driving maternal deaths [21].

6. Conclusions

More strategies should be in place to ensure the County ambulance referral services are well financed and sustainable for quality maternal health services, since cost of ambulances a major determinant the possible maternal health outcome in Wajir County. Cost influences decision in seeking maternal health care but severity of complication overrides cost as a barrier in accessing health care which should also be eliminated through good leadership and accountability within the county health sector. The county should look for more ways to finance the extra cost involved with the use of ambulance referral service. It should also provide good leadership and outline systems for monitoring accountability within the County ministry of health. The county and national government should provide also provide ring fenced budget for maternal ambulance referral services so that they can use it to provide better services which will help in reducing the maternal and infant mortality rates.

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