Association between maternal education and child immunization among married women in Kenya: Findings from the Kenya Demographic and Health Survey, 2008-09

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Abstract:

Introduction: In 2008-09, child mortality rate dropped to 74/1000 from 115/1000 in 2003. Infant mortality rate dropped to 52/1000 from 77/1000 in the same period in Kenya representing a decline of 36% and 32% respectively (CBS, 2004; KNBS & ICF Macro, 2010). **Methods:** Retrospective cross-sectional data for married women aged 15-49 (n=3,233) responding to vaccination questions in 2008-09 KDHS were used. Stata version 10.1 was used for analyses, $p<0.05$. **Results:** Seventy percent, 66%, 93%, and 75% women indicated that their children had received immunization for poliomyelitis, measles, bacille calmette-guérin, and disambiguation respectively. After adjusting for confounding, women with primary and secondary education were 1.68 times (95% CI: [1.04, 2.71]), $p <0.05$ and 2.25 times (95% CI: [1.25, 4.07]), $p<0.01$

more likely to immunize their children for poliomyelitis compared to those who had less than a primary education. **Conclusion:** Education among married women is crucial in ensuring good health outcomes among children. Integration of immunization knowledge with maternal and child health services is imperative.

Keywords: Poliomyelitis • Measles • Bacille Calmette-Guérin • Disambiguation • Women • Kenya

Introduction

Child vaccination continues to be the most useful cost effective public health intervention and a cost effective strategy to reduce mortality and morbidity of infants associated with infectious diseases. Immunization delays approximately two million deaths in the world every year (WHO, 2002). In this respect, Kenya has focused on immunization as one of the ways of preventing child mortality which is one of the key Millennium Development Goals (MDGs) expected to be achieved by 2015 (United Nations, 2008). In the 2008-09 Kenya Demographic and Health Survey (KDHS), child mortality rate dropped to 74/1000 children (KNBS & ICF Macro, 2010) compared to 115/1000 which was recorded in the 2003 KDHS (CBS, 2004) representing a decline of 36% in the five year period. Infant mortality rate dropped by 32% from 77/1000 in 2003 to 52/1000 in 2008-09 surveys (CBS, 2004; KNBS & ICF Macro, 2010).

This implie that one in every 19 children born in Kenya die before their first birthday, while one in every 14 children does not survive to age five (KNBS & ICF Macro, 2010). Despite this substantial gains in ensuring that more children survive to age five, 74/1000 child mortality and 52/1000 infant mortality is still relatively high. Substantive progress has been made in child mortality reduction primarily due to improvements in the immunization coverage. However, the September 2011polio case in Nyanza Province highlighted by the Ministry of

Health (MOH) in Kenya, where a three-year-old boy was found to have polio (All Africa.com, September 7, 2011), is indeed a reason to revisit immunization coverage in Kenya.

Child health remains a critical issue in Kenya, with the relatively high infant and child mortality rates. For instance, the presence of polio in one child is considered to be an outbreak and a public health emergency, because this indicates that about 200 people have the polio virus and could spread it, but never develop polio. The researchers come to this paper with a realization that mothers being the caregivers in the early years of life for children especially in Kenya determine the extent to which their children will be immunized. Therefore, this paper seeks to determine the association between maternal education and child immunization among married women in Kenya.

Conceptual framework

The study will be guided by an equity framework. Scholars argue that the socioeconomic status gaps present in developing countries in child mortality cannot be oversimplified by regarding them as inequalities. Rather, they are inequities, which are not fair (Victora, Wagstaff, Schellengberg, Gwatkin, Claeson, & Habicht, 2003). The question that remains in relation to child survival is why poor children die relatively earlier than their peers in relatively more resource endowed environments? Results from the demographic and health surveys show that inequities exist in child health across countries (Gwatkin et al., 2000; World Bank, 2003). Children born to better-resource endowed households are less likely to be exposed to risks of disease through inadequate water and sanitation, indoor air pollution, crowding, poor housing conditions, and high exposure to disease vectors unlike the children in resource constrained households (WHO, 2002). Moreover, poor children are less likely to be vaccinated, to receive vitamin A supplement, or to prevent malaria by sleeping under a treated mosquito net (Hanson &

Jones, 2000; World Bank, 2003). Therefore, "...inequities in exposure and resistance are therefore compounded by inequities in coverage for preventive interventions, making poor children even more likely to become sick and in need of curative care compared with their better-off peers" (Victora et al., 2003, p. 234).

Methods

Data source

This is a cross-sectional study that used the 2008-09 Kenya Demographic and Health Survey representing married women aged 15-49 who responded to child immunization questions on poliomyelitis, measles, bacille calmette-guérin, and disambiguation. All data were weighted due to clustering effect to eliminate over or under estimation of the standard errors (StataCorp, 2009).

Study sample

Immunization services are provided as part of maternal and child health care, with the responsibility mainly falling on women due to cultural gender role assignment in majority of the Kenyan tribes. Study sample was limited to married women aged 15-49 (n=3,233) who responded to immunization questions on Poliomyelitis (3,232/3,233 – 99.97% response rate), Measles (3,231/3,233 – 99.94% response rate), bacille calmette-guérin (3,232/3,233 – 99.97% response rate), and disambiguation (3,232/3,233 – 99.97% response rate), which allowed for the estimation of the association between education and immunization.

Outcome

All four immunization outcomes are dichotomous variables determined by asking the question whether the child had received vaccination for poliomyelitis, measles, bacille calmette-guérin, and disambiguation. Disambiguation was generated from three vaccinations (deptheria,

pertussis, and tetanus). The dichotomous variables were generated form the following responses: 1.) no, 2.) vaccination date on card, 3.) vaccination reported by mother, and 4.) vaccination marked on hospital card. Response of "no [1]" was given a value of "1" and "yes [2, 3, and 4]" were combined to represent child was vaccinated and given a value of "0."

Exposure

Education, a categorical variable seeking to measure an individual's formal educational training. An individual had either less than a primary, primary, secondary, or college/graduate education.

Covariates

Stepwise logistic regression analyses and manual selection (important variables based on previous studies) were used in the determination of control variables. The variables included residence (urban or rural), wealth, children under 5 years, immunization knowledge, partners education, ethnicity, age, religion, desired number of children, province, and health insurance.

Data analysis

The analytical framework used is: svy: logit [Pr ($Y_x = 1$)] = $e^{(Z)}$/ $1+e^{(Z}$; $z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k + \varepsilon$. The logit is the natural log of the odds of the outcome i.e. ln(e/[1-e]. Y_x represent the outcomes of interest (poliomyelitis, measles, bacille calmette-guérin, and disambiguation) [$Y_x = 1$] or otherwise (not immunized) [$Y_x = 0$]. X_1, $X_2 \ldots X_k$ represents the different independent variables, β_0, β_1, $\beta_2, \ldots \beta_k$ represent the corresponding regression coefficients to be estimated, which measure the effect of the independent variable and covariates on the probability of not being immunized. The exponential of the coefficients (β_1, $\beta_2, \ldots \beta_{k)}$ gives the odds ratios indicating the likelihood that those with a primary, secondary and university education will be different from those with less than a primary education. ε represents the

random error term that has a normal distribution with a mean that is zero [$E(\varepsilon \mid x) = 0$] (Dupont, 2002; Wooldridge, 2006).

Data analyses for descriptive, bivariate, univariate logistic regression analyses, and multivariate logistic regression analyses were conducted using STATA version 10.1. Bivariate analyses estimated the prevalence of vaccination by study independent variables. Univariate (unadjusted) logistic regression analyses estimated the odds (OR) of each vaccination outcome and the exposure variable. Multivariate (adjusted) logistic regression analyses estimated the odds of each vaccination outcome and the exposure variable while controlling for various covariates. Results for univariate and multivariate logistic regression are presented with 95% confidence intervals (CI), $p<0.05$.

Ethical approval

This study was approved for exempt by Winston-Salem State University Institution Review Board. Furthermore, data collection procedures were approved by the ORC Macro institutional review board with supervision in Kenya provide by KEMRI (KNBS & ICF Macro, 2010). Data were approved for use by MESURE Demographic and Health Surveys (DHS).

Results

Descriptive analysis

Among women, 70%, 66%, 93%, and 75% indicated that their children had received immunization for poliomyelitis, measles, bacille calmette-guérin, and disambiguation respectively (see Table 1-1 and Figure 1). Overall, majority of the women did not have a college/university education (5%). However, most of them had a primary education (62%) with only 21% reporting having a secondary education. Compared to their partners' education which was 9%, 52%, and 31% respectively (see Table 1-2).

Table 1-1: Child immunization, 2008-09 KDHS

Study Characteristics	Percentage (n)	Number (%)
Poliomyelitis (n=3,232)		
No	1032	30
Yes	2200	70
Measles (n=3,231)		
No	1185	34
Yes	2046	66
Bacille Calmette-Guérin/BCG (n=3,232)		
No	285	7
Yes	2947	93
Disambiguation/DPT (n=3,232)		
No	966	25
Yes	2266	75

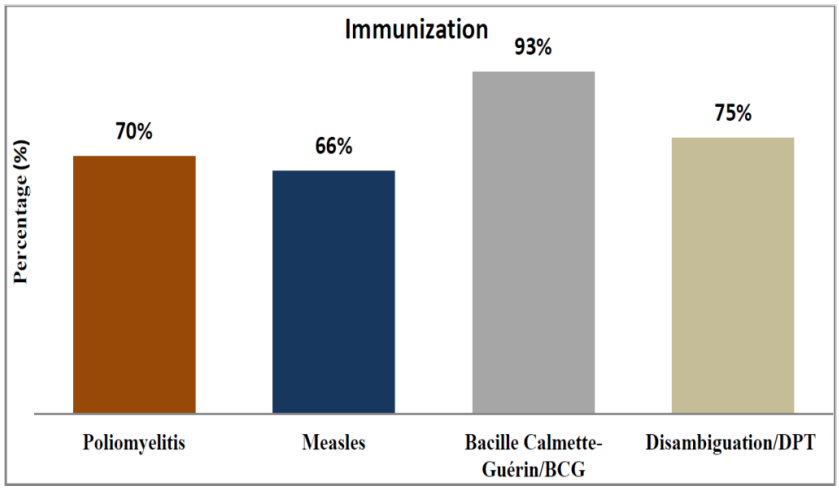

Figure1: Percentage of immunization; poliomyelitis (n = 3, 232), Measles (n = 3, 231), Bacille Calmette-Guérin (n = 3, 232), and Disambiguation (n = 3, 232) among children in Kenya, 2008-09 KDHS

Table 1-2: Study population characteristics, 2008-09 KDHS

Study Characteristics	Percentage (n)	Number (%)
Education (n=3,233)		
Less than primary	651	12
Primary	1781	62
Secondary	597	21
University	204	5
Wealth (n=3,233)		
Poorest	864	21
Poorer	548	20
Middle	516	18
Richer	548	19
Richest	757	22
Children under 5 years (n=3,233)		
≤ 11 months	81	2
12-23 months	1380	43
24-35 months	1257	39
≥ 36 months	515	16
Immunization Knowledge (n=3,232)		
Not knowledgeable	533	17
Knowledgeable	2699	83
Partners education (n=3,232)		
Less than primary	495	8
Primary	1526	52
Secondary	896	31
University	315	9
Age (n=3,233)		
15-19	163	4
20-24	843	26
25-29	864	28
30-34	680	22
35-39	430	12
40-44	184	6
45-49	69	2
Desire for more children (n=3,232)		
Within 2 years	382	9
After 2 years	1206	34
Wants but unsure of timing	212	5
No desire or sterilized	1432	52

Continued

Table 1-2: Cont.

Study Characteristics	Percentage (n)	Number (%)
Province (n=3,233)		
Nairobi	255	6
Central	303	9
Coast	477	9
Eastern	434	16
Nyanza	531	18
Rift Valley	538	28
Western	402	11
North Eastern	293	3
Religion (n=3,227)		
Protestant	1906	68
Roman catholic	558	20
Muslim	641	9
Other religions	122	3
Residence (n=3,233)		
Urban	835	21
Rural	2398	79
Health insurance (n=3,229)		
No	3016	93
Yes	213	7
Ethnicity (n=3,233)		
Kikuyu	437	15
Luhya	463	15
Luo	445	13
Kalenjin	322	16
Kamba	229	11
Kisii	169	7
Meru	129	5
Mijikenda/Swahili	318	6
Somalia	326	4
Other tribes	395	8

Bivariate analysis

More women with a primary education immunized their children for poliomyelitis , (43% vs. 20% F_3, 1032 = 23.86, P<0.001), Measles (41% vs. 22% F_3, 1116 = 7.49, P<0.001), bacille calmette-guérin (58% vs. 4% F_3, 1123 = 8.98, P<0.001), and disambiguation (47% vs. 16% F_3, 1119 = 12.78, P<0.001) compared to those who indicated that they did not immunize their children respectively (see Table 2 and Figure 2).

Overall, immunization was higher for bacille calmette-guérin among those with less than a primary education (10%, p<0.001), primary education (58%, p<0.001), and secondary education (20%, p<0.001). It was also higher for disambiguation among those with a university education (41%, p<0.001).

Table 2: Bivariate analysis, number and percentage of the association between education and immunization, 2008-09 KDHS

	Education				
	Less than Primary	Primary	Secondary	University	
Immunization	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**pv**
Poliomyelitis					
Yes	303(6)	1226(43)	489(17)	182(4)	***
No	348(6)	555(20)	108(4)	21(1)	
Measles					
Yes	349(6)	1129(41)	416(15)	152(4)	***
No	301(6)	652(22)	181(6)	51(1)	
Bacille Calmette-Guérin					
Yes	531(10)	1651(58)	571(20)	194(5)	***
No	120(2)	130(4)	26(1)	9(0.3)	
Disambiguation					
Yes	357(7)	1278(47)	471(17)	160(41)	***
No	294(5)	503(16)	126(4)	43(1)	

Note: Percentages might not add up to 100% due to rounding off
pv: p-value | * p<0.05; **p<0.01; ***p<0.001

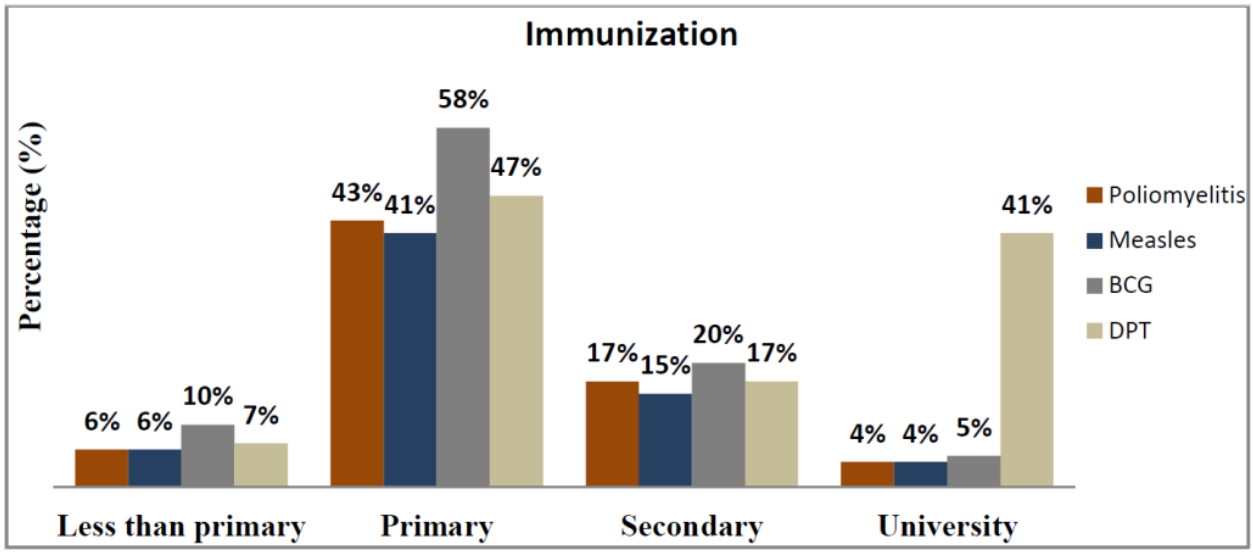

Figure 2: Percentage of immunization; poliomyelitis (n = 2, 200), Measles (n = 2, 046), Bacille Calmette-Guérin (BCG) (n = 2, 947), and Disambiguation (DPT) (n = 2, 266) by mothers education in Kenya, 2008-09 KDHS

Univariate logistic regression

Associations between education and immunizations were observed. Women with a primary, secondary, and university education were 2.12 times (95% CI: [1.45, 3.09]), p <0.001, 4.63 times (95% CI: [2.94, 7.29]), p <0.001, and 7.55 times (95% CI: [4.05, 14.07]), p <0.001 more likely to immunize (poliomyelitis) their children compared to those who had less than primary or no education. For measles, women with a primary, secondary, and college education were 1.63 times (95% CI: [1.2, 2.2]), p <0.01, 2.33 times (95% CI: [1.62, 3.37]), p <0.001, and 2.39 times (95% CI: [1.4, 4.07]), p <0.001 more likely to immunize their children compared to those who had less than primary or no education. For bacille calmette-guérin, women with a primary, secondary, and college education were 2.6 times (95% CI: [1.61 4.21]), p <0.001, 4.06 times (95% CI: [2.12, 7.77]), p <0.001, and 3 times (95% CI: [1.19, 7.57]), p <0.05 more likely to immunize their children compared to those who had less than primary or no education. For disambiguation, women with a primary and secondary education were 2.05 times (95% CI: [1.36, 3.12]), p <0.001 and 2.82 times (95% CI: [1.58, 5.03]), p <0.001 more likely to immunize their children compared to those who had less than primary or no education (see Table 3).

Multivariate logistic regression

After adjusting for confounding, there were attenuation in the odds ratios for the association between education and immunization. However, women who had a primary and secondary education were 1.68 times (95% CI: [1.04, 2.71]), p <0.05 and 2.25 times (95% CI: [1.25, 4.07]), p<0.01 more likely to immunize (poliomyelitis) their children compared to those who had less than primary or no education (see Table 3).

Table 3: Unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) of immunization and study characteristics in a multivariate logistic regression model, 2008-09 KDHS

	Unadjusted				Adjusted[§]			
Immunization	**UOR**	**pv**	**95%**	**CI**	**AOR**	**pv**	**95%**	**CI**
Poliomyelitis								
Education								
Less than primary	Ref.				Ref.			
Primary	2.12	***	1.45	3.09	1.68	*	1.04	2.71
Secondary	4.63	***	2.94	7.29	2.25	**	1.25	4.07
University	7.55	***	4.05	14.07	1.78	NS	0.76	4.20
Measles								
Education								
Less than primary	Ref.				Ref.			
Primary	1.63	**	1.20	2.20	1.53	B	0.93	2.52
Secondary	2.33	***	1.62	3.37	1.48	NS	0.86	2.54
University	2.39	***	1.40	4.07	0.95	NS	0.40	2.22
Bacille Calmette-Guérin (BCG)								
Education								
Less than primary	Ref.				Ref.			
Primary	2.60	***	1.61	4.21	1.56	NS	0.73	3.35
Secondary	4.06	***	2.12	7.77	1.93	NS	0.75	4.96
University	3.00	*	1.19	7.57	0.83	NS	0.18	3.89
Disambiguation (DPT)								
Education								
Less than primary	Ref.				Ref.			
Primary	2.05	***	1.36	3.12	1.46	NS	0.78	2.72
Secondary	2.82	***	1.58	5.03	1.61	NS	0.74	3.53
University	1.96	NS	0.83	4.61	0.80	NS	0.25	2.50

UORs and AOR: Unadjusted and Adjusted Odds Ratios | CIs: Confidence Intervals | Ref: Reference group | pv: p-value | * $p<0.05$; ** $p<0.01$; *** $p<0.001$ | $^{\beta}=0.096$ | NS: Not Significant

[§]Adjusted for wealth, children under 5 years, immunization knowledge, partners education, age, desire for more children, province, religion, residence, health insurance, and ethnicity.

Discussion

The study seeks to establish the association between maternal education and child immunization in Kenya using 2008-09 KDHS. The descriptive statistics show that vaccination for polio, measles, and disambiguation were generally lower. However, higher percentages of children were immunized for bacille calmette-guérin.

The results seem to be mixed for different vaccines; however, one striking result is that after adjusting for other factors mothers' education predicts the odds of a child getting the polio vaccine, with 1.68, 2.25, and 1.78 for women with primary, secondary and university education compared to their counterparts with less than a primary education. This infers that children of mothers with higher education are more likely to receive the polio vaccine. This trend in the differences in polio vaccination is one that needs to be followed for the eradication of poliomyelitis, and hence improved child health.

Other factors influencing child immunization for poliomyelitis include being wealthier, being knowledgeable about immunization, being from Eastern province, having health insurance, and being from the Kamba ethnicity. For measles it includes: being wealthier, child being ≥36 months, partners education, age, desire for more children, and being from Western province. For bacille calmette-guérin it includes: being poorer, partners education, and desired for more children. Lastly, for disambiguation it includes: child being ≥36 months, partners education, desired for more children, those from Nyanza and Western province, and having health insurance. In the unadjusted results, we also found that married women in rural areas were less likely to immunize their children for poliomyelitis and measles (significant) and bacille calmette-guérin, and disambiguation (no significance).

While Kenya has been on appositive direction with the support of free primary education by the government in 2003, secondary education has been on the increase as well with 29.3% enrollment rate in 2005; however, Kenya's adult literacy rates stood at 84% (Ngware, Onsomu, & Muthaka, 2007; United Nations Development Program [UNDP], 2005). Other strategies include improved financing, secondary school importance and awareness among households, and policies that support secondary education attainment especially for girls (Ngware, Onsomu,

Muthaka, & Manda, 2006). Another key strategy to improve child immunization is the integration of healthcare services and maternal and child health services. These healthcare services include counseling of pregnant women on services including the importance of immunization, record keeping, follow up systems and services, electronic record keeping and sharing to prevent duplication or misinformed services.

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