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CLINICAL ARTICLE

The relationship between facility delivery and infant immunization in Ethiopia

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ABSTRACT

Objective: To determine whether facility delivery is related to compliance with recommended infant immunizations, particularly those that occur weeks or months after delivery. **Methods:** In a retrospective analysis, multivariate logistic regression was used to assess data from the 2011 Ethiopia Demographic and Health Survey (EDHS) to determine the strongest correlates of facility delivery. These correlates were then used, along with facility delivery itself, to determine the relationship between facility delivery and infant immunization. **Results:** In total, 3334 women delivered a newborn 12–24 months before the 2011 EDHS: 90.2% (3007) delivered at home, and 9.8% (327) delivered in a facility. Education, wealth status, urban residence, and number of children under 5 years living in the household were the factors most strongly associated with facility delivery. When facility delivery and its strongest correlates were entered into multivariate logistic regression models with infant immunizations as the outcome, facility delivery was significantly associated with increased likelihood of DPT-HepB-Hib, polio, and measles vaccination, and increased likelihood of being fully immunized (all $P < 0.01$). Facility delivery was the strongest single factor associated with infants being immunized, doubling the odds of full immunization. **Conclusion:** The impact of facility delivery on health outcomes transcends the immediate delivery and postpartum period.

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1. Introduction

Encouraging women to deliver in a health facility is a key strategy to increasing childbirth with skilled attendants and thereby reduce both maternal and neonatal mortality rates in low-resource countries. Facility deliveries have been linked to lower rates of neonatal mortality [1–3] in addition to maternal mortality [4]. Despite challenges to the methodology of studies making such links [5,6], facility delivery remains a cornerstone of intervention strategies to address both Millennium Development Goal 4 (MDG4) and MDG5 in much of Sub-Saharan Africa.

One question that has not been asked is whether facility delivery has an impact on the subsequent health-seeking behavior of the mother, especially after controlling for factors such as education and wealth that might be associated with both facility delivery and health-seeking behaviors. Specifically, what is the impact of facility delivery on compliance with recommendations regarding infant immunizations, particularly those that occur weeks or months after delivery? Immunization coverage is one of the indicators used to monitor progress toward

the achievement of MDG4 and the reduction of child morbidity and mortality. Given that facility delivery and immunization coverage are both designed to address MDG4, the relationship between these 2 indicators is worth exploring.

The aim of the present study was to answer the following questions. Are mothers who deliver in facilities more likely to obtain immunizations for their infants in the weeks and months after delivery compared with women who deliver at home? If so, is that effect sufficiently robust to remain after controlling for factors such as education, wealth, and urban residence, which are known to be drivers of facility delivery that might also be related to infant care-seeking?

2. Materials and methods

The present study was a cross-sectional analysis of data from the 2011 Ethiopia Demographic and Health Survey (EDHS). All data were anonymous and available publically; thus, the study was not subjected to review by an institutional review board. All respondents in the survey participated in an informed consent process pursuant to DHS protocols [7].

The 2011 EDHS is a nationally representative survey of 16 515 women aged 15–49 years and 14 110 men aged 15–59 years. The

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2011 EDHS is the third comprehensive survey conducted in Ethiopia as part of the worldwide DHS project.

Data were obtained from the global DHS website [8], formatted for use in Stata IC version 11.0 (StataCorp, College Station, TX, USA). Data for this analysis were derived from the “births” data set, which includes all female respondents and variables such as demographics, birth history, childhood mortality, knowledge and use of family planning methods, fertility preferences, prenatal care, delivery care, postnatal care, vaccinations, and childhood illnesses.

Among the 16 515 women included in the 2011 survey, 8205 indicated that the interval between their last delivery and the time of the interview was between 12 and 24 months. This interval was chosen to ensure that the woman’s most recent delivery would match the DHS question pertaining to where the most recent delivery occurred, and that the infant would be old enough to have been eligible for all infant immunizations recommended for the first year of life. The sample of 3385 women with valid place of delivery data and whose last delivery was 12–24 months previously was weighted as per DHS analysis instructions [7] to account for the complex survey design of the DHS, yielding a weighted sample of 3334 women.

The present analysis relied on several dependent variables of interest. The first was “place of delivery,” to which there were 9 different response options recorded in the DHS, including respondent’s home, other home, government hospital or polyclinic, government health center, government health station, government health post, private hospital, private clinic, or non-governmental organization health facility. The 9 response options were collapsed into a dichotomous variable: deliveries reported to have occurred at the respondent’s home or at another’s home were combined to yield “facility-based delivery =no,”

and the remaining response options were combined to yield “facility-based delivery = yes.”

Place of delivery also served as an independent variable as a predictor of immunization status, along with the factors listed in Table 1. Demographic factors included age-related variables, education, marital status, wealth, religion, and ethnicity.

In Ethiopia, the vaccination policy calls for BCG vaccine (to prevent tuberculosis) to be given at birth or first clinical contact; 3 doses of DPT-HepB-Hib vaccine (the replacement for DPT vaccine that protects against diphtheria, pertussis, tetanus, hepatitis B, and *Haemophilus influenzae* type b) to be given at approximately 4, 8, and 12 weeks of age; 4 doses of oral polio vaccine given approximately at 0–2, 4, 8, and 12 weeks of age; and measles vaccine to be given at or soon after 9 months of age. The 2011 EDHS collected information on vaccination coverage in 2 ways: from vaccination cards shown to the interviewer, and from mothers’ verbal reports. If a vaccination card was available, the interviewer copied the vaccination dates directly onto the questionnaire. When there was no vaccination card for the child or if a vaccine had not been recorded on the card as being given, the respondent was asked to recall the vaccines given to her child.

The EDHS includes 624 census enumeration areas across Ethiopia, which require cluster weighting prior to analysis. In addition, sample weighting is required to adjust for the differential probability that some individuals are more likely to be sampled than others. Each analytical procedure was preceded with the appropriate weighting codes in Stata to ensure the ability to draw conclusions regarding the target population rather than the sample.

Univariate and bivariate statistics were calculated for demographic variables, and health and health system utilization variables, including

Table 1
Demographic characteristics of EDHS respondents who delivered in the previous year stratified by facility delivery vs home delivery.^a

Variable	Overall	Facility delivery	Home/non-facility delivery	P value
No. of women	3334	327 (9.8)	3007 (90.2)	
Maternal age, y	28.7 (28.3–29.1)	27.4 (26.3–28.5)	28.9 (28.4–29.3)	0.023
Age at first birth, y	18.9 (18.7–19.2)	20.5 (19.8–21.1)	18.8 (18.5–19.0)	<0.0001
Total no. of births	4.3 (4.1–4.5)	2.8 (2.3–3.3)	4.5 (4.5–4.6)	<0.0001
Education				
None	71.4	37.9	75.1	<0.0001
Primary	24.9	31.4	24.2	
Secondary	2.1	16.3	0.5	
Higher	1.6	14.4	0.2	
Literacy				
Unable to read	81.3	45.4	85.2	<0.0001
Able to read partial sentences	7.9	4.6	8.2	
Able to read full sentences	10.8	50.0	6.5	
Married	89.2	81.3	90.1	0.002
Children <5 y in household				
0	3.4	7.3	3.0	<0.0001
1	25.5	45.5	23.4	
2	55.2	41.8	56.7	
≥3	15.8	5.4	17.0	
Any prenatal care (n = 2066)	43.2	87.7	37.1	<0.0001
Start of PNC				
First trimester	25.3	37.9	21.2	0.009
Second trimester	56.8	51.0	58.7	
Third trimester	17.9	11.2	20.1	
Number of PNC visits				
0	57.0	12.3	63.2	<0.0001
1–3	24.7	23.7	31.6	
≥4	18.3	13.1	56.1	
Wealth index				
Poorest	24.6	4.1	26.8	<0.0001
Poorer	23.9	3.4	26.2	
Middle	18.5	6.8	19.8	
Richer	19.3	13.3	19.9	
Richest	13.7	72.4	7.4	
Covered by health insurance	0.2	1.1	0.1	0.023
Urban residence	12.1	70.4	5.7	<0.0001

Abbreviations: EDHS, Ethiopia Demographic and Health Survey; PNC, prenatal care.

^a Values are given as number (percentage), mean (95% confidence intervals), or percentage unless stated otherwise.

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