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Individual-, family- and community-level determinants of full vaccination coverage among children aged 12–23 months in western Kenya

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ABSTRACT

To identify individual-, family-, and community-level determinants of full vaccination status at most challenging areas in Kenya, we conducted a cross-sectional study among children aged 12–23 months and their mothers. 1965 children were involved in this research and their mothers completed a questionnaire. Middle or high knowledge of vaccination schedule (Adjusted Odds Ratio (AOR) = 2.69, 95%CI: 2.01–3.60 or AOR = 8.12, 95%CI:5.50–11.97), medium/long birth interval or first birth (AOR = 2.46, 95%CI: 1.29–4.69 or AOR = 1.84, 95%CI:1.10–3.09 or AOR = 2.14, 95%CI: 1.20–3.84), less than 5 children under five years old (AOR = 1.39, 95%CI: 1.04–1.88) and highest community health worker's (CHWs) performance (AOR = 2.20, 95%CI: 1.39–3.47) were significantly associated with complete vaccination status in the final multiple regression model. In addition, a interaction between literacy and wealth was significantly related in full vaccination status (AOR = 1.38, 95%CI: 1.08–1.75). Increased frequency and quality of CHW visits could be effective intervention to enhance vaccination coverage. Future interventions focusing on vaccination coverage should be given more attention especially to high risk group identified in this study.

1. Introduction

Immunization is a highly cost effective way of improving survival in children in developing countries [1]. Every year throughout the world, however, an estimated 27 million children and 40 million pregnant women do not receive the basic package of vaccination [1]. In addition, it is estimated that two million children worldwide die each year as a consequence of vaccine-preventable diseases [2]. As a result of sub-optimal vaccination coverage, the World Health Organization (WHO) introduced its Expanded Program on Immunization (EPI) in 1974. EPI in middle- and low-income countries has prevented more than 2 million child deaths from the Tuberculosis, Diphtheria, Tetanus, Pertussis, Polio, and Measles each year since its initiation [1]. By reducing morbidity and mortality, Immunization is expected to contribute significantly to the achievement of the Millennium Development Goal 4 (to achieve a two-thirds reduction in mortality rate for children under the age of 5 years between 1990 and 2015).

In Kenya, vaccination services are provided daily by free in most of the health facilities, and the roles of CHWs to improve vaccination coverage are to convey health messages such as vaccination schedule to community member, to identify defaulters from vaccination services and to refer to health facility. However, the proportion of children aged 12–23 months that were reported to have received all recommended vaccinations was 77.4%, and Nyanza province was one of the lowest vaccination coverage provinces (64.6%) [3].

Research has been undertaken in a number of developed and developing countries to identify the determinants of childhood vaccination coverage. In developed countries, children from low income families [4–6], with a greater number of siblings[4], with higher birth orders [4,7], whose parents are unmarried [4,7,8], whose parents are lacking private health insurance [4,7], and whose mothers are less educated [4,8,9] are at greater risk of not being fully vaccinated. In developing countries, lower maternal [10,11] and parental education [12,13], lower household wealth [10,12], and area of residence [10,11] are all risk factors for lower vaccination rates. There are recent studies [14,15] which have been conducted in Kenya to estimate vaccination coverage and identify risk factors for failure of fully vaccination. However, their research areas were informal urban settlement and Coast area. Our research area was one of the poorest area and HIV prevalence and Malaria infectious rate are still higher than other area in Kenya [3]. The differences in living conditions suggest that the determinants of vaccination of children may be need to be studied. In addition, the role of community characteristics as determinants of full vaccination coverage has not been studied.

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The objectives of this study were (1) to assess full vaccination coverage among children aged 12–23 month in the area, (2) to describe individual, family and community level determinants of full vaccination by using a multiple logistic regression analysis.

2. Methods

2.1. Research site and population

This study was conducted the all 64 sub-location covered by community health workers (CHWs) in community units (CUs) which were identified as level one of the health system in Kenya since 2006 [16] and established by May, 2011 in Siaya, Ugenya, Gem and Kisumu West district, Nyanza Province, Kenya. The average of the population in each sub-location was around 5000. CHWs were nominated from community member. Their main activities were door to door canvassing to teach health related preventive methods and collect health related-data from each household. They did not provide any drugs and vaccinations to community member in this area. This area is mainly inhabited by subsistence farmers and fishermen and their main tribe is the Luo tribe. Their main languages are Luo language, followed by Swahili and English. The research population consisted of all children aged 12–23 months and their mothers in this research area.

The sample size was calculated according to Naing et al. [17]. With average of vaccination coverage in Kenya (74.4%), confidence level of 95% and with a relative precision of 5% points on each side, a sample of 1075 children was needed. Taking the cluster design effect into consideration, the required sample became 2150. In consideration of missing data, 2560 children finally were required.

2.2. Study design and data collection

This study was conducted as a community-based cross sectional study from August to September, 2011. Total 11,906 children aged 12–23 months were identified by CHWs in the 64 sub-locations on August, 2011. Their name, parent's name, contact number and household place were collected. 40 children in each sub-location were selected by using simple-random sampling methods. Finally 2560 children were targeted and their mothers were asked from August to September, 2011 by using an interviewer-administered questionnaire to assess their socio-economic characteristics, their health and sanitation practice as follows: maternal age, marital status, maternal education level, knowledge of vaccination schedule, occupation, literacy for English, antenatal care (ANC) visit, possession of MCH booklet, number of household member, number of children under five in the household, sex of target child, birth interval, monthly salary, household assets, toilet utilization, possession of hand washing facilities and dish rack, amount of time to health facility, social capital by using standard questionnaire [18] and vaccination status of target child. Information about the child's vaccination status was obtained from the maternal & child health booklet (MCH booklet) or by maternal recall and transferred to the survey instrument. The main contents of MCH booklet in Kenya are about antenatal/postnatal examination, family planning, danger sings in child, child nutrition/growth monitoring and vaccination schedule. 69% of the mothers kept their MCH booklet in this study, the data from other 31% of them were collected by maternal recall. In addition, times of CHW's visitation to their household and its satisfaction score to generate CHWs performance were also asked to their mothers at the same time.

The research assistants, not CHWs, were recruited from each sub-location. All were high school graduates (12 years of education) and had previous similar experience of data collection. Furthermore, One day intensive training including guidance for the data-collection procedure and pre-testing the questionnaire was conducted. After data collection, the principal investigator checked questionnaires for completeness and consistency. When incomplete or/and inconsistency questionnaires were identified, the missing data was obtained by re-visiting or calling as much as possible.

2.3. Measures

2.3.1. Dependent variable

The outcome variable is the likelihood of a child aged 12–23 months having received all of the eight required vaccinations (full vaccination). Written vaccination records in MCH booklet or maternal recall if MCH booklet was not available were used to determine children's vaccination status. 69% of the mothers kept their MCH booklet, so that the vaccination status of them was determined by the booklet. On the other hand, the vaccination status was determined by maternal recall among 31% of them, because MCH booklet was not available at the time of the survey. In addition 141(7%) among the 602 (31%) have never possessed MCH booklet. Children were categorized as being "fully vaccinated" if they received all eight does of the vaccines recommended by the EPI (BCG, 3 OPV, 3 DPT, Measles); and "not fully vaccinated" if they did not receive all required vaccinations.

2.3.2. Independent variables

Seventeen community-, family-, and individual-variables of interest were examined. There were two community variables in this study. (i) One was a indicator on CHWs performance generated by using both frequency of visitation by CHWs and its satisfaction score reported by target mothers. Frequency of household visitation was scored as follows: 0; less than once per month, 1; once per month, 2; more than once per month. Satisfaction score was also scores as follows: 0; low score, 1; middle score, 2; high score. The CHWs performance was generated by adding the score of the household visitation and the score of satisfaction, and categorized into five quintiles as: poorest, poor, middle, high and higher. (ii) Second was social capital. Social capital was measured by using the standard questionnaire [18]. Total score by sub-location was calculated and classified as: lowest, low middle, high and higher.

There were five variables describing family characteristics assessed in this study; (iii) household wealth index, (iv) number of household member, (v) number of children under five in the household, (vi) amount of time to nearest health facility and (vii) household sanitation practice. (iii) The household wealth index was evaluated by indexing all household assets (ex. mobile phone, television, bicycle, etc.), materials of wall, floor and roof, and monthly salary, and categorized into five quintiles as: poorest, poorer, middle, richer and richest. Two binary variables were created for (iv) number of household numbers (less than 5 and 5 or more) and (v) number of children under five in the household (less than 2 and 2 or more). (vi) Amount of time to nearest health facility was assessed and categorized into four quintiles as: less than 20 min, 21–40 min, 41–60 min, and more than 60 min. In addition, (vii) household sanitation practice was created by using three indicators such as possession of toilet, hand washing facility and dish rack and grouped as: none, possession of at least one among three things, possession of two, and possession of all.

The individual characteristics included nine variables: (viii) sex of child assessed as: male and female; (ix) birth interval classified as: short birth interval (<24 months) and medium birth interval (24–47 months), long birth interval (>48 months) and first birth; (x) maternal age grouped as: less than 20, 20–24, 25–29, 30–34, and over 35 years old; (xi) marital status, grouped as: married and single/divorced/widowed/separation; (xii) maternal education status, categorized as: no education and drop out