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## Original Research

# Effects of three interventions and determinants of full vaccination among children aged 12–59 months in Nyanza province, Kenya

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## ABSTRACT

**Objectives:** The purpose of this study is to describe the effects of the three main interventions and identify the individual and community determinants of full vaccination coverage among children aged 12–59 months in Nyanza province, Kenya.

**Study design:** Cross-sectional study.

**Methods:** We utilized three datasets. One is the Nyanza Province County-based Multiple Indicator Cluster Survey 2011. The other two datasets are the lists of community units and health facilities in Nyanza Province, Kenya. A three-level multilevel logistic regression analysis was performed.

**Results:** In the final model, the highest wealth quintile (AOR: 2.49; 95% CI: 1.333–4.642;  $P = 0.004$ ), the community with high coverage of media devices (AOR: 1.50; 95% CI: 1.029–2.198;  $P = 0.035$ ), the participation of mass immunization campaigns (AOR: 1.63; 95% CI: 1.153–2.303;  $P = 0.006$ ) were the significant determinants of complete child vaccination.

**Conclusions:** In conclusion, further implementation of mass immunization campaigns is the recommended intervention to increase the uptake of required vaccinations among children. In addition, further attention to the poor and the low coverage of media devices is necessary, since they are the most vulnerable population in terms of accessibility of vaccination services. Implementation community based activity, such as community health workers, would have a positive impact on vaccination coverage, if their performance is continuously high.

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## Introduction

Immunization is one of the most cost-effective interventions.<sup>1</sup> According to the estimation by the World Health Organization (WHO), more than two million child deaths caused by vaccine-

preventable diseases were prevented by vaccinations in 2003.<sup>1</sup> However, it is estimated that worldwide, there were an estimated 27 million infants who remained in need of immunization in 2003.<sup>1</sup> The full vaccination rate among children aged 12–23 months in Kenya was increased from 56.8% in 2003<sup>2</sup> to 77.4% in 2008.<sup>3</sup> In addition, the percentage of full vaccination

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in Nyanza province, one of the poorest provinces, was 64.6%, which is still clearly in need of improvement.<sup>3</sup>

The vaccination coverage is influenced by various factors such as parental education background,<sup>4–6</sup> maternal age,<sup>4</sup> number of children in a household,<sup>4,7</sup> maternal unemployment,<sup>4</sup> health knowledge,<sup>5,8,9</sup> birth interval,<sup>7</sup> type of residence,<sup>7</sup> and economic status.<sup>6,10</sup> In addition, there are two main interventions to increase vaccination coverage; routine vaccination services, and mass immunization campaign.<sup>11–13</sup> Because distance to a health facility is one of the significant factors associated with full immunization,<sup>14–16</sup> availability of health facilities is important for community members. A study conducted in Uganda showed that the additional campaigns for measles containing vaccine made outbreaks less frequent and lower in magnitude.<sup>17</sup> The integrated routine and mass immunization campaign is recommended to control measles transmission.<sup>18</sup> Although routine immunization services are more accessible for the rich, a mass campaign can reduce the gap of the coverage between the poor and the rich.<sup>19</sup>

In addition, community health workers (CHWs) have an important role to play in increasing the uptake of childhood immunization.<sup>20–22</sup> As well as addressing the shortage of health staff in rural areas, CHWs can assist in building a positive interaction between the health system and the community, which is also one of the reasons related to the uptake of vaccinations.<sup>16</sup>

To increase equitable access to health services, the Kenyan government has launched the Community Health Strategy (CHS) as one of their national flag strategies in 2006.<sup>23</sup> In the strategy, community units (CUs) are identified as level one of the Kenyan Health System. 50 CHWs, two of their supervisors named community health extension workers (CHEW) and 10 community health committee members (CHCs) were allocated in a CU. The strategy was revised in 2010. After the revision, the number of CHWs in a CU was decreased from 50 to 10 CHWs. Although two studies describe the positive relationship between vaccination coverage and high performance CHWs and implementation of all CHS components respectively,<sup>21,24</sup> there is no large scale study to confirm the effectiveness of the establishment of CUs.

Although there are lots of studies focusing on individual determinants of vaccination coverage, there is no study to evaluate the three interventions, such as mass immunization campaign, availability of health facilities and CU establishment, under the same background. In addition, community level variables are not commonly examined. Therefore, utilizing multi-level analysis, we describe the effects of the three main interventions and identify the individual and community determinants of full vaccination coverage among children aged 12–59 months in Nyanza province, Kenya. Finally, we discuss which kind of interventions need to be strengthened in the future, with consideration of the significant factors influencing child vaccination coverage.

## Methods

### Study design and dataset

This study was a cross-sectional study using three secondary datasets. The main dataset for this study was the

dataset of Nyanza Province County-based Multiple Indicator Cluster Survey (MICS) 2011 conducted by the Kenya National Bureau of Statistics (KNBS) with support from UNICEF. In the survey, 300 enumeration areas (EAs) were sampled using probability proportional to size (PPS) sampling methods as a first step. As the second step, the households were selected systematically using a random start from the list of households. The total number of participants was 30,439 household members within 6828 households.<sup>25</sup> The survey dataset was provided from UNICEF, Kenya. The other additional datasets were lists of both community units and health facilities in Nyanza Province provided by the Ministry of Health (MOH), Kenya. The first list included the names of sub-locations (equal to EAs) where the CU was established, and date of the establishment. The second list also contained the data on the names of health facilities and sub-locations where each health facility was located. The three datasets were merged using sub-location names (EA's names).

UNICEF and Ministry of Health, Kenya approved to provide and utilize these datasets. Ethical approval for this research was obtained from the Ethical Committee of Nagasaki University, Japan.

### Detail of routine immunization service, mass campaign and community health intervention in Kenya

There were six levels of health system in Kenya in 2011: CU (level one), dispensary/clinics (level two), health centers (level three), primary hospitals (level four), secondary hospitals (level five), tertiary hospitals (level six).<sup>26</sup> In level one, the vaccination services were not provided, while in other upper levels health facilities were providing it for free. In Nyanza province, the number of health facilities has been increasing continuously from 453 in 2004<sup>27</sup> to 868 in 2011.<sup>28</sup> The locations of all health facilities have been identified by the Ministry of Health (MOH), Kenya.

As one of the mass campaigns in Kenya, a comprehensive mass campaign focusing on mother and child health, named 'Malezi Bora', was implemented twice a year to make health services more accessible for mothers, and children under five. Although this program mainly encourages caregivers to bring their children to a fixed health post, outreach services were also conducted depending on the availability of the resources. National immunization campaigns, such as a measles campaign, were also implemented in Kenya.

There were two main phases to establish CUs. The first was the selection of CHC, CHWs and CHEWs. The second was provision of standard training and other necessary equipments to them.<sup>29</sup> CHC members and CHWs were selected from community members who were willing to participate, or who were nominated. The role of the CHC was to coordinate all community health activities as the governance body. CHWs mainly visited households under their covering areas to educate community members on the essential health knowledge and the recommended health seeking behavior. CHWs were supervised by two CHEWs. One of these specialized in supporting CHWs at community level. The other was a nurse assigned to a health facility around the community.

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