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**NOTES FROM THE FIELD****Childhood immunisation in Bungoma County, Kenya, from 2008 to 2011: need for improved uptake**G. W. Muthia,<sup>1</sup> A. D. Harries,<sup>2,3</sup> A. A. Obala,<sup>1</sup> H. D. N. Nyamogoba,<sup>1</sup> C. Simiyu,<sup>1</sup> M. E. Edginton,<sup>2</sup> M. Khogali,<sup>4</sup> B. L. Hedt-Gauthier,<sup>5</sup> B. K. Otsyla<sup>1</sup><http://dx.doi.org/10.5588/pha.13.0106>

Uptake of immunisations in children aged 1–2 years in Bungoma County, Kenya, was determined as part of the 6-monthly Health and Demographic Surveillance System surveys. A total of 2699 children were assessed between 2008 and 2011. During this time period, full immunisation declined significantly from 84% to 58%, and measles vaccine uptake from 89% to 60% ( $P < 0.001$ ). Each year there was a significant fall-off for the third doses of the oral polio and pentavalent vaccines ( $P < 0.001$ ). These findings are of concern, as low immunisation coverage may lead to vaccine-preventable disease outbreaks. Further investigations into the reasons for declining immunisation trends are required.

**A**lthough childhood immunisation is recognised as a cost-effective public health intervention to prevent specific communicable diseases, vaccination coverage in low- and middle-income countries may be poor.<sup>1</sup> In 2008, the World Health Organization (WHO) estimated that 1.5 million deaths in children aged <5 years were due to vaccine-preventable diseases.<sup>2</sup> Kenya's immunisation policy dictates that all infants receive the bacille Calmette-Guérin (BCG) vaccine at birth; the oral polio vaccine at birth and at 6, 10 and 14 weeks; the pentavalent vaccine to prevent diphtheria, tetanus, whooping cough, hepatitis B and *Haemophilus influenzae* type B at 6, 10 and 14 weeks; and the measles vaccine at 9 months.<sup>3</sup> Per national policy, an infant is regarded as having full immunisation coverage if all scheduled vaccinations are completed before 1 year of age.

Despite a well-established programme on immunisation, national immunisation coverage in Kenya for 2008 was 77%, with coverage in the Western Region reported at 73% and in some districts at below 50%.<sup>4</sup> These data are based on cross-sectional demographic surveys conducted every 5 years on a sampled population, and in interim years on data provided by health facilities. The relatively poor immunisation coverage in Kenya, coupled with a polio outbreak in 2013, is of concern, and there is a need to analyse coverage in the last 5 years to assess whether or not there has been any improvement.

In Bungoma County, Western Region, the Webuye Health and Demographic Surveillance System (HDSS) was set up in 2007 with the goal of collecting comprehensive demographic, health and economic data to

inform health policy and planning at local and national levels. Among others, data on childhood immunisation was collected at 6-monthly intervals from households. The aim of the present study was to use the Webuye HDSS to report on immunisation uptake in children aged 1–2 years in Bungoma County between 2008 and 2011.

**ASPECT OF INTEREST**

This was a cross-sectional study of routinely collected data from HDSS surveys. The HDSS, a collaborative research programme between Moi University, Eldoret, Kenya, and Ghent University, Ghent, Belgium, was implemented in an area of 120 km<sup>2</sup> and included both rural and semi-urban areas with approximately 73 000 individuals in 13 000 households.<sup>5</sup> The first survey was carried out in 2008 using paper-based questionnaires, with subsequent semi-annual surveys; each cycle lasted 3 months (a total of eight surveys until 2011). In each survey, the same trained community interviewers visited the same 13 000 households to collect longitudinal health-related data, including information on childhood immunisation. The data from each survey were linked using household identity numbers.

All children aged 1–2 years recorded in the HDSS database from January 2008 to December 2011 were included in the study. Data variables included year of registration and immunisation status by vaccination type, and were extracted into an Excel spreadsheet (Microsoft, Redmond, WA, USA) and analysed using Stata version 11.1 software (Stata Corp LP, College Station, TX, USA). Differences in total vaccine and vaccine-specific uptake between the years were analysed using logistic regression, the  $\chi^2$  test and the  $\chi^2$  test for trend, with levels of significance set at 5%.

Approval for this secondary analysis of HDSS data was obtained from the Moi University-Flemish Inter-university Council University Development Cooperation (VLIR UOS) Steering Committee, Médecins Sans Frontières Ethics Review Board, Geneva, Switzerland, and the Ethics Advisory Group of the International Union against Tuberculosis and Lung Disease, Paris, France.

Immunisation uptake for each vaccine is shown in Table 1. Over the total 4-year period, 90% or more of children received each scheduled vaccine, except for the measles vaccine, which was received by 74%. For

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**KEY WORDS**

childhood vaccinations; measles; operational research; health and demographic surveillance systems

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**TABLE 1** Immunisation uptake in each year and for all 4 years by vaccine type, Bungoma County, Kenya, 2008–2011\*

Vaccine types and schedules	2008 (n = 746)* n (%)	2009 (n = 760)* n (%)	2010 (n = 683)* n (%)	2011 (n = 510)* n (%)	Total (n = 2699)* n (%)
BCG	730 (98)	744 (98)	672 (98)	481 (94)	2627 (97)
OPV1	731 (98)	741 (97)	665 (97)	458 (90)	2595 (96)
OPV2	723 (97)	733 (96)	645 (94)	448 (88)	2549 (94)
OPV3	696 (93)	689 (91)	609 (89)	416 (82)	2410 (89)
PENTA1	733 (98)	742 (98)	666 (97)	458 (90)	2599 (96)
PENTA2	724 (97)	730 (96)	657 (96)	449 (88)	2560 (95)
PENTA3	689 (92)	698 (91)	624 (91)	424 (83)	2435 (90)
Measles†	663 (89)	556 (73)	478 (70)	307 (60)	2004 (74)

\*Children aged between 1 and 2 years included in the survey during the year.

†At 9 months.

BCG = bacille Calmette-Guérin vaccine at birth; OPV1 = oral polio vaccine at 6 weeks; OPV2 = oral polio vaccine at 10 weeks; OPV3 = oral polio vaccine at 14 weeks; PENTA1 = pentavalent vaccine to prevent diphtheria, tetanus, whooping cough, hepatitis B and *Haemophilus influenzae* type B at 6 weeks; PENTA2 = pentavalent vaccine at 10 weeks; PENTA3 = pentavalent vaccine at 14 weeks.

**TABLE 2** Immunisation status for the 4 years combined and for each year, Bungoma County, Kenya, 2008–2011

Vaccination uptake	Total (n = 2699)* n (%)	2008 (n = 746)* n (%)	2009 (n = 760)* n (%)	2010 (n = 683)* n (%)	2011 (n = 510)* n (%)	P† χ <sup>2</sup> test
Fully immunised‡	1902 (70)	629 (84)	522 (69)	455 (67)	296 (58)	<0.0001
Partially immunised§	748 (28)	109 (15)	231 (30)	217 (32)	191 (37)	<0.0001
Not immunised¶	49 (2)	8 (1)	7 (1)	11 (1)	23 (5)	<0.0001

\*Children aged between 1–2 years included in the survey during the year.

†P value based on test for trend.

‡Vaccination with all eight vaccines, as shown in Table 1, during the first year of life.

§Vaccination in which at least one vaccine, as shown in Table 1, is missing during the first year of life.

¶No vaccines at all given in the first year of life.

each year, there was a significant decline in the uptake of the third doses of both oral polio vaccine and pentavalent vaccine compared to the first dose. The uptake of the eight vaccines (with the exception of measles vaccine) at scheduled times was similar between 2008 and 2010, but in 2011 there was a significant decrease compared with 2008 ( $P < 0.001$ ). There was a progressive and significant decline in uptake of measles vaccine from 2008 to 2011 ( $P < 0.001$ ).

Immunisation status for all vaccines combined is shown in Table 2. Over the full study period, 70% of children were assessed as fully immunised, with only 2% having no immunisation at all. However, from 2008 to 2011 there was a significant decrease in children with full immunisation uptake and a corresponding increase in those with partial immunisation.

## DISCUSSION

This is the first study to document immunisation uptake in rural and semi-urban Kenya based on longitudinal health demographic surveillance surveys. The findings are of concern: only 70% of children were fully immunised during the total 4-year period, although these results are better than recent data from other African countries.<sup>6,7</sup> There was evidence of a progressive decrease in full immunisation coverage, with a significant decrease in uptake in 2011, and for measles vaccine a progressive decrease in uptake over the 4 years.

The strengths of this study were the large number of households surveyed, its longitudinal nature, the use of the same community trained interviewers and methodology at each 6-month survey, and attention being paid to following internationally agreed recommendations for reporting on observational studies.<sup>8</sup> Limitations are related to the lack of information about 1) whether the number of children targeted annually for vaccinations and receiving every scheduled dose of vaccine changed with time, 2) whether vaccine dosages were administered as per scheduled timings, and 3) risk factors associated with poor immunisation uptake.

Despite these limitations, this study has important implications. First, it will be important to ensure that full courses of oral polio and pentavalent vaccines are completed by all children through community awareness campaigns and to secure sufficient stocks of vaccines. Second, more attention should be paid to measles vaccine uptake, not only in Kenya but elsewhere, as measles is re-emerging as an important and potentially fatal infectious disease.<sup>9,10</sup> Finally, this study illustrates the value of demographic surveillance systems in obtaining reliable community-level estimates of key health programme coverage indicators that can support programme and policy development.

In conclusion, this study shows low immunisation uptake in Bungoma County, Kenya, particularly for measles vaccination, and emphasises the need to rein-

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vigorate and continually evaluate the immunisation services in the area, the region and the country.

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La couverture vaccinale des enfants de âgés de 1 à 2 ans dans la conté de Bungoma au Kenya a été déterminée dans le cadre d'un enquête du Système de surveillance sanitaire et démographique. Au total 2699 enfants ont été évalués de 2008 à 2011. Au cours de cette période, le taux de vaccination complète a diminué de façon significative, de 84% à 58%, et celui de la vaccination contre la

rougeole de 89% à 60% ( $P < 0,001$ ). Chaque année, on a constaté une chute de l'administration de la 3e dose du vaccin polio oral et du vaccin pentavalent ( $P < 0,001$ ). Ces résultats sont préoccupants car cette faible couverture vaccinale pourrait conduire à des épidémies de maladies évitables. Il est nécessaire de faire d'autres investigations à la recherche des causes de ce déclin de la vaccination.

La vacunación de los niños de 1 a 2 años de edad en el condado de Bungoma, en Kenia, se investigó como parte de las encuestas semestrales del Sistema de Vigilancia Sanitaria y Demográfica. Se evaluaron 2699 niños del 2008 al 2011. Durante este período se observó una disminución considerable de la administración de un esquema completo de vacunación, de 84% a 58%, y la aplicación de la vacuna antisarampionosa disminuyó de 89% a 60% ( $P < 0,001$ ).

En cada año, se redujo de manera notable la administración de la tercera dosis de la vacuna antipoliomielítica oral y la vacuna pentavalente ( $P < 0,001$ ). Estas observaciones son fuente de preocupación, pues una baja cobertura de vacunación puede dar origen a brotes epidémicos de enfermedades prevenibles. Se justifica la realización de nuevas investigaciones que aclaren las razones de esta tendencia decreciente de las vacunaciones.

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