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Seroprevalence of measles IgG among HIV-1-infected and uninfected Kenyan adults

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Summary

Despite global efforts to reduce measles incidence, outbreaks continue to occur in developing countries where HIV-1-infected adults represent a vulnerable population. Immunization campaigns have targeted children, although little is known about the levels of measles protection in adult populations in Kenya. The objective of this study was to determine seroprevalence and titers of measles IgG among HIV-1-infected and uninfected adults in Nairobi, Kenya. The presence of anti-measles IgG was measured in cryopreserved serum of 257 HIV-1-infected and 367 uninfected adults using a commercial ELISA (Enzygnost, Germany). The measles IgG concentration was calculated for those samples that were positive. Overall, 96% of adults were measles seropositive and the mean measles IgG concentration among those who were seropositive was 4134 mIU/ml, which is well above previously reported protective levels. There was no statistical difference in seroprevalence or antibody concentration between the HIV-infected and HIV-uninfected groups. While local vaccination efforts and circulating measles infection likely contribute to this high measles seroprevalence rate, these data are unique to an urban population and may not reflect a country-wide distribution. Our results suggest that reduced immunity among HIV-1-infected adults is not a major contributor to measles resurgence in Kenya.

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Ethical approval: Written informed consent was obtained from all study participants for study procedures and sample storage. The University of Washington Institutional Review Board and the Kenyatta National Hospital/University of Nairobi Ethics and Review Committee, Nairobi, Kenya, approved this study.

Conflict of interest: No competing interest declared.

Keywords

Measles; HIV; Sub-Saharan Africa; Kenya; IgG antibody; Adult immunity

Introduction

Despite large gains towards measles eradication in Africa, over 50 000 measles-related deaths occur yearly;[1] 2380 measles cases were reported in Kenya in 2012, more than twice as many as in 2010.[2,3] While 24% of those affected were over the age of 15 years,[3] efforts to accelerate measles control have primarily targeted children.

Currently, there is little information on measles seroprevalence among HIV-infected or HIV-uninfected adults in developing countries. Few non-Western data exist and results vary: in Iran, 45% of previously vaccinated adults were measles seronegative[4] compared to <5% in Yemen.[5] According to the 2009 Kenya AIDS Indicator Survey, over 7% of adults are HIV-infected; these individuals may not have responded to vaccinations or may have lost immunity.

Methods

Between 2007 and 2009, 470 HIV-1 discordant and 80 HIV concordant negative couples were enrolled into a previously described study in Nairobi, Kenya.[6] For this retrospective study, an equal number of HIV-infected males and females were selected.

An ELISA (Enzygnost, Germany) was used as per the manufacturer's guidelines to measure anti-measles IgG in cryopreserved sera. Samples were classified as: negative if OD_{450} was <0.1; positive (protective) if >0.2; equivocal (non-positive) if 0.1 to 0.2. Measles IgG seroprevalence and titers (mIU/ml) were calculated in samples with protective antibodies. The difference in the proportion with protective antibody between the HIV-infected and uninfected groups was determined using Chi-square tests; independent *t*-tests were used to compare measles-specific IgG concentrations between groups. Stata IC/11 was used for the data analyses and random sample selection.

Results

Measles-specific antibody was measured in 257 HIV-infected and 367 uninfected adults in HIV discordant and HIV concordant negative partnerships. Median age was 31 years (interquartile range (IQR) 26–36). Three hundred and six (49%) of 624 lived in formal housing, and individuals had a median of 2 (IQR 1–3) living children. Among the HIV-infected, the median CD4+ T-cell count was 404 cells/μl (IQR 271–571) and the median plasma viral load was 4.6 $\log_{10}$ copies/ml (IQR 3.9–5.3) (Table 1). No participants reported taking highly active antiretroviral therapy.

Overall, 599 (96%) adults had positive measles IgG (Table 2). Positive measles IgG was observed in 246 (95.7%) HIV-infected adults and 353 (96.2%) HIV-uninfected adults ($p > 0.05$). Of the HIV-uninfected participants from HIV-1 discordant partnerships, 98.8% were measles seropositive compared to 90.5% from HIV concordant negative partnerships (not statistically significant). Among HIV-infected adults, there was no difference between those with a CD4 count greater or less than 250 cells/μl (data not shown).

The mean measles IgG concentration among those with positive titers was 4134 mIU/ml (range 359–16 756). In the HIV-infected and HIV-uninfected groups, of those with positive measles titers, the mean IgG concentration was 3961 mIU/ml (range 359–16 756) and 4255

mIU/ml (range 367–15 177), respectively (Table 2). Among those with positive titers, there was no difference in seroprevalence, mean antibody concentrations, age, or gender between HIV-infected and uninfected individuals (data not shown).

Discussion

While most measles seroprevalence studies focus on children, this report investigates another important target group for whom data are lacking: adults. In this urban cohort, measles seroprevalence was approximately 96% overall. These findings are higher than previously reported values for measles seroprevalence among Kenyan HIV-infected pregnant women; rates have ranged from 73% (1999–2004)[7] to 94% (1996–1997).[8] These differences could be due to variations in geographic vaccination coverage.

The average measles antibody concentration was 4134 mIU/ml, higher than previously reported protection levels (>200 mIU/ml). High antibody levels have been correlated with infection or viral exposure, suggesting some protection observed here might be due to exposure not solely vaccination.

We observed no difference in the proportion of individuals with protective levels of measles antibody when comparing HIV-infected and uninfected adult groups. This contrasts with a previous study that showed only one-third of previously vaccinated HIV-1-infected antiretroviral-naïve Kenyan children had protective measles antibody levels.[9] In our cohort, HIV-1 did not result in depressed levels of protective measles antibodies, perhaps because HIV was acquired during adulthood, not childhood. While we observed a small difference in seroprevalence amongst the HIV-uninfected groups, this was not statistically significant.

Although the observed high measles seroprevalence is encouraging, it is notable that these data are unique to some adults in Nairobi and not reflective of the entire country. Sustained vaccination efforts, coupled with circulating measles in the population have likely contributed to this high adult seroprevalence. Despite vaccination efforts, Kenya continues to experience measles outbreaks; in 2011 in northern Kenya, 59% of cases were in those 15 years or older,[3] indicating measles protection is not uniform throughout Kenya. Additionally, the HIV-uninfected participants in concordant HIV-negative partnerships did not meet the World Health Organization 95% herd immunity stipulation to eliminate transmission. These data, in combination with recent cases, suggest there is need for continued, wide-ranging public health programs to diminish measles infection and identify at-risk target populations in Kenya and the region.

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Table 1

Demographic and clinical data by partnership status and gender[a]

	HIV discordant partnership[b]		HIV concordant negative partnership		
	Women (*n* = 254)	**Men (*n* = 254)**	**Women (*n* = 58)**	**Men (*n* = 58)**	**Total (*n* = 624)**
HIV-positive	130 (51%)	127 (50%)	0	0	257 (41%)
Formal housing	132 (52%)	130 (51%)	18 (31%)	26 (45%)	306 (49%)
Lives with partner	245 (96%)	246 (97%)	43 (74%)	43 (74%)	577 (92%)
Age, years	29 (24–33)	35 (30–40)	25 (22–30)	28.5 (25–33)	31 (26–36)
Years living with partner	5 (2–10)	5 (2–10)	3 (1–8)	3 (1–7)	4 (2–10)
Number of living children	2 (1–3)	2 (1–3)	1 (0–2)	1 (0–2)	2 (1–3)
Completed school years	8 (8–12)	12 (8–12)	12 (8–12)	12 (11–12)	11 (8–12)
CD4 count (cells/μl)[c]	456 (299–634)	342 (238–493)	NA	NA	404 (271–571)
Viral load (log_{10} copies/ml)[c]	4.5 (3.7–5.0)	4.7 (4.0–5.4)	NA	NA	4.6 (3.9–5.3)

IQR, interquartile range; NA, not applicable.

[a] Results are given as *n* (%) or median (IQR).

[b] Equal number of HIV-positive male and female partner couples chosen.

[c] Among those with HIV (*n* = 257)

Table 2

Percentage of individuals with protective measles antibodies and their mean IgG titer, by HIV status and partnership

Cohort	Number	Protective antibodies, *n* (%)	Mean IgG mIU/ml (range)
HIV-1-infected			
Total	257	246 (95.7)	3961 (359–16 756)
HIV-1-uninfected			
In HIV-1 discordant partnership	251	248 (98.8)	4587 (379–15 177)
In HIV concordant negative partnership	116	105 (90.5)	3471 (367–11 772)
Total	367	353 (96.2)	4255 (367–15 177)
Overall total	624	599 (96.0)	4134 (359–16 756)

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