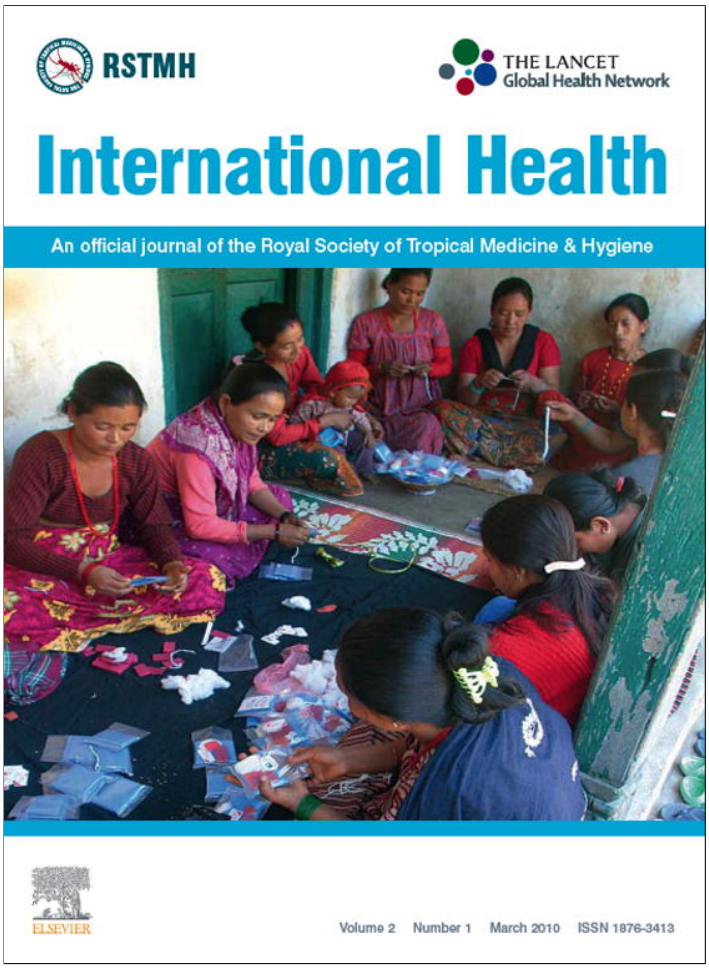

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Reactive vaccination as an effective tool for measles outbreak control in measles mortality reduction settings, Democratic Republic of Congo, 2005–2006

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ABSTRACT

New WHO guidelines for measles outbreak response in measles mortality reduction settings now include reactive vaccination for outbreaks. Here we used surveillance data and vaccine coverage surveys following two mass vaccine campaigns in the Democratic Republic of Congo, to show the impact of reactive vaccination on reducing cases during outbreaks.

The number of measles cases reported was collected via the national surveillance system. Following vaccination campaigns, two-stage cluster sampling surveys were used to evaluate pre and post campaign coverage.

In Matadi, 1035 cases were reported from 24 October 2005 to 19 February 2006 and in Mbuji Mayi, 4734 cases were reported from 3 October 2005 to 30 April 2006. Following the mass vaccination campaign, coverage rose from 87.5% (95% CI 87.2–87.8) to 97.1% (95% CI 96.9–97.3) in Matadi and from 74.0% (95% CI 70.9–77.0) to 96.5% (95% CI: 95.7–97.2) in Mbuji Mayi. Weekly reported cases reduced respectively by 89.3% and 68.9% in the 3 weeks following the mass vaccination campaigns.

The introduction of reactive vaccination for measles outbreak control provides an additional tool to help reduce the impact of outbreaks. Our experience shows that this type of intervention is feasible and effective even when baseline vaccination coverage is > 70%.

1. Introduction

The Democratic Republic of Congo (DRC) is a vast country with 65 million inhabitants. It has poor transport infrastructure, with running water and electricity only partially available in urban centres. These difficulties, linked with limited human resources, make ensuring high routine vaccination coverage (VC) challenging and measles outbreaks are regularly reported.

Measles cases in DRC are reported to the Ministry of Health (MoH) through a national surveillance network of health structures. At the end of October 2005, the number of reported measles cases began to rise in the western town of Matadi (population 204 000, MoH 2005). The last outbreak in this area occurred in 2002–2003 with over 1000 cases reported during six months. No supplementary wide-age range (age 6 months to 15 years) mass vaccination campaigns (MVC) had been carried out in recent years. As cases

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continued to rise, Médecins Sans Frontières (MSF), a non-governmental organization, in partnership with the MoH, implemented a MVC for children aged 6 months to 15 years during the first week of January 2006. This campaign was conducted as part of control efforts, which included reinforcing surveillance and providing treatment for measles patients free of charge.

When a simultaneous outbreak erupted in the central Congolese city of Mbuji Mayi (population 2.3 million), the MoH and MSF provided the same package of surveillance, free access to treatment and a MVC in an effort to control the outbreak. This time only children aged 6 months to 5 years were targeted during the MVC as a supplementary wide-age range campaign had been carried out in Mbuji Mayi in December 2002 (reported coverage 96.4%), and for logistic reasons. Both outbreaks were confirmed by laboratory testing carried out under the supervision of the WHO in DRC.

The primary objective of the MVCs was to control the outbreak and reduce measles morbidity. We present surveillance data and the results of VC surveys conducted after the MVCs to document whether they were effective control measures in reducing measles cases.

2. Methods

In Matadi, surveillance data was collected from 1 June (Week 22), 2005 to 19 February (Week 7) 2006 from the registers of all 39 outpatient public health structures. In Mbuji Mayi, surveillance data was collected from 19 September (Week 38) 2005 to 30 April (Week 17) 2006 from 137 of the 411 outpatient health structures. These 137 centres were the most visited, and had received 70% of all measles cases reported to the end of February 2006. Data was collected for patients resident in Matadi and Mbuji Mayi, the target areas for the MVCs. Inpatient data was not included to avoid double-counting, as inpatients must be referred from an outpatient structure. We used the MoH case definition of suspected measles: any person with fever and maculopapular rash and cough, coryza or conjunctivitis. Data presented is for children aged 0 to 14 years.

In Matadi, 25 vaccination sites were used and the MVC carried out over four days. In the larger city of Mbuji Mayi, the MVC was carried out sequentially in three predefined geographic areas, using over 100 vaccination sites. Social mobilisation to promote the MVCs was conducted prior to vaccination in both sites. The campaigns were conducted according to MSF standard organisation of vaccination sites.[1]

The VC in both cities was evaluated using two-stage cluster sampling surveys.[2] Population lists of administrative sub-units were used to select clusters proportional to population size. A sample size of 24 children in each of 30 clusters was calculated for a precision of ±2.5% based on 65% coverage.[2] Households were selected using the spin-the-pen method described previously.[3]

After providing oral informed consent, information was collected from the head of household on age, gender, measles vaccination status pre and post campaign, and reason for non-vaccination if applicable for children in the target group. If no vaccination card was presented, the interviewers asked where the child was vaccinated. In DRC, measles vaccine is the only vaccine administered in the left arm. Data on the number of times a child was vaccinated for measles was also recorded.

Data was entered into EpiData (Odense, Denmark) and analysed in Stata 9.0 (College Station, Texas, USA). Following data entry, one child per household was selected at random for inclusion in the analysis. Authorization was obtained for these surveys from the Ministry of Health.

3. Results

Between Week 43 2005 and Week 6 2006, 1035 cases of measles were reported in Matadi, an overall attack rate (AR) of 0.5%. The AR was 2.1% in children under five and 0.4% in children from 5 to 14 years. The peak of 159 cases was recorded in Week 1 2006, the week of the MVC, during which 104 839 children aged between 6 months and 15 years were vaccinated. There was a slight decrease to 135 cases (15.1%) during the two following weeks and then a sharp decrease to 17 cases in Week 4; a reduction of 89.3% from the week of the MVC (Figure 1).

The VC survey was carried out during Week 4 2006. Prior to the MVC, the estimated coverage was 32.6% (95% CI 31.9–33.4) by card or 87.5% (87.2–87.8) by card or oral history. Following the MVC, the VC increased to 79.8% (79.3–80.4) by card or 97.1% (96.9–97.3) by card or oral history. Of the 579 children aged 12 to 59 months included in the survey who reported, by card or oral history, to be vaccinated during the MVC, 8.5% received their first dose ($n = 49$) and 89.5% received a second dose ($n = 518$) during the MVC. Prior vaccination status was unknown for 2.1% ($n = 12$).

In Mbuji Mayi, from Week 40 2005 to Week 17 2006, 4734 cases of measles were reported, an overall AR of 0.3%. The AR was 1.4% in children under 5 and 0.02% in children 5 to 14 years. A peak of 640 cases was reported in Week 11, the week the MVC began. In total 359 318 children between 6 and 59 months were vaccinated in 11 days. The number of cases decreased slightly to 540 (15.6%) the following 2 weeks and then decreased sharply to 199 cases in Week 14; a total decrease of 68.9% from the week of the MVC (Figure 2).

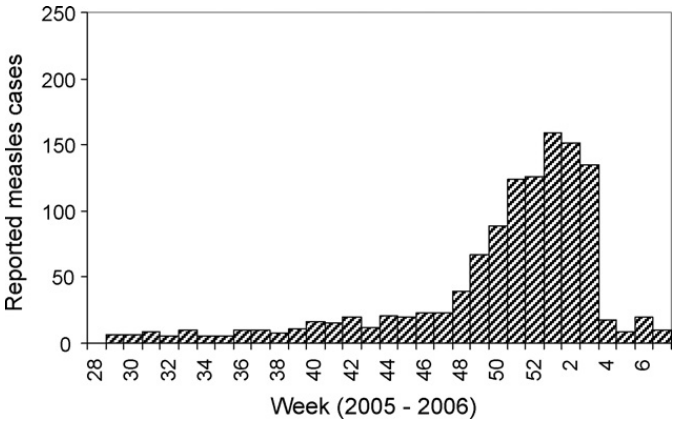

Figure 1. Reported measles cases Week 28 2005 – Week 7 2006, Matadi, Democratic Republic of Congo. The mass vaccination campaign was carried out in Week 1, 2006.

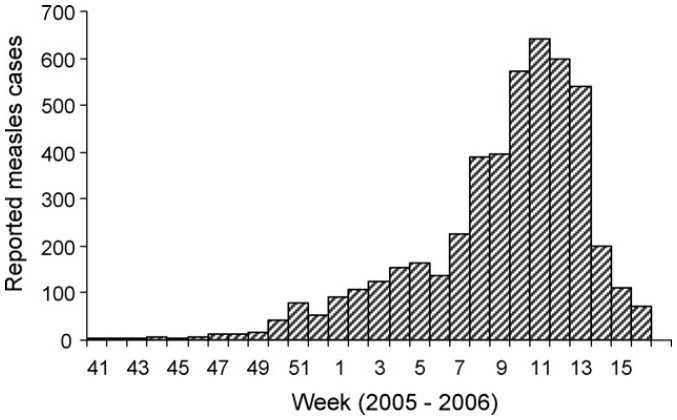

Figure 2. Reported measles cases Week 41 2005–Week 16 2006, Mbuji Mayi, Democratic Republic of Congo. The mass vaccination campaign was carried out in Weeks 11 and 12.

The VC survey was carried out during Week 14 2008. Prior to the campaign, the estimated coverage for measles for Mbuji Mayi was 17.4% (13.2–21.5) by card or 74.0% (70.9–77.0) by card or oral history. Following the campaign, the coverage increased to 65.5% (61.9–69.0) by card or 96.5% (95.7–97.2) by card or oral history. Of the 2005 children aged 12 to 59 months included in the survey who reported to be vaccinated during the campaign, 31.2% reported receiving their first dose ($n = 625$) and 60.0% ($n = 1202$) their second dose of vaccine. The remaining 8.2% ($n = 165$) reported receiving a third dose during the MVC. Prior vaccination status was unknown for 0.6% ($n = 13$).

4. Discussion

As recommended in new WHO guidelines for outbreak control in measles mortality reduction settings,[4] non-selective MVCs were used effectively as a part of the outbreak control strategy in the two outbreaks described here. Routine vaccination against measles is available in DRC, but our survey results show that the coverage was insufficient to prevent these outbreaks.

The surveillance data in both cities suggests that the reactive campaign had a positive impact on the outbreak curve. The number of cases decreased by 89% and 69% in Matadi and Mbuji Mayi respectively, three weeks after the mass vaccination campaign. This delay is expected as protection is only accorded 7 to 10 days post vaccination; surveillance data is reported on a weekly basis and vaccination will not prevent children infected with measles prior to vaccination from developing the disease. Previous studies have shown the impact of reactive campaigns on an outbreak where the baseline VC was low,[5] our experience shows a positive impact in outbreaks where the baseline VC was >70%. In addition, the surveillance data prior to and following the MVCs were considered representative of the true measles outbreak epidemiology as good public awareness campaigns about the free treatment of measles cases had been carried out early on during each outbreak.

Our results also show the benefits of MVCs in providing opportunities for children to receive their first dose of measles vaccine, but also providing children with the opportunity to receive their second dose as recommended by WHO and UNICEF.[6] An opportunity for a second dose is not currently implemented within the DRC routine vaccination programme.

It is also important to take into consideration the resources necessary to implement this type of campaign during an outbreak. Matadi is a small, contained city, and it was logistically possible to rapidly organize a MVC. In these conditions, it was possible to vaccinate over 100 000 children in 4 days. In contrast, Mbuji Mayi is a larger city and spread over a much wider geographic area. The MVC was resource intensive, with over 100 vaccination sites used to vaccinate approximately 350 000 children in 11 days.

Further, the campaigns were conducted at the time of the apparent peak of cases in both cities. Although the surveillance systems were sufficient to detect the increasing number of cases, logistical concerns meant that the campaigns were delayed (for example, the Christmas holiday). In addition, delays associated with the implementation of large-scale policy changes following modification of WHO international recommendations are to be expected. Had the MVCs been implemented earlier during the outbreaks, their impact would probably have been even greater.

Ultimately, achieving sufficiently high VC to prevent outbreaks through routine vaccination is the best method to prevent measles outbreaks and the resulting childhood mortality. In DRC, large-scale reinforcement of the routine immunization programme in terms of the number of children vaccinated and the routine administration of a second dose would be necessary to achieve this goal. An additional means of preventing outbreaks could be lowering the minimum age of routine measles vaccination, which would protect younger children and slow the accumulation of the vulnerable population. Initial research on this subject is yielding interesting results.[7]

Until this ultimate goal is achieved, our experience shows that reactive vaccination in measles mortality reduction settings like DRC, as recommended in the new WHO guideline,[4] is an effective way to reduce the scope and duration of measles outbreaks. The reactive campaigns were effective even in settings where baseline coverage is estimated at >70%. In all settings, good surveillance is essential to detect an outbreak and plan appropriate action. The feasibility of such an intervention will depend on resources available and in some settings, outside resources may be necessary to support this type of activity.

Authors' contribution: KPA and RFG participated in the conception and design of the study, interpretation of data, drafting the paper and revising it critically for substantial intellectual content; LAK participated in the design of the study and interpretation of data, and revising the paper critically for substantial intellectual content. MEB and BKI participated in the conception of the study and revised the paper critically for substantial intellectual content. All authors have read and approved the final manuscript. KPA is the guarantor of the paper.

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Conflict of interest: The authors declare no conflict of interest.

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