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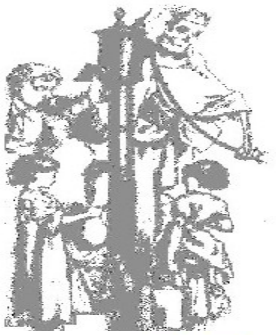

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FEATURE ARTICLE HEATHER GIDDING

Monitoring measles control in Australia: the national serosurveillance program

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Global efforts to control measles

Measles is an acute and highly communicable viral disease usually associated with a fever and rash, but also causing pneumonia and encephalitis. Although it is still a major cause of morbidity and mortality (with an estimated 450,000 deaths world wide in 2004) substantial progress has been made to control measles. This has been done by achieving high coverage with an infant dose of measles vaccine, and providing a second opportunity for vaccination either as a 'catch-up' campaign or as a routine second dose. As a result of these practices, many countries, such as the United States and Finland, have achieved measles elimination and the Western Pacific Region of the World Health Organization, which includes Australia, is committed to measles elimination by 2012.

Measles immunisation programs in Australia

In Australia, measles immunisation was first recommended for infants in 1971 and a two-dose schedule (one dose at 12 months and another at 10-16 years) was introduced in November 1993. However, sub-optimal vaccination coverage and the gap between the age when the first and second doses were given meant that the number of susceptible individuals increased over time making further outbreaks likely. To address this situation, Australia conducted a Measles Control Campaign (MCC) in 1998. The MCC comprised a number of components; the centrepiece was administration of a 'catch up' dose of MMR to all primary school children at the same time as the age for the second dose of measles-mumps-rubella (MMR) vaccine was lowered from 10-16 years to 4-5 years (prior to school entry).

Since the MCC, the incidence of measles has declined to an all time low. However, outbreaks have continued to occur, mostly involving young adults. This cohort of young adults were identified as being at-risk because they are too old to have been recipients of the two-dose MMR vaccination program and too young to have been exposed to wild virus prior to the introduction of measles vaccination programs in Australia. To address this gap in immunity, a young adult MMR immunisation program was funded in 2000-2001 to provide free MMR vaccine to 18 to 30 year olds attending their general practitioner in 2001.

The importance of serosurveillance

Serosurveillance is performed by testing a representative sample of sera from the population for antibodies to diseases, where specific antibody levels are known to be correlated with immunity. Serosurveys are an important component of any comprehensive surveillance system for vaccine preventable diseases, such as measles. They compliment surveillance for vaccination coverage using data from the Australian Childhood Immunisation Register (ACIR) by being able to estimate immunity in older age groups, and due to the cumulative effect of both natural infection and vaccination. Serosurveillance also complements surveillance for the disease itself. Notification data are necessary to detect outbreaks and can provide timely epidemiological profiles on a disease. However, notifications may under-estimate incidence, especially when a proportion of cases are asymptomatic. Notification data may also produce a biased picture if, for example, clinical presentation, and thus the chances of a diagnosis, changes with age. Finally, serosurveillance data are an essential ingredient in mathematical modelling. Models can predict the potential for cases in the future and thus when, and in which age groups, intervention is required to prevent an epidemic. This is particularly important for diseases approaching elimination, such as measles.

Measuring the impact of Australia's control efforts using serosurveillance data

Australia's national serosurveillance program is coordinated by the National Centre for Immunisation Research and Surveillance (NCIRS) and the Centre for Infectious Diseases and Microbiology-Public Health. We have performed two population-based national serosurveys, one in 1996-9 and the other in 2002. In both serosurveys we used sera that had been submitted for diagnostic testing to laboratories throughout Australia and would otherwise have been discarded. Ideally, sera tested in mass serological surveys would be collected from subjects randomly selected to represent the study population. However, such studies are costly and difficult to perform. We have found our results to be comparable to those of a prospective serosurvey designed specifically to evaluate the MCC in Victoria and therefore believe our opportunistic collections are unbiased, at least for respiratory diseases such as measles, mumps and rubella.

The first serosurvey was timed to evaluate the MCC and included sera collected from individuals aged 1 to over 90 years in the two years prior to the MCC as well as a post MCC sample from 1-18 year olds collected between January and May 1999. A comparison of the pre and post MCC results showed that the campaign was spectacularly successful (Figure 1.); immunity in the age group actively vaccinated during the campaign (6-11 year olds) increased from 84 to 94% (p value <0.001). Population immunity was estimated to be 95% and modelling indicated that measles transmission had been interrupted. However, predictions about future measles control using the ACIR and serosurvey data suggested that another catch-up campaign might be needed before 2007 to prevent re-introduction of endemic measles transmission.

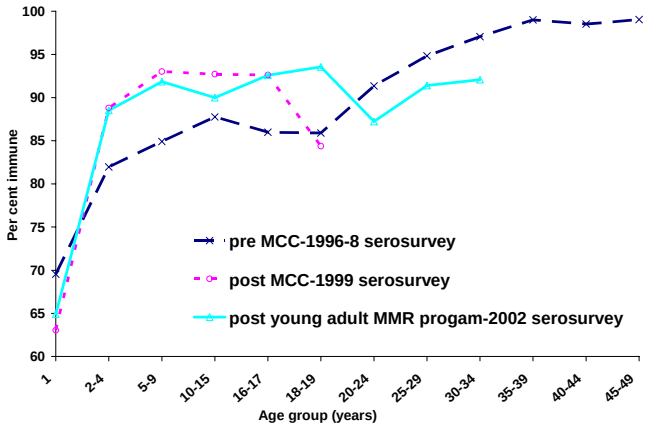
The second serosurvey was timed to evaluate the young adult MMR program and included sera collected in 2002 from people aged 1-34 years. Immunity was lowest in one year olds (65%; Figure 1.) indicating a delay in the uptake of the first MMR dose. A comparison with the first serosurvey showed that immunity in the age group targeted by the young adult MMR program had not improved following the program (Figure 1.). A significant proportion of young adults born in 1968-1982, especially those born in 1978-82 (20-24 years old in 2002), remained susceptible to measles. Despite this, population immunity remained high (94%) and modelling, using the 2002 serosurvey data and updated ACIR estimates, predicts that Australia will remain free of endemic measles transmission at least until 2012. This is because coverage estimates with the two-dose childhood program have improved since the first serosurvey and measles is best controlled by achieving good vaccine uptake in children, who have the highest rates of transmission.

In the longer term however, cohorts with high levels of natural immunity will be replaced by cohorts with suboptimal vaccination coverage and population immunity will decline. Additional strategies are therefore required to improve immunity in young adults. Such strategies include a mass vaccination campaign, programs targeting travellers, or requirements for up-to-date vaccination records for entry to tertiary or further education.

Conclusion

The success of the MCC in Australia has been consolidated by improved coverage with scheduled childhood vaccinations. In the near future Australia is expected to remain free of endemic measles transmission. However, to maintain elimination in the longer term, additional efforts are needed. The young adult MMR program did not have an adequate impact on the targeted age groups. Therefore other strategies should be considered, in conjunction with improving timeliness and coverage of scheduled infant vaccinations.

Figure 1: Percentage of sera positive for measles IgG antibody (immune) by age group and serosurvey



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Prior to joining CIDM Public Health in 2004, Judith received a multi-disciplinary pathology training and then went on to work in two major microbiology departments in England where she gained Fellowship of the Institute of Medical Laboratory Scientists and an MSc by research from the University of Birmingham. Judith's MSc project looked at methods for the prevention of infections in intravascular catheters and resulted in a product that went on to clinical trials.

Since moving to Australia in 1992, she has lectured in microbiology at the University of Western Sydney and has also worked as a communications consultant and freelance writer.

Judith manages the CIDM Public Health education program and web site content, compiles and edits our annual reports and produces regular newsletters and e-zines.

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18 Aug: Vaccine Preventable Diseases Symposium

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