

Measles – a killer disease that can be eliminated but how will we know when we are getting close?

With increased measles immunisation coverage, there has been a dramatic global reduction in childhood deaths and measles cases. The World Health Assembly has endorsed a target of achieving measles elimination in at least five of the six World Health Organisation Regions by 2020. Although interruption of endemic ("native") measles circulation has been achieved in the Americas, global elimination will require very high immunisation coverage everywhere, as measles is the most infectious virus known.

It is essential that all countries carefully monitor their measles epidemiology, as distinctive common patterns are highly predictive of progress towards elimination and identify gaps in coverage. We reviewed some of the most useful epidemiological markers.

But first a warning, the actual number of measles cases occurring may be misleading. While measles is occurring anywhere in the world and international travel thrives, the integrity of most countries' population measles immunity will be regularly tested when non-vaccinated residents return from countries with circulating measles or infectious visitors arrive from these countries. So having a few local cases that are related to an importation is to be expected. However, if there are ongoing generations of cases that persist for more than 12 months, then it is clear that elimination has not been achieved.

Careful detective work is necessary to determine who infected a new case. This sleuthing is considered adequate if the likely source of 80% of cases can be identified. Being able to determine the source reflects the thoroughness and timeliness of epidemiological investigation. Where a large proportion of cases are of "unknown" origin it is challenging to argue that ongoing local spread is not occurring. All "unknown" source cases need to be carefully analysed by time and space at local level in an attempt to rule out ongoing chains of transmission.

The population patterns of measles occurrence provide excellent evidence of approaching elimination. Where measles is uncontrolled there are large measles epidemics every 1 to 4 years and there is a definite seasonal pattern of disease. As higher immunity is achieved across the population, the duration and size of epidemics decreases, the time between epidemics increases, and seasonality of epidemics is lost.

Measles is incredibly infectious, so it finds immunity gaps in the community. So measles is a sensitive "canary in the coalmine" detecting deficiencies in vaccination coverage and pockets of non-immune people.

Every measles outbreak should be studied because the demographic characteristics of those affected, including their location, age group, social, cultural, religious and ethnic features may

reveal groups in the broader community that are vulnerable to measles because of inadequate immunity. This can help health services target special immunisation efforts and community engagement initiatives.

The collective wisdom gained from understanding the distribution of outbreak sizes and duration provides an estimate of the effective reproduction number (the average number of secondary cases that result from an infectious case in a particular population). As elimination is approached this number should remain less than one and this is reflected in most outbreaks being very small in size (single digit cases) and generally very few generations of spread.

Measles' infectiousness and distinctive clinical picture result in predictable epidemiological patterns as elimination is approached. Careful analysis of: size and duration of outbreaks; timing and geography of "unknown source" cases; seasonality and age-distribution of cases; and effective reproduction rate provide a good indication of progress or achievement of elimination.

Prof. David Durrheim

*School of Public Health and Medicine University of Newcastle
Australia*

Publication

[Measles - The epidemiology of elimination.](#)

Durrheim DN, Crowcroft NS, Strebel PM.

Vaccine. 2014 Dec 5