

Dry season brings on measles in sub-Saharan Africa

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Measles epidemics in Niger fluctuate wildly from one season to another but the timing of the outbreaks always coincides with the end of the annual rainy season, according to an international team of researchers.

The erratic nature of the outbreaks, they add, underlies the need for greater surveillance to detect potential epidemics and a quicker vaccination response to control the disease.

"What you really need to do is to step up monitoring early in the measles season," said Matthew Ferrari, research associate at Penn State's Center for Infectious Disease Dynamics and lead author of the study. "Then, if you see a trend towards an early epidemic, you can rapidly switch your resources towards staving off the epidemic before it gets out of control."

Although vaccination has largely brought measles under control in many parts of the world, the disease remains a major killer in much of sub-Saharan Africa and Southeast Asia.

"The mortality rate from measles, which usually runs its course without being fatal in industrialized countries, is very high in a lot of these developing countries," said Nita Bharti, co-author and graduate student at Penn State. "Some of these kids are already suffering from malnutrition, lack of medical attention, and an immune system suppressed from other infections such as HIV."

The key to protecting all kids from an outbreak, the researchers say, is to

vaccinate at least 95 percent of the children with two doses of the measles vaccine. A single dose of vaccine only provides an 80 percent protection from infection.

"So if you vaccinate all the kids with just one dose, the effective protection is 80 percent, not 95 percent, even though you have vaccinated every single child," added Ferrari, whose findings appear in today's *Nature*. "The gap between 80 percent protection with one dose and the 99 percent protection with two doses is the crux of the problem."

Unlike pre-vaccination measles outbreaks in North America and Europe, which show persistent and regular cycles of infection, epidemics in Niger have been highly erratic over the last 30 years.

Ferrari and his colleagues used data, collected by Medecins Sans Frontieres and the Niger Ministry of Public Health, on monthly infections in Niamey – Niger's capital – over a 17-year period from 1986 to 2004 to understand the seasonal dynamics of the disease.

They found a strong seasonal fluctuation of the measles transmission rate in Niamey: fourfold greater than the seasonal fluctuation previously estimated for London.

Outbreaks in Niamey also tend to be severe. Infections spike and tail off rapidly, as the disease declines with the onset of the rainy season. Infections rise at the start of the dry season in November and fall with the onset of rain in March.

"What appears to be happening is that just after an epidemic, there are very few infections around and measles tends to go locally extinct," explained Ferrari. "When that happens, you have more and more kids being born without being exposed to measles. It is like building up fuel for an epidemic, in terms of unvaccinated kids."

Then when measles is reintroduced into that area, it results in a large epidemic.

"The seasonal dynamics change from year to year and sometimes you get a year that randomly skips for measles," said Ferrari. "The following year you have added that much more fuel to the fire and that is what creates this erratic fluctuation in the size of outbreaks."

Researchers are still not fully sure why infections tend to drop at the start of the rainy season and pick up in the dry season, but Ferrari suspects that changes in population density during Niger's dry and rainy seasons might be playing a role.

Cities in Niger tend to swell in population during the dry season, as there is no agriculture. When the rains start, people move back to the less-dense surrounding areas for agriculture.

Bharti says the findings offer a cautionary lesson against making assumptions that diseases always follow a predictable pattern. "Just because we understand how measles was tackled in England and Wales with a specific immunization plan does not mean the problem is going to be solved the same way in Niger," she added.

That problem in Niger is further compounded by the country's high birth rate, which at 51 births per 1000 is the highest in the world.

"More births mean you have that many more kids that you need to get vaccinated," explained Ferrari.

Despite measles' erratic epidemics in Niger, researchers say the strong seasonal nature could help in predicting annual outbreaks, which might help protect susceptible kids from previous years.

"The key really is that you need to get that second opportunity for vaccination. It stops the fire from burning the fuel," Ferrari added.

Source: Penn State

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