NEWS

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Method could cut number of vaccinations by half

Physicists in the US and Israel claim to have come up with a method that reduces the number of vaccinations required to immunize a population by as much as a half.

Vaccines are often limited or expensive and it is therefore important for authorities to make immunization as efficient as possible. One approach is to target individuals who come into contact with the greatest number of people, so that they cannot spread disease quickly.

Now, however, Yiping Chen (http://physics.bu.edu/people/show/ypchen) of Boston University in the US and colleagues have used statistical physics to improve on this strategy. They split a population up into a number of equal-sized clusters that are connected with one another through "separator groups". Individuals within a cluster are only in contact with each other, while people within separator groups are connected to individuals in more than one cluster. By immunizing only those within the separator groups, a new outbreak can be self-contained inside the cluster in which it originated. The idea is to arrange the members of the separator groups so that only a few of them — and vaccines — are required (*Physical Review Letters* (http://prl.aps.org/) in publication).

Real data

Chen and colleagues examined the effectiveness of their "equal-graph partitioning" strategy by plotting the fraction of a population at risk of infection against the number of doses required. They found, using different types of theoretical network, that their strategy required fewer doses than other strategies for any given level of immunization.

For example, compared with targeting well-connected individuals, the new strategy would need between 30% and 50% fewer doses. When compared against more sophisticated "adaptive" targeting, which involves recalculating how connected individuals are after successive vaccinations, they would need between 5% and 10% fewer doses.

Working with Fredrik Liljeros, a sociologist at Stockholm University, Chen's group applied its strategy to data from workplaces in Sweden. They found that in this kind of network, which has been shown to be important in the transmission of flu, would need 15–30% fewer doses for complete immunization.

The new strategy could even work for immunizing computer networks. Chen's group showed that completely immunizing the Internet would need anti-virus software for only half the number of servers used in alternative strategies.

No waste

Chen believes that the success of his group's approach stems from its more global perspective. He points out that in the case of a highly connected small cluster of individuals and a loosely connected larger cluster, the conventional targeted strategy will first of all immunize people in the small cluster, which means in effect wasting resources on a small fraction of the population. "This will not happen in our algorithm," he says.

Even the most effective immunization strategy depends on good quality data, however. Chen admits that data on social relationships can be hard to come by but he points out that social networking websites, such as Facebook, can help.

About the author

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