Is the basic reproductive number (R_0) for measles viruses observed in recent outbreaks lower than in the pre-vaccination era?

P Plans Rubió (pedro.plans@gencat.net)¹

1. Public Health Agency of Catalonia, Barcelona, Spain

Citation style for this article:

Plans Rubió P. Is the basic reproductive number (R_0) for measles viruses observed in recent outbreaks lower than in the pre-vaccination era?. Euro Surveill. 2012;17(31):pii=20233. Available online: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20233>

Article submitted 26 July 2012 / published on 2 August 2012

To the editor:

In their recent article on the large outbreak of measles in Merseyside, England, Vivancos et al. [1] obtained a basic reproductive number R_0 of 1.2 in week 3 after the start of the outbreak. This result could suggest that measles viruses are less infectious in recent outbreaks than in the pre-vaccination era, when the basic reproductive number R_0 ranged from 11 to 18 [2]. The basic reproductive number obtained in the study is however the effective basic reproductive number.

The basic reproductive number R_0 is the average number of individuals directly infected by one infectious case (secondary cases) during the entire infectious period, when the infectious agent has entered a totally susceptible population [3]. The effective basic reproductive number R , on the other hand, is the reproductive number observed when of a part of the population is immunised (I) [3]. In this situation, the reproductive number decreases from R_0 to $R=R_0-R_0I$ [3]. Outbreaks can be interrupted when $R=1$.

The basic reproductive number R_0 in the Merseyside outbreak can be determined from $R_0=R/(1-I)$, where I is the prevalence of protected individuals in the population. Assuming that prevalence of protected individuals was at least equal to 81–87% (85–92% vaccination coverage (V) x 95% vaccine effectiveness (VE)) the

value of R_0 necessary to generate the outbreak was 6.2–9.5, only slightly lower than in the pre-vaccination era. The lowest value is obtained taking into account a vaccination coverage of $V=85\%$ (two doses of measles-mumps-rubella (MMR) vaccine at five years) and vaccine effectiveness of $E=95\%$: $R_0=R/(1-I)=R/(1-VE)=1.2/(1-0.8075)=6.2$. The highest value is obtained taking into account a vaccination coverage of 92% (first dose of MMR at 24 months) and 95% vaccine effectiveness: $R_0=1.2/(1-0.874)=9.5$.

Measles is one of the most contagious infectious diseases, and outbreaks can only be prevented by means of achieving a high vaccination coverage. For a $R_0=11$ –18, the vaccination coverage required to prevent measles outbreaks is 96–99% [3].

References

1. Vivancos R, Keenan A, Farmer S, Atkinson J, Coffey E, Dardamissis E et al. An ongoing large outbreak of measles in Merseyside, England, January to June 2012. Eurosurveillance, Volume 17, Issue 29, 19 July 2012. Available from: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20226>
2. Anderson RM, May RM. Infectious diseases in humans. Dynamics and control. Oxford: Oxford University Press; 1992.
3. Plans-Rubió P. Evaluation of the establishment of herd immunity in the population by means of serological surveys and vaccination coverage. Hum Vaccin Immunother 2012;8(2):184–8.