

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

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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

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