Reviewer's report

Title: Combining serological and contact data to derive target immunity levels for achieving and maintaining measles elimination

Version: 0 Date: 18 May 2019

Reviewer: William Moss

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The authors use serological and contact data, largely from European countries, to derive contact-adjusted, age-specific immunity thresholds for measles elimination. The authors build on prior work showing that mathematical models of measles virus transmission are improved when age-specific contact patterns are incorporated rather than the simplifying assumption of homogenous mixing. Important public health findings include the importance of increasing measles immunity among children 5-9 years of age to increase contact-adjusted immunity, because of their high contact patterns in school, as well as the increased risk of measles outbreaks with lowered immunity in older children, adolescents and young adults.

Major comments

1. Is there any supporting evidence to the claim that the age-specific immunity thresholds developed in the late 1990s for Europe are "widely applied within and occasionally outside Europe" (page 2, line 22)? I wonder if the authors have set up a false "straw man" and that these immunity thresholds are not as widely used as claimed. They are not included in the WHO position paper on measles vaccines. Are there countries that explicitly aim to have only at least 85% immunity to measles virus among children 1-4 years of age?

2. It is unclear to me why the authors thought it reasonable to predict the probability measles outbreaks for a 10-year period based on seroprevalence data without accounting for changes in age-specific population immunity following changes in vaccination coverage, conduct of vaccination campaigns, or wild-type measles virus transmission over that period? This is obliquely addressed in the discussion section for countries where the model predictions were inconsistent with the data but could be explicitly addressed earlier in the manuscript.

3. I think the authors should more clearly differentiate population immunity and vaccination coverage for the general reader. For example, the second paragraph of the background (page 2, lines 8-14) moves between descriptions of population immunity and references to vaccine coverage, without explicitly stating the levels of vaccine coverage that would be necessary to achieve these levels of population immunity.
4. Another complicating factor, not included in these models, is the impact of spatial clustering on the critical vaccination threshold.

Minor comments

1. I suggest the authors use "measles virus" rather than "measles" when referring to what is transmitted, e.g. line 16 in the abstract.

2. I suggest the results section of the abstract include reference to the findings in 5-9 year old children. This is mentioned in the abstract conclusions but not in the results.

3. Page 2, line 3: measles vaccine was introduced in the early 1960s, e.g. in 1963 in the United States.

4. Page 3, line 3: suggest deleting "around" and changing to "countries in the late 1990s and early 2000s"

5. Page 3, line 35: I think it would be helpful to the general reader, who is familiar with the common definition of the basic reproduction number, to briefly explain the definition used in this paper, which may be quite unfamiliar ("spectral radius (or largest eigenvalue) of the next-generation matrix").

6. Page 7, line 2: suggest "correlation, but scaling..." or change the comma to a semi-colon

7. Page 7, line 7: delete "was"

8. Page 7, line 12: specify the direction of change
Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.

Yes

Does the work include the necessary controls?
If not, please specify which controls are required in your comments to the authors.

Not applicable

Are the conclusions drawn adequately supported by the data shown?
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