Reviewer’s report

Title: The introduction of "No jab, No school" policy and the refinement of measles immunisation strategies in high-income countries

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Reviewer: Felicity Cutts

Reviewer's report:

This is a potentially very interesting paper that builds on previous work conducted by this group. At present, however, the conclusions are not relevant to Ethiopia and Kenya because current vaccination programs are not adequately captured in the models and the assumptions about how additional strategies would be implemented are not necessarily appropriate. Either the authors need to conduct extensive re-analyses incorporating the effect of past and planned campaigns (SIAs) in Kenya and Ethiopia as well as removing the restriction that the 2nd routine dose only reaches those already vaccinated in those countries, or else they should drop these two countries from their analyses. If they focus on the other countries that rarely do SIAs and have almost universal school enrolment then their assumptions may be more appropriate and the paper would be clearer.

The first paragraph talks about some components of measles elimination strategies but ignores one of the main strategies used in low income countries including Kenya and Ethiopia - Supplementary Immunization Activities (SIAs) or campaigns. As the authors know from their previous paper (Trentini et al 2017), there have been multiple national and subnational campaigns in both these countries covering varying age ranges (see spreadsheet of SIAs on http://www.who.int/immunization/monitoring_surveillance/data/en/). For example, SIAs were conducted among varying age groups in Ethiopia in 2013, 2015, 2016 and 2017; while Kenya conducted a catch-up measles-rubella campaign up to age 15 years in 2016 with high coverage (see Subaiya et al 2018) and then introduced rubella vaccine into the routine schedule. Ethiopia has not yet introduced rubella vaccine but when it does in the next few years, a wide age range campaign up to age 15 years will be done (see WHO rubella vaccine position paper).

The conduct of wide age range SIAs will have a big effect on any potential benefit of school-entry vaccination hence needs to be taken into account in this paper. Conduct of SIAs should be part of the base-case vaccination scenario in Kenya and Ethiopia. For example, in addition to taking account of recent SIAs done in both countries, the authors should be aware of existing plans for follow-up SIAs in both countries in 2019 (see summary of SIAs on http://www.who.int/immunization/monitoring_surveillance/data/en/).

p.5: The authors make several assumptions that can be challenged when considering low income countries. First, they assume that only individuals who have been previously vaccinated with a
first dose are considered eligible for the second dose routine program. This is not necessarily the case, indeed one major factor that made WHO change their recommendation about introduction of a routine 2nd dose was the hope that continuing to offer routine vaccination in the second year of life would increase coverage of both the first and the second doses by extending the period of eligibility for the 1st dose from 9-11 months to 9-23 months. This allows more time for mothers who have difficulty reaching health centres to attend and offers more opportunities for health center contacts to be used to administer measles vaccine. Hence, many children who would have been unvaccinated under the one-dose schedule are expected to receive at least one dose under a two-dose schedule. The extent to which this happens in practice is so far unknown but should be considered in this paper at least under a sensitivity analysis. Second, school entry vaccination in low income countries is unlikely to target only children who have not yet received two doses because of the difficulty in obtaining documented evidence of previous vaccination. If the authors look at DHS data they will see that even in the 2nd year of life, a large proportion of children lack a home-based record even if the mother says that they have been vaccinated. Hence a school-entry program that offers at least one dose of vaccine to all children should be assessed at least as part of a sensitivity analysis, as this may be the only feasible option at present.

Interpretation of results: the authors estimate population immunity in different age groups under different scenarios but all this in the context of low measles transmission which is not currently the case in Ethiopia. The length of time that a child remains susceptible to measles and at risk of infection should be considered when comparing different strategies for offering a 2nd dose. Furthermore, the assumptions from the authors that in effect, school entry vaccination will reach children who missed the routine first dose whereas vaccination in the 2nd year of life can only reach children who already received the routine first dose in the first year of life, automatically gives school entry vaccination an advantage. It is not clear that in reality this advantage would hold, especially given low school enrolment rates in some areas and population groups and the difficulty in enforcing any school vaccination laws.

Minor comments:

Line 14: Reported measles cases worldwide were about 140,000: please correct to 173330 (http://www.who.int/immunization/monitoring_surveillance/data/en/).

Note that this is less than 2% of estimated cases occurring worldwide. For example in 2016 there were an estimated 6,976,800 (95% CI: 4,190,500-28,657,300) cases globally while only 132,137 cases were reported to WHO (see Dabbagh et al 2017).

Lines 16-17: European cases accounted for one sixth of total cases - again, this is reported cases, it is clearly not reality. I would rephrase this and say that reported incidence was among the
highest in Italy and Romania although reporting rates are likely to be much higher in European countries than in low income countries where access to care is much lower.

p.4 Line 41: I think the authors mean following the indications of the World Health Organization, not the World Health Assembly. They should reference the WHO Measles Position Paper (2017).

Reference 6: this weblink does not work.

Page 6 line 54: please clarify whether coverage for both doses in the routine programs in these countries needs to be at least 95%.

Page 7: the results for Kenya and Ethiopia need to take account of SIAs. SIAs have, since 2000, provided a second opportunity and for many children, a 2nd dose of measles vaccine. In Ethiopia, so many SIAs have been conducted that many children will have received more than 2 lifetime doses.

Page 7 line 35: a catch-up campaign targeting ages 1-15 years is not only targeting school-age children.

Page 7 lines 56-60 and page 8: please clarify under what assumption of coverage of the first routine dose and of the dose at school entry the cited susceptibility levels are estimated to be achieved in Kenya and Ethiopia.

Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.

No

Does the work include the necessary controls?
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Not applicable

Are the conclusions drawn adequately supported by the data shown?
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