Reviewer's report:

This manuscript covers an important topic for global polio eradication (risks of cVDPV emergence under different scenarios with bOPV cessation). The introduction and discussion are well written, and the authors have extensive experience with modeling. The main conclusion, that global bOPV cessation should be synchronized, is not surprising but is important to emphasize. The following critiques are from the viewpoint of a doctor who is well-versed in the issues surrounding polio eradication, but who has limited experience with modeling. If the intended readers are those who are experienced with modeling, then some of these critiques can be disregarded.- I found the methods and results sections very difficult to read overall. I had to reread many sentences several times to understand the meaning. Likewise, I had to spend a lot of time examining the tables and figures to understand what information they were meant to convey. I cut and pasted several paragraphs from the results section into an online readability calculator, and the Flesch Reading Ease score was 23%. Consequently, I don't think this issue of finding these sections difficult to read will be unique to me.- I am having a hard time wrapping my head around some of the details from analysis 1 in figures 1-3. I understand that the Rn has to do with both the Ro for that serotype at that particular reversion stage, as well as the immunity of the population as a whole (which will go down with time). However, the text states that even subpopulations with high immunity will experience ongoing transmission of partially revertant serotype 2 strains up to stage 8, and partially revertant serotype 1 and 3 strains up to stage 5 or 6. If that's true, then how can the analysis be divided into Figure 1, Figure 2, and Figure 3? Will there ever be a situation where only stage 0 OPV virus is introduced? If Analysis 1 is supposed to represent the situation with failure to synchronize bOPV cessation, then most likely the continued OPV use is happening in an entire community for a continuous period (ie a country that continues to do routine immunizations with bOPV). If that community is adjacent to a community that has undergone bOPV cessation, then there will likely be multiple stages of OPV present that could be transmitted. I think it might be helpful to give practical examples of how the situations in Figures 1, 2, and 3 might occur.- Table 1 needs units for the average time.- Table 2 took me a long time to figure out. I'm assuming that the numbers in the right side of the chart are the number of yearly bOPV SIAs that were used in the model for the different scenarios (high, medium, or low population immunity). If this is a correct assumption, it should be more clearly stated in the text, title, and legend. If this is an incorrect assumption, the table needs to be redone.- I had a lot of difficulty with Figure 4. First of all, if the legend is correct, there is more of a risk of type 3 continuous transmission and cVDPV emergence with a high immunity scenario versus a low immunity scenario, which makes no sense. Secondly, the text describing Figure 4 states the following: "However, the low population immunity maintenance scenario involves the emergence of an indigenous serotype 1 cVDPV in one of the subpopulations after bOPV cessation. Although the
resulting response subsequently lowers the Rn values for the "Highest" (red) curve in Figure 4c, this scenario implies a programmatic failure. For serotype 3, no cVDPV occurs even with a large reduction in bOPV SIAs, and therefore none of the Rn curves include a decrease due to an outbreak." However, the curves for 4c, 4b, and 4a all look very similar, and actually have similar ups and downs as 4f, 4e, and 4d. So I can't see in the figure what the authors describe in the text. It would be helpful if this could be pointed out in the figure (maybe an arrow to the time point when the cVDPV emerged?).-It is unclear why the authors did not use updated dates for bOPV cessation for Analyses I and II. Wouldn't these analyses be more accurate with the currently predicted bOPV cessation date?-I am also not sure why Analyses III and IV assumed constant levels of unapproved use of bOPV over time. Logically, wouldn't the bOPV stocks run out if global cessation has been decided on? I'm assuming that vaccine manufacturers would stop making bOPV after the cessation date, since mOPV would likely be used to control cVDPV outbreaks. Was this assumption made because the models are only looking at several years past the cessation date?

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

Unable to assess

Does the work include the necessary controls?
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Yes

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