The effect of small and unvaccinated subpopulations on polio elimination

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Polio eradication efforts have reduced the regions of endemic circulation down to Pakistan, Afghanistan, and Nigeria. One of the challenges involved in eliminating polio in these regions is that political conflict has the potential to form isolated subpopulations, making vaccination and reporting of symptomatic cases (surveillance) challenging. Additionally, polio can circulate without detection in a population because few infections are symptomatic and those that have already had a poliovirus infection are asymptomatic during subsequent infections. Asymptomatic transmission coupled with poor surveillance can make it difficult to determine when the virus has gone extinct in a population. We use a discrete-individual stochastic counting process model of polio to access the impact that small and unvaccinated subpopulations may have as countries move towards elimination. We consider their effect in the context of a well-mixed population as well as within a metapopulation framework.