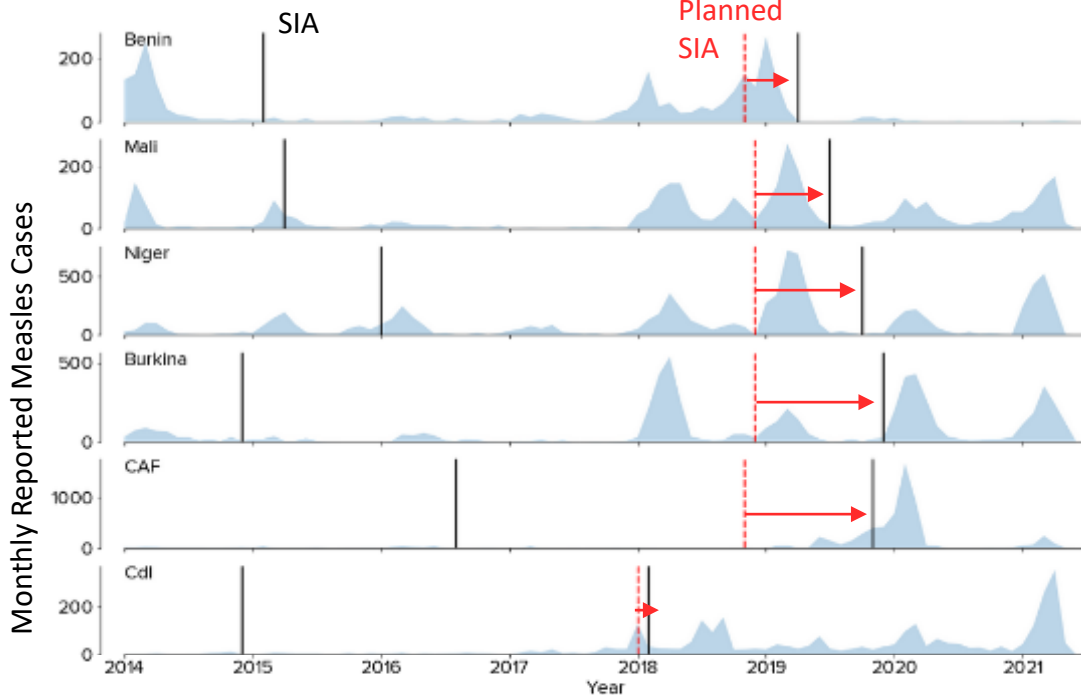


Optimal timing regularly outperforms higher coverage in prophylactic measles SIAs

Katherine Rosenfeld*, Kurt Frey, Niket Thakkar, and Kevin McCarthy
Institute for Disease Modeling (IDM)
IDM Symposium

Effectiveness of measles SIAs is a delicate balance of timing and efficacy



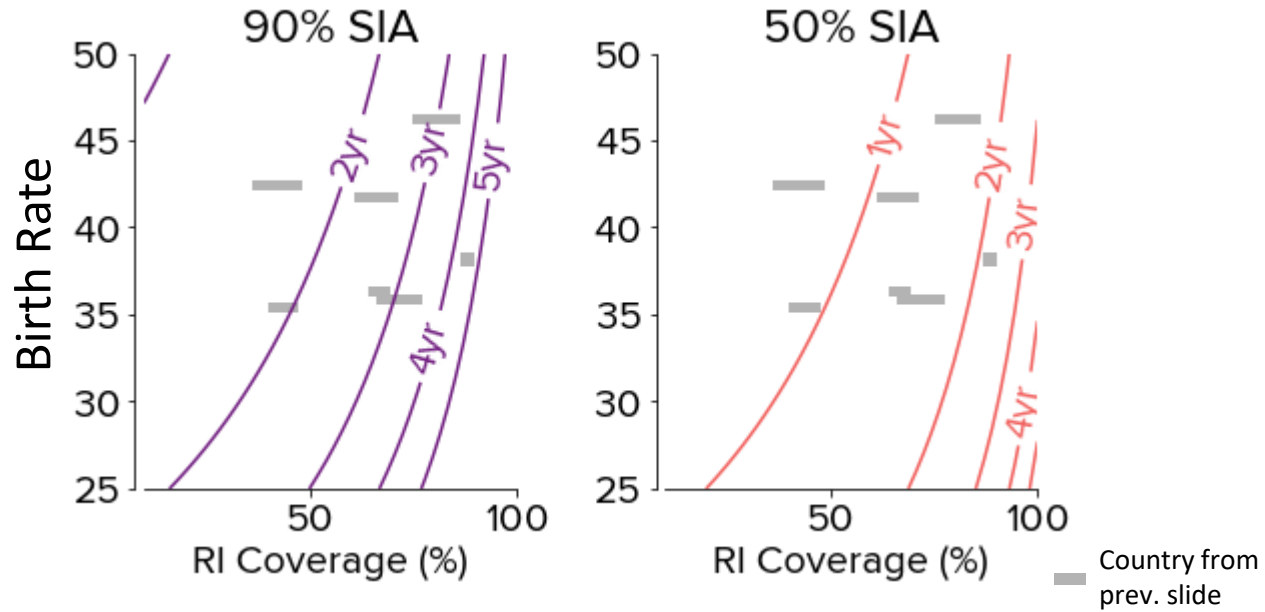
Delays to SIA campaigns can incur serious measles outbreaks. In the past 10 years there have been at least 6 examples of AFR outbreaks occurring during this “inter-SIA” period due to delays.

How can we quantify the relative gains of a less effective SIA implemented “on-time”?

SIA cadence and coverage expectations

Previous modeling suggests high coverage SIAs (90%) are necessary for countries to delay the next outbreak by at least 3 years.

SIA cadence affected by birth rate and RI



Adapted from Verguet et al. (2015)

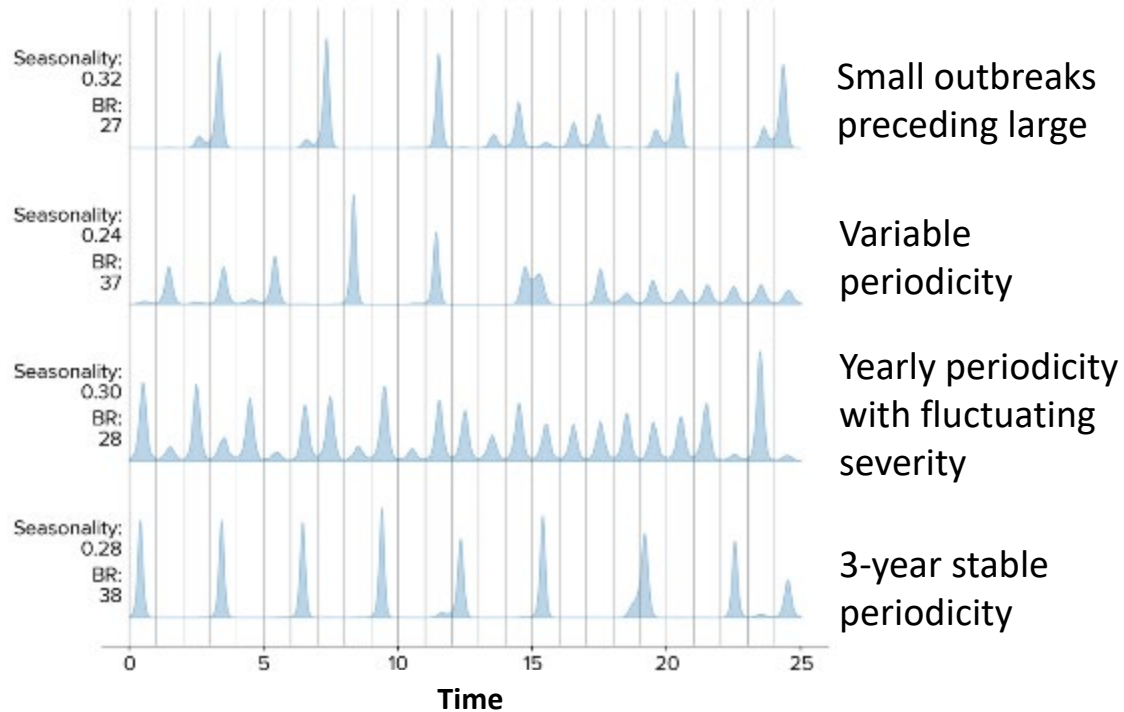
Stochastic simulations exhibit a diversity of outbreak behaviors

Seasonality and births introduce periodic outbreak behavior, **but without SIAs** the periodicity is difficult to predict.

Baseline EMOD Simulation	
Population Size	1 million*
Age pyramid	Nigeria
Maternal immunity	Yes
Importation	Yes*
Birth rate	25 – 40 / 1k pop
Seasonality factor	0 – 0.5
Routine immunization	30%, 70%

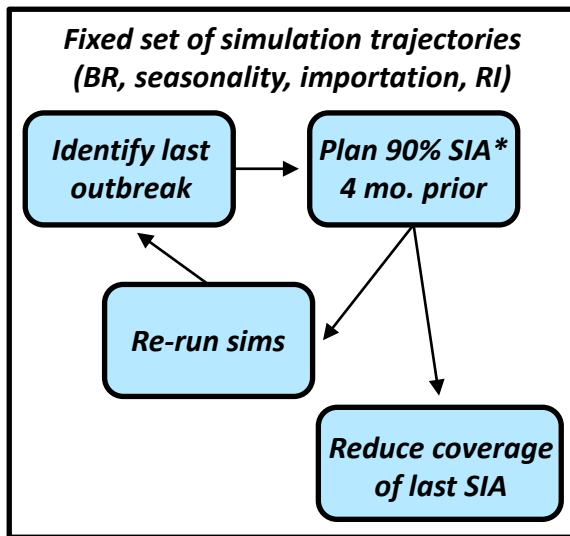
*considered in sensitivity analysis

Sample traces of infected individuals



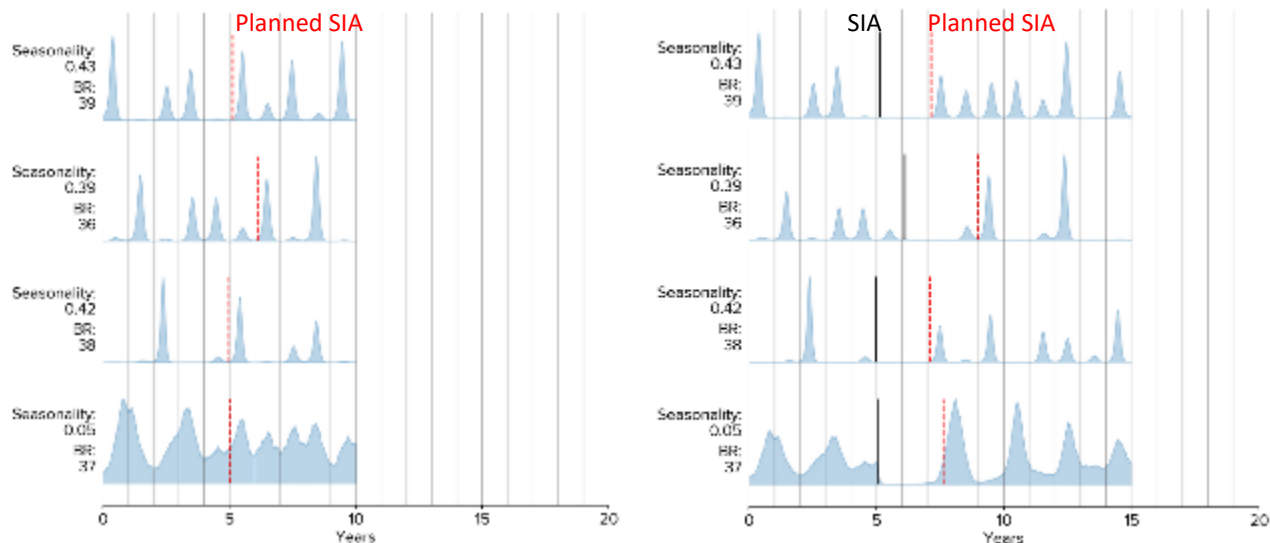
Planned SIAs stabilize periodicity

Iterative SIA schedule generator



*SIA doses go first to children who received a dose from RI

Example traces of with planned SIAs



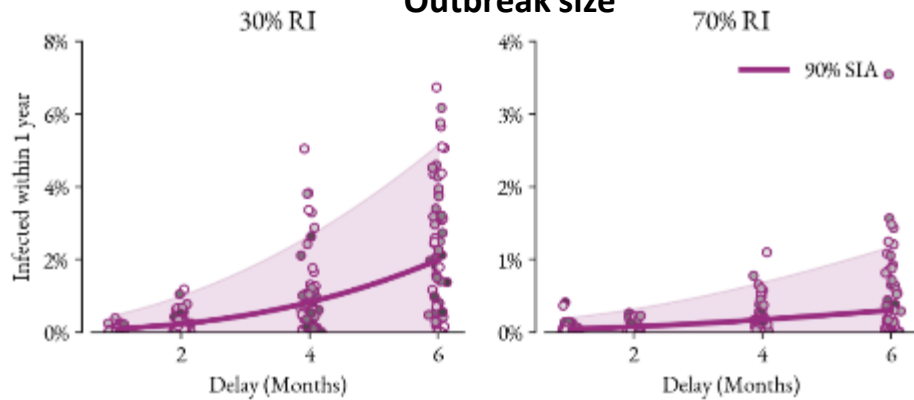
Identification of upcoming outbreak and retroactively plan SIA



SIA conducted, identify next outbreak and plan SIA

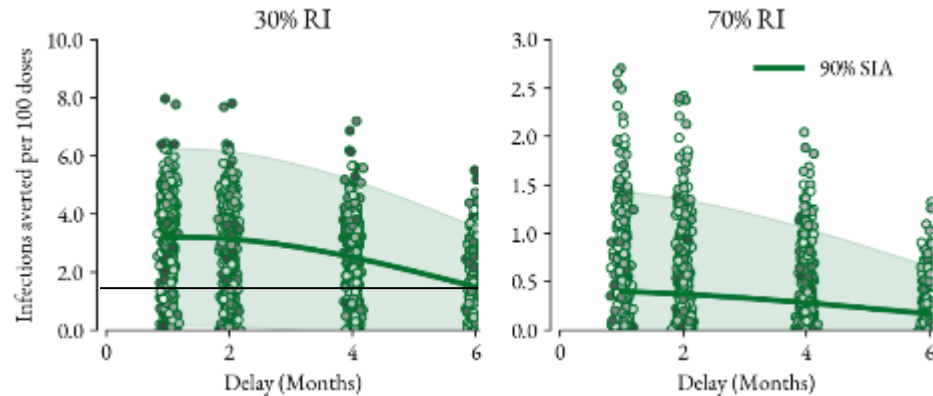
Delay results for fixed SIA coverage

Outbreak size

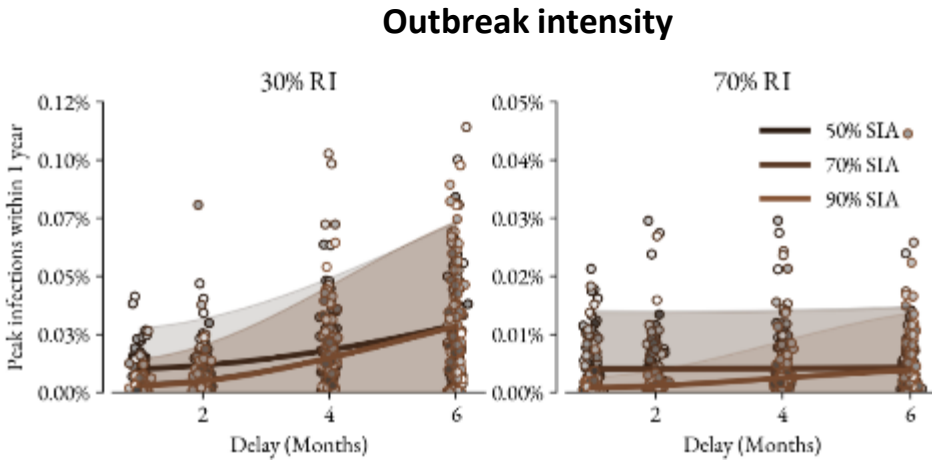
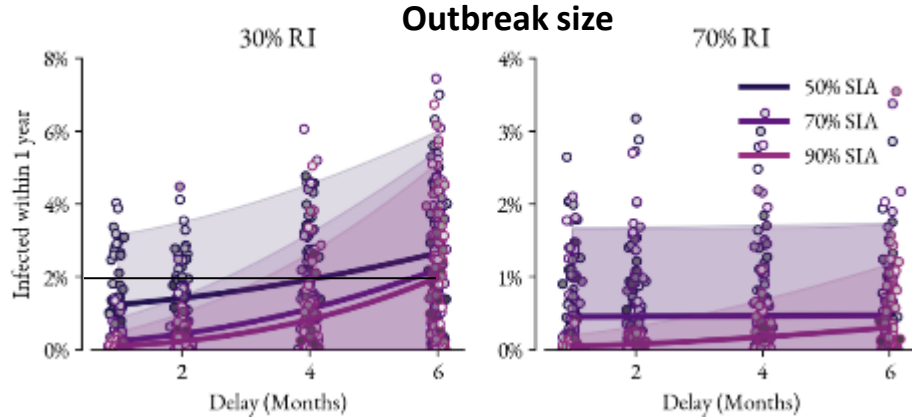


- Outbreak sizes are large with short (6 month) delays, between 1 to 4% depending on RI
- Delays also decrease a campaign's cost-benefit ratio, reducing the number of infections averted per dose

Campaign cost effectiveness



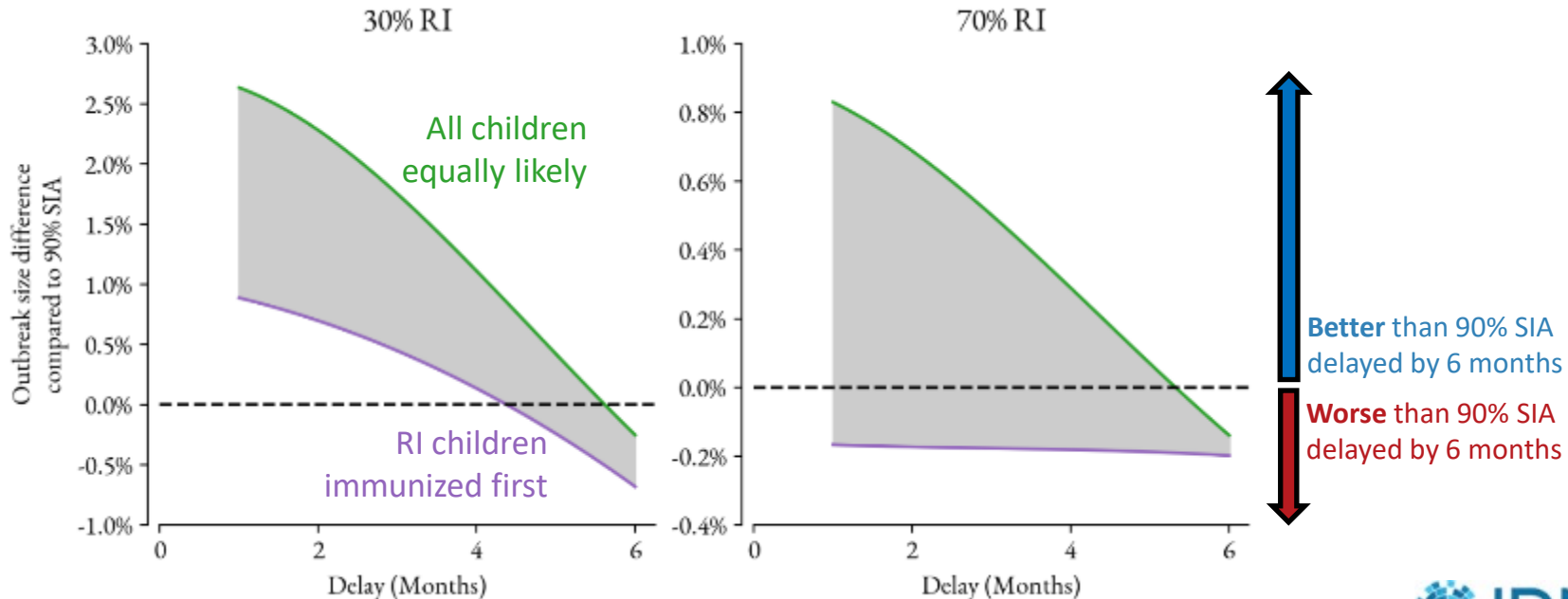
Well-timed, lower coverage SIAs can outperform delayed, high coverage campaigns



- For low RI (30%) context:
 - Immediate 50% SIA has **fewer infections** than 90% SIA delayed by 6 months
 - Immediate 50% SIA has less severe outbreak peak than 90% SIA delayed by 6 months
- For high RI (70%) context:
 - Requires timely and higher SIA coverage for impact

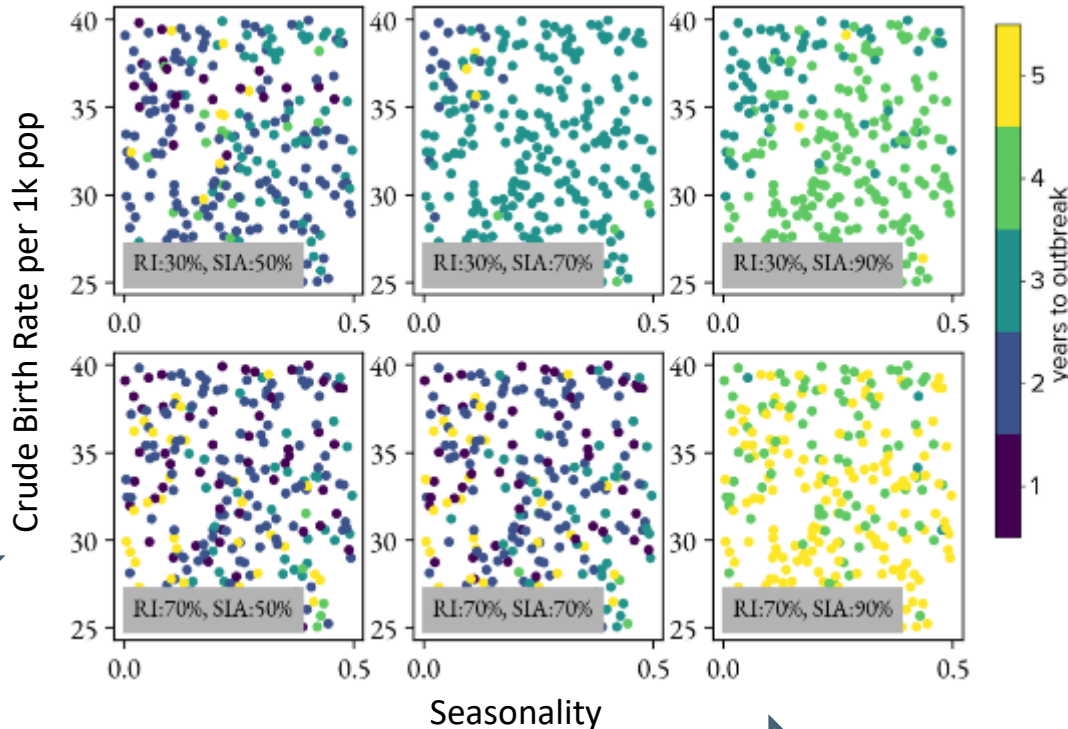
Dose association impacts how effectiveness of lower coverage, timely SIAs

1 year infection outcomes for 50% SIA compared to delayed 90% SIA



Effect of SIA campaign coverage on timing for the next

Honeymoon period to next outbreak



- Higher quality SIAs provide more time (honeymoon period) until next outbreak
 - High quality SIAs provide more consistent effect to delay outbreak
- Weak dependence on birth rate and seasonality

Summary

- Large outbreaks have been observed in between SIAs for multiple countries and regions
- Using coverage as the primary metric of SIA performance can incentivize delays in execution, potentially resulting in less impactful/effective campaigns
- Reduced quality campaigns can still impact outbreak size and severity
- Trade-off between an SIA's near and long-term effects for disease control
- Campaign quality and local factors should be a consideration for planning the following SIA