**popim package – Summary of terminology and goals**

**Terminology**

List of terms used for different vaccination-related quantities and other information, to avoid confusion:

* **Vaccination activity:** Collected information on routine vaccination and vaccination campaigns in a region (e.g. in Montagu format), including coverage levels, dates and age ranges. Population vaccination immunity levels and vaccination rates can be calculated from this information (calculation includes taking skew into account)
* **Vaccination coverage:** The proportion of a population given vaccinations in a year as part of a specific item of vaccination activity (campaign or routine)
* **Vaccination immunity:** The proportion of the population calculated to be immune due to vaccination at a given point in time, calculated from vaccination activity information (taking skew into account). Vaccination immunity does not take vaccine efficacy into account (because vaccine efficacy is a variable parameter in models), so the actual proportion of the population immune due to vaccination may be lower.
* **Vaccination rate:** The rate of change in vaccination immunity in a population during a time period, given by the difference in vaccination immunity between the beginning and end of the time period divided by the duration.
* **Vaccine efficacy:** The proportion of vaccinations which successfully provide immunity, moving them into the V group in SEIRV modelling. The resulting immunity values may differ from pre-calculated vaccination immunity if vaccine efficacy is less than 100%.
* **Routine:** Vaccinations given every year to infants (age 0-1 when using 1-year age categories), not necessarily with the same coverage
* **Campaign:** Non-routine vaccination carried out in a single year on people in any age range (potentially including infants), separate to or in combination with routine vaccination
* **Skew:** A parameter between -1 and 1 indicating how “overlapping” vaccination activity (e.g. a population with some immunity due to childhood vaccination is the subject of a campaign) is handled:
  + If skew = -1, different parts of the population are always targeted (i.e. all vaccinations are assumed to be given to unvaccinated individuals, so new immunity values are calculated by adding together the previous immunity and the coverage from the new campaign).
  + If skew = 0, the allocation is random, so the change in immunity varies depending on the existing immunity (the probability of a “double vaccination” is equal to the existing immunity, so the change in immunity is given by the coverage multiplied by 1-immunity).
  + If skew = 1, the same part of the population is always targeted first, such that the new immunity is given by whichever is highest out of the existing immunity and the coverage of the new activity.
  + If skew is not an integer value, the “overlap” of vaccination activity lies between these scenarios with some randomness and some precision, and the final immunity is calculated using a mixture model.

**Goals**

The package should be capable of being easily used to convert between different vaccination quantities, including activity in standard formats (e.g. Montagu), calculated vaccination immunity, and immunity-based vaccination rates. This includes converting in both directions where possible; vaccination immunity and rate can be freely converted to one another, but it may not be possible to fully reconstruct activity from immunity or rate even if additional information is available. This is due to the need to use the skew parameter to calculate immunity or rate from activity (a calculation which may not be reversible), and the need to distinguish between routine vaccination and campaigns. (TO DO: Discuss the extent to which activity information could be reconstructed from immunity/rate data and what additional information would be needed to do so.) Figure 1 displays the current understanding of which conversions can be carried out.

Diagram

Description automatically generated

**Figure 1: Diagram of key vaccination quantities and where conversion between them can be carried out (TO DO – Update diagram to indicate which conversions can be done with existing code, and possibly to show that vaccination activity can be reconstructed from immunity/rate data given**

[Additional goals TBA]