**Basic model**

ダイアグラム

自動的に生成された説明

For the environmental surveillance. To reflect shedding history for participants, let ­Inew­(t)be newly infected individuals, and amount of viral shedding (hazard function) is expressed as

The probability of detecting virus per one sample, ωt, is represented as

For each time, we take *n*t and the number of polio-positive sample, wt, is given by.

**Parameters**

|  |  |  |
| --- | --- | --- |
| Parameters | Values | Ref. |
| Basic reproduction number (R0) | 10 | [Kimberly M. Thompson 2020](https://onlinelibrary.wiley.com/doi/pdf/10.1111/risa.13484) |
| Population size (N),  should be under 15 years old | 10,000 | Assumption |
| Latent period (γ1) | 4 days | [John R. Paul WHO 1955, p14.](https://apps.who.int/iris/bitstream/handle/10665/41659/WHO_MONO_26.pdf?sequence=1&isAllowed=y) |
| Infectiousness period (γ2) | 24 days | [Andrew F. Brouwer 2023](https://pubmed.ncbi.nlm.nih.gov/35582812/) |
| Paralysis-to-infection ratio (pAFP) | 1/200 for WPV1, | [Neal Nathanson 2010](https://academic.oup.com/aje/article/172/11/1213/194806?login=false) |
| Duration from the onset to the time of seeking healthcare (γ3) | 5 days | assumption |
| Function for virus shedding (g) to sewage (shedding of individuals and delay for sewage detection) | Expert opinion for fraction of the infected population shedding WPV1 | [Andrew F. Brouwer 2023](https://pubmed.ncbi.nlm.nih.gov/35582812/) |

I assumed monthly environmental sampling. (the initial date of sampling is randomly chosen from 1 to 30).

is set as maximum ω(t) become 0.05 when one infection occurs. (Results would not be changed if this value is set to be 0.8).

**グラフ, 散布図

自動的に生成された説明**

**Results**

グラフ, ヒストグラム

自動的に生成された説明

Figure: Example trajectories of Ia per 1000, I\_AFP, newly infected per 100 (Ia + I\_AFP) and detected AFP (H\_New).

グラフ, 折れ線グラフ

自動的に生成された説明

Figure: Survival curve for the first detection of polio through AFP surveillance or Environmental surveillance.

**Table and Figure for the lead time of Environmental surveillance.** Take a difference of the date of AFP surveillance. Lead time more than 0 (early detection in environmental surveillance) is 85% among 1000 simulations.

グラフ, じょうごグラフ

自動的に生成された説明グラフ, 箱ひげ図

自動的に生成された説明

Mean: 12.22

Minimum: -26.00

1st Quartile: 3.00

Median: 12.00

3rd Quartile: 21.25

Maximum: 46.0