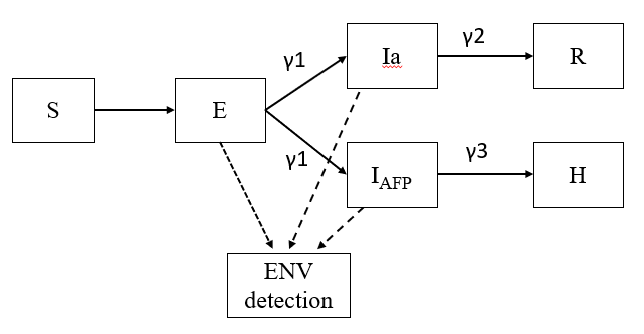
More broad overview of MSc study.

<https://docs.google.com/document/d/1t5BrLxJZkIWpyK8Um6_TUZIAqN9r86uZyPQUXNZRujs/edit?usp=sharing>

**Basic model**



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.

Note: Or if excreted viruses are present in the catchment area and a sample is taken, the probability of detection should be one? Shedding period is 24 days.

Results would be expressed as the survival curve of the first detection among all simulations for each surveillance method.

**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 | 2 million for hypothetical, 60 million for South Africa for all. | [Yi An Lai 2022](https://www.thelancet.com/action/showPdf?pii=S2589-5370(22)00238-3) |
| 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) | 42 days  31 days since onset. | [NICHOLAS C. GRASSLY 2006](https://www.science.org/doi/full/10.1126/science.1130388?casa_token=ZS_aSWmyjA0AAAAA:72LaEL-r455LerNI6mRKGzY5rtu1ini5ZCocQFfQRslOcBBJW0wm49ymTdMsdw-D8OCwkTLLq1c7q58)   [James P. Alexander 1997](https://pubmed.ncbi.nlm.nih.gov/9203713/) |
| Paralysis-to-infection ratio (pAFP) | 1/200 for WPV1,  1/2000 for WPV2,  1/100 for WPV3, | [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) | Exponential distribution with 31 days since onset (paralysis or meningitis)   Expert opinion for fraction of the infected population shedding WPV1 | [NICHOLAS C. GRASSLY 2006](https://www.science.org/doi/full/10.1126/science.1130388?casa_token=ZS_aSWmyjA0AAAAA:72LaEL-r455LerNI6mRKGzY5rtu1ini5ZCocQFfQRslOcBBJW0wm49ymTdMsdw-D8OCwkTLLq1c7q58)     [Andrew F. Brouwer 2023](https://pubmed.ncbi.nlm.nih.gov/35582812/) |

**Old Writing**

For the environmental surveillance. To reflect shedding history for participants, the hazard function is defined as

and consider the decay of shedding virus amount,

Where g(t) represents a function of virus shedding contribution to sewage.