**MODEL SUMMARY – ENHANCED SHIELDING**

**Model Equations**

Eqn1.1

**Generic WAIFW Contact Matrix**

**MODIFYING THE BETAS**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Vulnerable** | **Shielders** | **Remainders** |
| **Vulnerable** | β1 + [β1bv(1- δ)]\* | β1 | β4δ |
| **Shielders** | β1 | β2 | β2 |
| **Non-Vulnerable** | β4δ | β2 | β3 + [β3br(1- δ)]\* |

\*Square brackets denote the beta-inflation calculations

**AFTER inflation – Example Phase 0**

**Phase 0:** β1 = **0.198** (R0 = 1.7), β2 = **0.198** (R0 = 1.7), β3 = **0.198** (R0 = 1.7) and β4 =**0.198** (R0 = 1.7)

**Phase 1:** β1 = **0.058** (R0 = 0.5), β2 = **0.07** (R0 = 0.6), β3 = **0.07** (R0 = 0.6) and β4 = **0** (R0 = 0)

**Phase 2:** β1 = **0.029** (R0 = 0.25), β2 = **0.134** (R0 = 1.15), β3 = **0.263** (R0 = 2.25) and β4 = **0** (R0 = 0)

**Phase 3:** β1 = **0.029** (R0 = 0.25), β2 = **0.134** (R0 = 1.15), β3 = **0.263** (R0 = 2.25) and β4 = **0** (R0 = 0)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Vulnerable** | **Shielders** | **Remainders** |
| **Vulnerable** | 0.595 | 0.198 | 0.066 |
| **Shielders** | 0.198 | 0.198 | 0.198 |
| **Non-Vulnerable** | 0.066 | 0.198 | 0.243 |

**Parameters for Phase 0 Example:** bv = 3, br = 0.333, delta = 0.333

**USING BASELINE PARAMETERS**

**Phase 0 (Up until trigger day)– Beta Values**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Vulnerable** | **Shielders** | **Remainder** |
| **Vulnerable** | 0.347 | 0.347 | 0.099 |
| **Shielders** | 0.198 | 0.198 | 0.198 |
| **Remainder** | 0.099 | 0.198 | 0.231 |

**Phase 1 (for 6 weeks) – Beta Values**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Vulnerable** | **Shielders** | **Remainder** |
| **Vulnerable** | **0.102\*** | **0.102\*** | 0 |
| **Shielders** | **0.058\*** | 0.070 | 0.070 |
| **Remainder** | 0 | 0.070 | 0.082 |

\*To account for shielding already in place (R0 = 0.5)

**Phase 2 (Linear change from phase1 until 12 weeks after) – Beta Values**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Vulnerable** | **Shielders** | **Remainder** |
| **Vulnerable** | **0.051\*** | **0.051\*** | 0 |
| **Shielders** | **0.029\*** | 0.134 | 0.134 |
| **Remainder** | 0 | 0.134 | 0.306 |

\*To account for shielding already in place (R0 = 0.5)

**Phase 3 (After phase 2) – Beta Values**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Vulnerable** | **Shielders** | **Remainder** |
| **Vulnerable** | **0.051\*** | **0.051\*** | 0 |
| **Shielders** | **0.029\*** | 0.134 | 0.134 |
| **Remainder** | 0 | 0.134 | 0.306 |

\*To account for shielding already in place (R0 = 0.5)

**Appendix**

**Table 1 – Compartment Descriptions and Baseline Initial Conditions**

|  |  |  |
| --- | --- | --- |
| Compartment | Description | Initial Conditions |
| Sv | Susceptible fraction of the population who are vulnerable | 0.2 – 0.00002 |
| Sh | Susceptible fraction of the population who are shielders | 0.2 – 0.00002 |
| Sr | Susceptible fraction of the population who are remaining | 0.6 – 0.00006 |
| Iv | Infectious fraction of the population who are vulnerable | 0.0001\*0.2 |
| Ih | Infectious fraction of the population who are shielders | 0.0001\*0.2 |
| Ir | Infectious fraction of the population who are remaining | 0.0001\*0.6 |
| Rv | Removed fraction of the population who are vulnerable | 0 |
| Rh | Removed fraction of the population who are shielders | 0 |
| Rr | Removed fraction of the population who are remaining | 0 |

**Table 2 – Parameter Descriptions and Baseline Values**

|  |  |  |
| --- | --- | --- |
| Parameter | Description | Value |
| R0 | Baseline basic reproduction number (to calculate gamma) | 2.8 |
| T2 | Doubling time | 3.3 days |
| βij | Per capita rate of infectious transmission | See Table |
| γ | Per capita rate of recovery | 0.1167 day-1 |
| ζ | Per capita rate of immunity loss | 0.0027 day-1 |
| Cb | Relative level (scale) of contact between the vulnerable and remainder groups at baseline | 0.5 |
| bv | Relative level of remainder-to-vulnerable population size | Sr+Ir+Rr/Sv+Iv+Rv |
| br | Relative level of vulnerable-to-remainder population size | Sv+Iv+Rv/Sr+Ir+Rr |

**How the Beta Values are Inflated at BASELINE**

**Complex Equations – If you were to substitute the Betas from the Appendix**

\*Yellow highlights denote the beta (or set of betas for inflated values) that are used to calculate the absolute value of the final simplified βij

**Sensitivity Analysis**

1. Trigger day modification (expressed in terms of R(t+7))
   1. 71 Days (Baseline: R(t+7) = 0.06)
   2. 96 Days (+ 25 Days)
   3. 46 Days (- 25 Days)
2. SIS, SIRS and SIR Model comparison (baseline parameter set)
3. Alterations to the relative composition of the 3 populations: Vulnerable, Shielders and Remainders
   1. Identical Fractions of Shielders and Vulnerable:
      1. 0.2, 0.2, 0.6 (Baseline)
      2. 0.1, 0.1, 0.8
      3. 0.2, 0.2, 0.96
   2. Alteration to the ratio of Shielders to Vulnerable
      1. 0.2, 0.2, 0.6 (Baseline)
      2. 0.2, 0.4, 0.4
      3. 0.2, 0.1, 0.7
4. Targeted alterations to the baseline beta values
   1. 10/20% increase to ALL beta values
   2. 10/20% Increase to specific Beta values (for the sake of this using β1, β2, β3, β4 to denote targeting) – For ALL PHASES
      1. 10/20% Increase to β1
      2. 10/20% Increase to β2
      3. 10/20% Increase to β3
      4. 10/20% Increase to β4