***Epidemiology and Infection***

**Quantifying the impact of mass vaccination programmes on notified cases in the Netherlands**

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**Supplementary Tables S1-S6**

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| --- | --- |
|  | Median (95% credible interval) |
|  | Secular trend |  | Harmonic terms |
|  | $$β\_{1}$$ |  | $$α\_{1}$$ | $$γ\_{1}$$ | $$α\_{2}$$ | $$γ\_{2}$$ | $$α\_{3}$$ | $$γ\_{3}$$ | $$α\_{4}$$ | $$γ\_{4}$$ |
| Diphtheria | -0.005(-0.009, -0.002)  |  | 0.147(0.061, 0.233) | -0.374 (-0.459, -0.289) |  |  |  |  |  |  |
| Poliomyelitis |  |  | -1.287(-1.528, -1.046) | -0.959 (-1.194, -0.723) |  |  |  |  | 0.981 (0.445, 1.528) | -0.538 (-1.109, -0.002) |
| Mumps | -0.009 (-0.012, -0.006) |  | 0.392 (0.258, 0.526) | -0.018 (-0.149, 0.114) |  |  | -0.171 (-0.359, 0.019) | -0.444 (-0.623, -0.258) |  |  |
| RubellaaPre-vaccination |  |  | 0.876 (0.775, 0.976) | -0.241(-0.341, -0.141) |  |  |  |  | 0.913 (0.617, 1.207) | -0.122 (-0.409,0.166) |
| Pre-extended programme | -0.015(-0.021, -0.009) |  | 0.857 (0.729, 0.985)  | -0.431 (-0.558, -0.305 |  |  | -0.458 (-0.739, -0.173) | -0.236 (-0.522, 0.043) | 0.036 (-0.291, 0.377) | -0.534 (-0.857, -0.211) |
| aFor rubella two models were fitted: one to the period prior to mass vaccination of 11-year old girls in 1974 (the restricted programme), and another to the period following this restricted programme but prior to extension with the measles-mumps-rubella vaccine in 1987 to both boys and girls of 14 months of age and revaccination at 9 years of age. |

**Supplementary Table S1:** Final models used for the analyses presented in the main text. Model selection was based on statistical relevance of the coefficients and wavelet analysis. Latent process Poisson regression models were fit to pre-vaccination notified cases of poliomyelitis. Models were fit in a Bayesian framework using flat priors and assuming a latent auto-correlation process. For more detail see the main text.

**Supplementary Table S2:** Fitted models for diphtheria for the period July 1948 – December 1952. Final model used for the analyses is highlighted in bold. Model selection was based on statistical relevance of the coefficients and wavelet analysis. Latent process Poisson regression models were fit to pre-vaccination notified cases of poliomyelitis. Models were fit in a Bayesian framework using flat priors and assuming a latent auto-correlation process. For more detail see the main text.

|  |  |  |
| --- | --- | --- |
|  |  | Median (95% credible interval) |
|  |  | Secular trend |  | Harmonic terms |
| Model | DIC | $$β\_{1}$$ |  | $$α\_{1}$$ | $$γ\_{1}$$ | $$α\_{2}$$ | $$γ\_{2}$$ |
| **1.** | **605.39** | **-0.005****(-0.009, -0.002)** |  | **0.147** **(0.061, 0.233)** | **-0.374****(-0.459, -0.289)** |  |  |
| 2. | 605.65 |  |  | 0.145(0.045, 0.244) | -0.367(-0.464, -0.268) |  |  |
| 3. | 605.55 | -0.006(-0.010, -0.003) |  | 0.145(0.062, 0.226) | -0.379(-0.459, -0.298) | -0.075(-0.165, 0.015) | -0.041(-0.132, 0.049) |

**Supplementary Table S3:** Fitted models for poliomyelitis for the period January 1947 – June 1957. Final model used for the analyses is highlighted in bold. Model selection was based on statistical relevance of the coefficients and wavelet analysis. Latent process Poisson regression models were fit to pre-vaccination notified cases of poliomyelitis. Models were fit in a Bayesian framework using flat priors and assuming a latent auto-correlation process. For more detail see the main text.

|  |  |
| --- | --- |
|  | Median (95% credible interval) |
|  | Secular trend |  | Harmonic terms |
| Model | DIC | $$β\_{1}$$ |  | $$α\_{1}$$ | $$γ\_{1}$$ | $$α\_{2}$$ | $$γ\_{2}$$ | $$α\_{4}$$ | $$γ\_{4}$$ | $$α\_{5}$$ | $$γ\_{5}$$ |
| 1. | 779.97 | 0.003 (-0.017, 0.021) |  | -1.276(-1.530, -1.022) | -0.967(-1.215, -0.719) |  |  |  |  |  |  |
| 2. | 779.94 |  |  | -1.278(-1.532, -1.025) | -0.968(-1.215, -0.720) |  |  |  |  |  |  |
| 3. | 780.39 |  |  | -1.268(-1.521, -1.015) | -0.968(-1.216, -0.721) | 0.023(-0.412, 0.465) | -0.296(-0.726, 0.136) |  |  |  |  |
| **4.** | **779.24** |  |  | **-1.287****(-1.528, -1.046)** | **-0.959****(-1.194, -0.723)** |  |  | **0.981****(0.445, 1.528)** | **-0.538****(-1.087, -0.002)** |  |  |
| 5.  | 780.79 |  |  | -1.290(-1.537, -1.043) | -0.972(-1.214, -0.731) |  |  |  |  | -0.137(-0.789, 0.542) | 0.927(0.280, 1.596) |
|  |

**Supplementary Table S4:** Fitted models for mumps for the period January 1976 – December 1986. Final model used for the analyses is highlighted in bold. Model selection was based on statistical relevance of the coefficients and wavelet analysis. Latent process Poisson regression models were fit to pre-vaccination notified cases of poliomyelitis. Models were fit in a Bayesian framework using flat priors and assuming a latent auto-correlation process. For more detail see the main text.

|  |  |
| --- | --- |
|  | Median (95% credible interval) |
|  | Secular trend |  | Harmonic terms |
| Model | DIC | $$β\_{1}$$ |  | $$α\_{1}$$ | $$γ\_{1}$$ | $$α\_{2}$$ | $$γ\_{2}$$ | $$α\_{3}$$ | $$γ\_{3}$$ | $$α\_{4}$$ | $$γ\_{4}$$ |
| 1. | 1073.77 | -0.008 (-0.014– -0.003) |  | 0.396(0.242, 0.551) | -0.024(-0.176, 0.128) |  |  |  |  |  |  |
| 2. | 1073.63 |  |  | 0.404 (0.245, 0.563)  | -0.022(-0.179, 0.135) |  |  |  |  |  |  |
| 3. | 1073.78 | -0.008(-0.014, -0.003) |  | 0.396(0.241, 0.551) | -0.026(-0.178, 0.127) | -0.104(-0.344, 0.136) | 0.096(-0.138, 0.330) |  |  |  |  |
| **4.** | **1075.16** | **-0.009****(-0.012, -0.006)** |  | **0.392****(0.258, 0.526)** | **-0.018****(-0.149, 0.114)** |  |  | **-0.171****(-0.359, 0.019)** | **-0.444****(-0.623, -0.258)** |  |  |
| 5. | 1073.76 | -0.008(-0.014, -0.002) |  | 0.397 (0.240, 0.553) | -0.024(-0.178, 0.130) |  |  |  |  | 0.019 (-0.319, 0.359) | 0.002(-0.315, 0.322) |
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**Supplementary Table S5:** Fitted models for rubella for the period January 1951 – December 1973 (prior to the start of vaccination of 11-year-old girls). Final model used for the analyses is highlighted in bold. Model selection was based on statistical relevance of the coefficients and wavelet analysis. Latent process Poisson regression models were fit to pre-vaccination notified cases of poliomyelitis. Models were fit in a Bayesian framework using flat priors and assuming a latent auto-correlation process. For more detail see the main text.

|  |  |
| --- | --- |
|  | Median (95% credible interval) |
|  | Secular trend |  | Harmonic terms |
| Model | DIC | $$β\_{1}$$ |  | $$α\_{1}$$ | $$γ\_{1}$$ | $$α\_{2}$$ | $$γ\_{2}$$ | $$α\_{3}$$ | $$γ\_{3}$$ | $$α\_{4}$$ | $$γ\_{4}$$ |
| 1. | 2405.25 | -0.002 (-0.008, 0.004) |  | 0.872(0.767, 0.977) | -0.241(-0.346, -0.137) |  |  |  |  |  |  |
| 2. | 2405.21 |  |  | 0.873(0.767, 0.978) | -0.241(-0.346, -0.137) |  |  |  |  |  |  |
| 3. | 2405.27 |  |  | 0.873(0.767, 0.978) | -0.241(-0.346, -0.136) | 0.095(-0.106, 0.295) | -0.067(-0.266, 0.132) |  |  |  |  |
| 4. | 2404.93 |  |  | 0.873 (0.768, 0.977) | -0.240(-0.344, -0.136) |  |  | 0.050(-0.234, 0.333) | -0.315(-0.593, -0.036) |  |  |
| **5.** | **2403.82** |  |  | **0.876****(0.775, 0.976)** | **-0.241****(-0.341, -0.141)** |  |  |  |  | **0.913****(0.617, 1.207)** | **-0.122****(-0.409, 0.166)** |
|  |

**Supplementary Table S6:** Fitted models for rubella for the period January 1974 – December 1986 (prior to the start of vaccination of 14-month- and 9-year-old boys and girls). Final model used for the analyses is highlighted in bold. Model selection was based on statistical relevance of the coefficients and wavelet analysis. Latent process Poisson regression models were fit to pre-vaccination notified cases of poliomyelitis. Models were fit in a Bayesian framework using flat priors and assuming a latent auto-correlation process. For more detail see the main text.

|  |  |
| --- | --- |
|  | Median (95% credible interval) |
|  | Secular trend |  | Harmonic terms |
| Model | DIC | $$β\_{1}$$ |  | $$α\_{1}$$ | $$γ\_{1}$$ | $$α\_{2}$$ | $$γ\_{2}$$ | $$α\_{3}$$ | $$γ\_{3}$$ | $$α\_{4}$$ | $$γ\_{4}$$ |
| 1. | 1207.49 | -0.012(-0.021, -0.001) |  | 0.845(0.708, 0.982) | -0.429(-0.564, -0.294) |  |  |  |  |  |  |
| 2. | 1207.74 |  |  | 0.849(0.713, 0.985) | -0.426(-0.561, -0.291) |  |  |  |  |  |  |
| 3. | 1207.81 | -0.012(-0.021, -0.001) |  | 0.846(0.708, 0.983) | -0.429(-0.566, -0.293) | 0.027(-0.224, 0.277) | 0.088(-0.160, 0.334) |  |  |  |  |
| 4. | 1207.51 | -0.014(-0.022, -0.005) |  | 0.851(0.719, 0.983) | -0.433(-0.563, -0.303) |  |  | -0.481(-0.794, -0.165) | -0.309(-0.623, 0.003) |  |  |
| 5. | 1207.63 | -0.014(-0.022, -0.006) |  | 0.851(0.717, 0.984) | -0.428 (-0.560, -0.297) |  |  |  |  | 0.013(-0.366, 0.401) | -0.610(-0.980, -0.239) |
| **6.** | **1208.05** | **-0.015****(-0.021, -0.009)** |  | **0.857****(0.729, 0.985)** | **-0.431****(-0.558, -0.305)** |  |  | **-0.458****(-0.739, -0.173)** | **-0.236** **(-0.522, 0.043)** | **0.036****(-0.291, 0.377)** | **-0.534****(-0.857, -0.211)** |
|  |

**Supplementary Figures S1-S6**

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**Supplementary Figure S1.** Wavelet time series analysis of monthly notified cases of diphtheria in the pre-vaccination period, the Netherlands, July 1948 – December 1952. Top panel shows the monthly notified cases of diphtheria. Bottom panel shows the local wavelet power spectrum; color code at top right. The bottom right panel shows the global wavelet power spectrum; arrows indicate the predominant signals.

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**Supplementary Figure S2.** Wavelet time series analysis of monthly notified cases of poliomyelitis in the pre-vaccination period, the Netherlands, January 1947 – June 1957. Top panel shows the monthly notified cases of diphtheria. Bottom panel shows the local wavelet power spectrum; color code at top right. The bottom right panel shows the global wavelet power spectrum; arrows indicate the predominant signals.

**Supplementary Figure S3.** Wavelet time series analysis of monthly notified cases of mumps in the pre-vaccination period, the Netherlands, January 1967 – December 1986. Top panel shows the monthly notified cases of diphtheria. Bottom panel shows the local wavelet power spectrum; color code at top right. The bottom right panel shows the global wavelet power spectrum; arrows indicate the predominant signals.

**Supplementary Figure S4.** Wavelet time series analysis of monthly notified cases of rubella in the pre-vaccination period, the Netherlands, January 1951 – December 1974. Top panel shows the monthly notified cases of diphtheria. Bottom panel shows the local wavelet power spectrum; color code at top right. The bottom right panel shows the global wavelet power spectrum; arrows indicate the predominant signals.

**Supplementary Figure S5.** Wavelet time series analysis of monthly notified cases of rubella in the period with a restricted vaccination programme for 11-year-old girls, the Netherlands, January 1974 – December 1986. Top panel shows the monthly notified cases of diphtheria. Bottom panel shows the local wavelet power spectrum; color code at top right. The bottom right panel shows the global wavelet power spectrum; arrows indicate the predominant signals.

**Supplementary Figure S6.** Estimated percentage of cases averted due to vaccination programmes under various ﬁtting periods for (A) diphtheria, (B) poliomyelitis, (C) mumps, (D) rubella restricted vaccination programme of 11-year-old girls, and (E) rubella extended vaccination programme of both boys and girls at 14 months and 9 years of age, the Netherlands. Pre-vaccination periods used for ﬁtting the regression models are indicated on the left. Base cases as presented in the main text are represented by the black bar. Except for several scenario’s, models were of an identical form as the base case. For diphtheria three scenario’s did not include a term for secular trend (\*); for rubella two scenario’s included a term for a two-year cycle rather than a four-year cycle.