**SUPPLEMENTARY FILE 1.**

**1.1 Overview predictors of rotavirus epidemiology, per region.**

**1.2 Definitions to define the onset, end, and duration of the annual epidemics.**

**1.1 Overview predictors of rotavirus epidemiology, per region.**

Population predictors were: the weekly total number of births, the estimated weekly average number of children under the age of two and the weekly total population size. Meteorological predictors were: the mean weekly rainfall, mean weekly relative humidity, mean maximum-, minimum- and average weekly temperature, number of days in a week in which the mean daily temperature was below the zero or the five degrees. As there is a strong seasonal pattern in rotavirus epidemiology, we additionally hypothesized that meteorological factors in the period prior to the epidemic, which is generally during the months December and January, may have the strongest influence on transmission and incidence. Therefore, we also tested the following meteorological factors from December and January: total number of weeks in which the mean temperature of the week was below five degrees, the lowest minimum temperature, the total number of days in which the temperature is below five degrees, the maximum, minimum, and average weekly temperature, and the average weekly relative humidity. Last group of predictors were the presence/absence of UMV.

**Table S1**. Predictors of rotavirus epidemiology per region

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **The Netherlands (NL)** | | | | **Denmark (DK)** | | | |
| Predictor | Univariate | | Multivariate | | Univariate | | Multivariate | |
|  | IRR | 95% CI | IRR | 95% CI | IRR | 95% CI | IRR | 95% CI |
| Total population number | **0.99** | 0.99-0.99 | 0.99 | 0.99-0.99 | **1.00** | 1.00-1.00 |  |  |
| Total number of births | **0.99** | 0.99- 0.99 |  |  | **0.99** | 0.99-0.99 |  |  |
| Population under 2 years | **0.99** | 0.99-0.99 |  |  | **0.99** | 0.99-0.99 |  |  |
| Mean average weekly temperature | 0.98 | 0.96-1.00 |  |  | 1.00 | 0.98-1.02 |  |  |
| Mean minimum weekly temperature | 0.99 | 0.97-1.01 |  |  | 1.01 | 0.98-1.03 |  |  |
| Mean maximum weekly temperature | **0.98** | 0.96-1.00 | 0.98 | 0.96-1.00 | 1.00 | 0.98-1.02 |  |  |
| Total weeks that mean weekly temperature is under 5 C° # | **1.04** | 1.02-1.07 |  |  | **0.95** | 0.92-0.98 |  |  |
| Mean weekly rainfall | 1.00 | 0.97-1.02 |  |  | NA | NA |  |  |
| Lowest minimum temperature value# | **0.95** | 0.93-0.97 |  |  | 1.03 | 0.97-1.10 |  |  |
| Mean minimum temperature# | **0.95** | 0.92-0.98 |  |  | **1.06** | 1.03-1.10 |  |  |
| Mean maximum temperature# | **0.94** | 0.91-0.96 |  |  | **1.07** | 1.03-1.11 | 1.08 | 1.04-1.12 |
| Average weekly temperature# | **0.94** | 0.91-0.97 |  |  | **1.07** | 1.03-1.10 |  |  |
| Average weekly humidity# | **0.95** | 0.93-0.98 |  |  | **1.07** | 1.03-1.10 | 1.08 | 1.05-1.11 |
| Total days temperature is under 5 C° # | **1.00** | 1.00-1.01 |  |  | 0.99 | 0.99-1.00 |  |  |
| Total rainfall# | 0.99 | 0.99-1.00 |  |  | NA | NA |  |  |
| Number of days mean temperature is below 0 C° | 1.02 | 0.97-1.06 |  |  | 0.97 | 0.94-1.00 |  |  |
| Number of days mean temperature is below 5 C° | 1.02 | 0.98-1.06 |  |  | 1.00 | 0.97-1.03 |  |  |
| Mean weekly relative humidity | 1.00 | 0.99-1.01 |  |  | 1.00 | 0.99-1.00 |  |  |
| Start vaccination in Belgium | **1.52** | 1.38-1.67 | 1.81 | 1.50-2.18 | - | - |  |  |
| Start vaccination in England and Wales | 0.92 | 0.79-1.07 |  |  | - | - |  |  |
| Start vaccination in West Germany | 0.92 | 0.79-1.07 |  |  | 1.17 | 1.01-1.36 |  |  |
| # = in December/January, - = Not Applicable, NA = Not Available. Temperature in C°, rainfall in mm, humidity in %. | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Belgium (BE)** | | | | **England and Wales (EW)** | | | |
| Predictor | Univariate | | Multivariate | | Univariate | | Multivariate | |
|  | IRR | 95% CI | IRR | 95% CI | IRR | 95% CI | IRR | 95% CI |
| Vaccination | **0.30** | 0.25-0.35 | 0.41 | 0.33-0.50 | **0.48** | 0.40-0.59 | 0.64 | 0.51-0.79 |
| Total population number | **0.99** | 0.99-0.99 | 0.99 | 0.99-0.99 | **0.99** | 0.99-1.00 |  |  |
| Total number of births | **0.99** | 0.99-0.99 |  |  | **0.99** | 0.99-0.99 |  |  |
| Population under 2 years | **0.99** | 0.99-0.99 |  |  | 0.99 | 0.99-1.00 |  |  |
| Mean average weekly temperature | 0.99 | 0.96-1.02 |  |  | **0.97** | 0.96-0.99 |  |  |
| Mean minimum weekly temperature | 0.99 | 0.96-1.03 |  |  | 0.98 | 0.96-0.99 |  |  |
| Mean maximum weekly temperature | 0.99 | 0.96-1.01 |  |  | **0.97** | 0.96-0.99 |  |  |
| Total weeks that mean weekly temperature is under 5 C° # | 1.02 | 0.97-1.08 |  |  | **1.03** | 1.02-1.05 |  |  |
| Mean weekly rainfall | **1.01** | 1.00-1.01 |  |  | 0.98 | 0.97-0.99 |  |  |
| Lowest minimum temperature value# | **1.06** | 1.04-1.09 |  |  | **0.95** | 0.94-0.96 |  |  |
| Mean minimum temperature# | 0.99 | 0.94-1.04 |  |  | **0.93** | 0.91-0.95 |  |  |
| Mean maximum temperature# | 0.98 | 0.93-1.03 |  |  | **0.93** | 0.91-0.95 | 0.94 | 0.93-0.96 |
| Average weekly temperature# | 0.98 | 0.94-1.04 |  |  | **0.93** | 0.91-0.95 |  |  |
| Average weekly humidity# | **1.05** | 1.01-1.08 |  |  | **1.02** | 1.00-1.03 |  |  |
| Total days temperature is under 5 C° # | 0.99 | 0.99-1.00 |  |  | **1.00** | 1.00-1.00 |  |  |
| Total rainfall# | **1.00** | 1.00-1.00 |  |  | **0.99** | 0.99-0.99 |  |  |
| Number of days mean temperature is below 0 C° | 1.02 | 0.91-1.15 |  |  | 1.02 | 0.98-1.06 |  |  |
| Number of days mean temperature is below 5 C° | 1.06 | 1.00-1.12 |  |  | 1.02 | 1.00-1.04 |  |  |
| Mean weekly relative humidity | **1.01** | 1.00-1.02 |  |  | 1.00 | 0.99-1.00 |  |  |
| Start vaccination in West Germany | **0.51** | 0.43-0.60 |  |  | - | - |  |  |
| # = in December/January, - = Not Applicable, NA = Not Available. Temperature in C°, rainfall in mm, humidity in %. | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **West Germany (West-DE)** | | | | **East Germany (East-DE)** | | | |
| Predictor | Univariate | | Multivariate | | Univariate | | Multivariate | |
|  | IRR | 95% CI | IRR | 95% CI | IRR | 95% CI | IRR | 95% CI |
| Vaccination | **0.69** | 0.62-0.77 | 0.86 | 0.74-0.99 | **0.71** | 0.66-0.77 | 0.52 | 0.45-0.61 |
| Total population number | 1.00 | 0.99-1.00 |  |  | **1.00** | 1.00-1.00 | 0.99 | 0.99-0.99 |
| Total number of births | 0.99 | 0.99-0.99 |  |  | **0.99** | 0.99-1.00 |  |  |
| Population under 2 years | **0.99** | 0.99-0.99 | 0.99 | 0.99-0.99 | **0.99** | 0.99-1.00 |  |  |
| Mean average weekly temperature | 0.99 | 0.98-1.00 |  |  | 0.99 | 0.98-1.00 |  |  |
| Mean minimum weekly temperature | 0.99 | 0.98-1.00 |  |  | 0.99 | 0.98-1.01 |  |  |
| Mean maximum weekly temperature | 0.99 | 0.98-1.00 |  |  | 0.99 | 0.98-1.00 |  |  |
| Total weeks that mean weekly temperature is under 5 C° # | **1.04** | 1.03-1.06 | 1.02 | 1.00-1.04 | **1.05** | 1.02-1.07 |  |  |
| Mean weekly rainfall | 1.01 | 0.99-1.03 |  |  | 1.00 | 0.98-1.02 |  |  |
| Lowest minimum temperature value# | 0.98 | 0.98-0.99 |  |  | **0.98** | 0.97-0.99 |  |  |
| Mean minimum temperature# | **0.96** | 0.95-0.98 |  |  | **0.93** | 0.91-0.95 | 0.93 | 0.92-0.95 |
| Mean maximum temperature# | **0.96** | 0.94-0.98 |  |  | **0.94** | 0.92-0.96 |  |  |
| Average weekly temperature# | **0.96** | 0.95-0.98 |  |  | **0.94** | 0.91-0.96 |  |  |
| Average weekly humidity# | NA | NA |  |  | NA | NA |  |  |
| Total days temperature is under 5 C° # | **1.00** | 1.00-1.01 |  |  | **1.00** | 1.00-1.01 |  |  |
| Total rainfall# in Dec/Jan | 0.99 | 0.997-1.00 |  |  | **0.99** | 0.99-0.99 |  |  |
| Number of days mean temperature is below 0 C° | 1.02 | 0.99-1.04 |  |  | 1.01 | 0.97-1.05 |  |  |
| Number of days mean temperature is below 5 C° | 1.01 | 0.99-1.03 |  |  | 1.00 | 0.97-1.03 |  |  |
| Mean weekly relative humidity | NA | NA |  |  | NA | NA |  |  |
| Start vaccination in East Germany | 0.93 | 0.87-1.00 |  |  | - | - |  |  |
| Start vaccination in West Germany | - | - |  |  | **0.69** | 0.62-0.76 |  |  |
| # = in December/January, - = Not Applicable, NA = Not Available. Temperature in C°, rainfall in mm, humidity in %. | | | | | | | | |

**1.2 Definitions to define the onset, end, and duration of the annual epidemics.**

For each epidemiological year (September-August), we defined the onset, end, and duration of the annual epidemics according to modified criteria used by Hungerford et al.: the region-specific overall median of weekly rotavirus cases in the pre-vaccination period was calculated, and this median was used as a threshold for defining the start and end of each rotavirus epidemic. A consecutive period of three weeks of weekly rotavirus detections greater than or equal to the median marked the start of the epidemic and the week number followed by a consecutive period of three weeks of rotavirus detections less than the median identifies the end of the epidemic, ensuring clear season identification robust to stochastic fluctuations. The epidemic peak was defined as the week with the highest number of rotavirus detections in that epidemiological year. The duration of the epidemic was the week number that marks the end of the epidemic minus the week number of the onset of the epidemic.

**Reference**:

Hungerford D, Vivancos R, Read JM, Pitzer VE, Cunliffe N, French N, et al. In-season and out-of-season variation of rotavirus genotype distribution and age of infection across 12 European countries before the introduction of routine vaccination, 2007/08 to 2012/13. Euro surveillance : bulletin Europeen sur les maladies transmissibles = European communicable disease bulletin. 2016;21(2).