***Epidemiology and Infection***

**Manuscript Title:** Transmission of respiratory and gastrointestinal infections in German households with children attending child care

**Authors**

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Supplementary Material

Supplementary Material 1: Definition of acute respiratory infection (ARI) and acute gastroenteritis (AGE) episodes

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| --- | --- |
| **Disease** | **Definition** |
| **ARI** (based onLambert et al. 2005, Lambert et al. 2007) | Either **one** of the below stated symptoms of **category A**  **and/or**  **at least two** (or more) symptoms of **category B**.   |  |  | | --- | --- | | Category A:   * Fever * Wheezing * Cough with sputum * Medically diagnosed otitis media or pneumonia | Category B:   * Cold (runny or blocked nose) * Cough * Sore throat * Pain in the limbs * Headache * Shivering * Weakness/fatigue/decreased   activity   * Irritability * Vomiting | |
| **AGE** (based on definition of diarrhoea of WHO 2005) | At least **3-times** liquid/pasty stool per day (24h)  **and/or**  at least **one time** vomiting per day (24h). |

**Lambert SB, et al.** Respiratory illness during winter: a cohort study of urban children from temperate Australia. *Journal of paediatrics and child health* 2005; **41**(3): 125-129.

**Lambert SB, et al.** Community epidemiology of human metapneumovirus, human coronavirus NL63, and other respiratory viruses in healthy preschool-aged children using parent-collected specimens. *Pediatrics* 2007; **120**(4): e929-937.

**World Health Organization (WHO)**. The treatment of diarrhoea: a manual for physicians and other senior health workers. Geneva: World Health Organization; 2005.

**Supplementary Material 2:** Different scenarios for assessment of transmission depending on infectious period of acute respiratory infections

Scenario 1 is the base case scenario, including every observation. In scenario 2, all participants started the observation with a healthy day. Scenarios 3 to 7 were based on scenario 2 and reflected the information on the infectiousness and the duration of diseases for common respiratory pathogens (*see detailed information below the table*).

The number of observed potential transmission events varied by the factor 2.4 between the different scenarios. The number of days attributable to transmission increased with an increased assumed duration of infectiousness. Increasing the assumed duration of infectiousness of the primary case resulted in an increased number of transmission episodes and hence there were more days associated with acquired infections. However, it also increases the risk of including transmission in both directions.

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|  | **Scenario 11** | **Scenario 22** | **Scenario 33** | **Scenario 44** | **Scenario 56** | **Scenario 66** | **Scenario 77** |
| ***Base case*** |
| Number of observed infection episodes | 608 | 546 | 546 | 546 | 546 | 546 | 546 |
| Number of households with at least one infection | 75 | 75 | 75 | 75 | 75 | 75 | 75 |
| Number of households with at least one potential transmission event | 60 | 55 | 49 | 49 | 48 | 48 | 55 |
| Number of infection episodes not resulting in transmission events | 254 | 219 | 292 | 292 | 324 | 314 | 209 |
| Number of secondary cases potentially resulting from transmission events | 212 | 196 | 138 | 188 | 118 | 171 | 243 |
| Number of days with symptoms | 4383 | 3955 | 3955 | 3955 | 3955 | 3955 | 3955 |
| Number of infectious days according to the respective definition | 3398 | 3139 | 644 | 1115 | 474 | 817 | 3846 |
| Number of days potentially resulting from transmission | 1589 | 1464 | 970 | 1303 | 852 | 1194 | 1763 |
| % of all symptomatic days potentially attributable to within household transmission | **36.3** | **37.0** | **24.5** | **33.0** | **21.5** | **30.2** | **44.6** |
| Number of potential transmission events | **277** | **254** | **161** | **223** | **134** | **196** | **316** |

1 All cases; **case definition of secondary case:** can acquire infection during all symptomatic days of the primary case.

2 Start of observation with a healthy day, because people might start documenting when they are affected by an infection (**Bayer et al.**, 2014); **case definition of secondary case:** can acquire infection during all symptomatic days of the primary case.

3 Start of observation with a healthy day; **case definition of secondary case:** can acquire infection during the first five days after onset of symptoms in the primary case, because common cold is infectious for five days after onset of symptoms (**Heymann**, 2008).

4 Start of observation with a healthy day; **case definition of secondary case:** can acquire infection during the first five days after- and one day before onset of symptoms in the primary case, because common cold is also infectious one day before onset of symptoms (**Heymann**, 2008).

5 Start of observation with a healthy day; **case definition of secondary case:** can acquire infection during the symptomatic days, but a maximum of five days since onset of symptoms in the primary case (**Heymann**, 2008).

6 Start of observation with a healthy day; **case definition of secondary case:** can acquire infection during the symptomatic days, but a maximum of five days since onset of symptoms, and additionally one day before onset of symptoms in the primary case (**Heymann**, 2008).

7 Start of observation with a healthy day; **case definition of secondary case:** can acquire infection during all symptomatic days and one day before onset of symptoms in the primary case (**Heymann**, 2008).

**References:**

**Bayer C, Remschmidt C, an der Heiden M, Tolksdorf K, Herzhoff M, Kaersten S, Buda S, Haas W & Buchholz U**. (2014). Internet-Based Syndromic Monitoring of Acute Respiratory Illness in the General Population of Germany, Weeks 35/2011 to 34/2012. *Euro Surveill, 19*(4).

**Heymann DL**. (2008). *Control of Communicable Diseases Manual* (Heymann DL Ed. Vol. 19th). Washington: American Public Health Association.

**Supplementary Material 3:** Different scenarios for assessment of transmission depending on infectious period of gastroenteritis

Scenario 1 is the base case scenario, including every observation. In scenario 2, all participants started the observation with a healthy day. Scenarios 3 to 7 were based on scenario 2 and reflected the information on the infectiousness and the duration of diseases for common gastrointestinal pathogens (*see detailed information below the table*).

The number of observed potential transmission events varied by the factor 3.7 between the different scenarios. The percentage of all symptomatic days, potentially attributable to acquired infections from within the household, also varied by a factor of 2.5 across the scenarios. Increasing the assumed duration of infectiousness of the primary case resulted in an increased number of transmission episodes and hence there were more days associated with acquired infections. However, it also increases the risk of including transmission in both directions.

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Scenario 11** | **Scenario 22** | **Scenario 33** | **Scenario 44** | **Scenario 55** | **Scenario 66** | **Scenario 77** |
| ***Base case*** |
| Number of observed infection episodes | 146 | 144 | 144 | 144 | 144 | 144 | 144 |
| Number of households with at least one infection | 56 | 56 | 56 | 56 | 56 | 56 | 56 |
| Number of households with at least one potential transmission event | 10 | 10 | 21 | 21 | 10 | 13 | 13 |
| Number of infection episodes not resulting in transmission events | 114 | 112 | 70 | 70 | 112 | 101 | 101 |
| Number of secondary cases potentially resulting from transmission events | 20 | 20 | 47 | 57 | 20 | 33 | 33 |
| Number of days with symptoms | 319 | 316 | 316 | 316 | 316 | 316 | 316 |
| Number of infectious days according to the respective definition | 73 | 73 | 469 | 688 | 70 | 122 | 125 |
| Number of days potentially resulting from transmission | 41 | 41 | 88 | 113 | 41 | 72 | 72 |
| % of all symptomatic days potentially attributable to within household transmission | **12.9** | **13.0** | **27.9** | **35.8** | **13.0** | **22.8** | **22.8** |
| Number of potential transmission events | **23** | **23** | **67** | **86** | **23** | **42** | **42** |

1 All cases; **case definition of secondary case:** can acquire infection during all symptomatic days of the primary case.

2 Start of observation with a healthy day, because people might start documenting when they are affected by an infection (**Bayer et al.**, 2014); **case definition of secondary case:** can acquire infection during all symptomatic days of the primary case.

3 Start of observation with a healthy day; **case definition of secondary case:** can acquire infection during the first eight days after onset of symptoms in the primary case, because Rotavirus detectable for eight days (**Heymann**, 2008) and Rotavirus mostly detected in gastroenteritis (**Payne et al.**, 2013) .

4 Start of observation with a healthy day; **case definition of secondary case:** can acquire infection during the first eight days after- and one day before onset of symptoms in the primary case, because we assume first day of incubation period (24-72 hours) as infectious (**Heymann**, 2008).

6 Start of observation with a healthy day; **case definition of secondary case:** can acquire infection during the symptomatic days or a maximum of eight days since onset of symptoms in the primary case.

7 Start of observation with a healthy day; **case definition of secondary case:** can acquire infection during the symptomatic days or a maximum of five days since onset of symptoms, and additionally one day before onset of symptoms in the primary case (**Heymann**, 2008).

9 Start of observation with a healthy day; **case definition of secondary case:** can acquire infection during all symptomatic days and one day before onset of symptoms in the primary case (**Heymann**, 2008).

**References:**

**Bayer C, Remschmidt C, an der Heiden M, Tolksdorf K, Herzhoff M, Kaersten S, Buda S, Haas W & Buchholz U**. (2014). Internet-Based Syndromic Monitoring of Acute Respiratory Illness in the General Population of Germany, Weeks 35/2011 to 34/2012. *Euro Surveill, 19*(4).

**Payne DC, Vinje J, Szilagyi PG, Edwards KM, Staat MA, Weinberg GA, Hall CB, Chappell J, Bernstein DI, Curns AT, Wikswo M, Shirley SH, Hall AJ, Lopman B & Parashar UD**. (2013). Norovirus and Medically Attended Gastroenteritis in U.S. Children. *N Engl J Med, 368*(12), 1121-1130. doi: 10.1056/NEJMsa1206589

**Heymann DL**. (2008). *Control of Communicable Diseases Manual* (Heymann DL Ed. Vol. 19th). Washington: American Public Health Association.

Supplementary Material 4: Distribution of identified pathogens (n=117) in case of acute respiratory infections (ARI)

|  |  |  |
| --- | --- | --- |
| **Pathogen** | **N** | **%** |
| Picornavirus | 78 | 66.7 |
| Picornavirus + Adenovirus | 13 | 11.1 |
| Adenovirus | 8 | 6.8 |
| Respiratory syncytial virus | 8 | 6.8 |
| Influenza (A/B) | 7 | 6.0 |
| Picornavirus + Influenza (A/B) | 1 | 0.9 |
| Picornavirus + Respiratory syncytial virus | 1 | 0.9 |
| Adenovirus + Respiratory syncytial virus | 1 | 0.9 |
| **Total** | **117** | **100.0** |

**Supplementary Material 5:** Sent swabs (n=293) by duration of acute respiratory infection (ARI) episodes (n=608)

|  |  |  |  |
| --- | --- | --- | --- |
| **Duration in days** | **Number of episodes** | **Number of sent swabs** | **%** |
| 1 | 71 | 20 | 28.2 |
| 2 | 61 | 16 | 26.2 |
| 3 | 73 | 34 | 46.6 |
| 4 | 59 | 28 | 47.5 |
| 5 | 52 | 22 | 42.3 |
| 6 | 50 | 23 | 46.0 |
| 7 | 40 | 21 | 52.5 |
| 8 | 25 | 16 | 64.0 |
| 9 | 30 | 14 | 46.7 |
| 10 | 21 | 16 | 76.2 |
| 11 | 21 | 13 | 61.9 |
| 12 | 14 | 8 | 57.1 |
| 13 | 11 | 6 | 54.5 |
| 14 | 12 | 6 | 50.0 |
| 15 | 5 | 3 | 60.0 |
| 16 | 9 | 6 | 66.7 |
| 17 | 5 | 4 | 80.0 |
| 18 | 7 | 3 | 42.9 |
| 19 | 7 | 4 | 57.1 |
| >= 20 | 35 | 30 | 85.7 |
| **Total** | **608** | **293** | **48.2** |

**Supplementary Material 6:** Extension of table in Supplementary Material 2 for pathogen information

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|  | **Scenario 1** | **Scenario 2** | **Scenario 3** | **Scenario 4** | **Scenario 5** | **Scenario 6** | **Scenario 7** |
| **%**  **Matching\*** | 65 | 64 | 67 | 63 | 67 | 63 | 62 |
| **%**  **Not Matching\*** | 35 | 36 | 33 | 38 | 33 | 38 | 38 |

\*Identified pathogens in both involved persons in a transmission event.