

# Epidemiological parameter review and comparative dynamics of influenza, respiratory syncytial virus, rhinovirus, human coronavirus, and adenovirus

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## 1 Introduction

Influenza-like illness (ILI) accounts for a large burden of annual morbidity and mortality worldwide (WHO 2020). Despite this, diagnostic testing for specific viruses underlying ILI is relatively rare (CDC 2019). This results in a lack of information about the pathogens that make between 9 million and 49 million people sick every year in the United States alone (CDC 2020). Yet knowledge of the specific diseases is necessary for timely treatment to prevent unnecessary suffering and death (Nguyen 2016, Van Asten et al. 2012, Pawelek et al. 2015).

ILI is defined by the CDC as fever of 100°F and a cough and/or a sore throat without a known cause other than influenza (CDC 2020). Defining ILI as a cluster of symptoms rather than a specific disease or diseases is necessary for keeping track of case counts, as well as for important analysis and forecasting (Osthus and Moran 2019). However, the cluster of symptoms known as ILI is caused by many underlying pathogens (Taylor 2017, Galindo-Fraga 2013). Positive diagnosis is a prerequisite for accurate treatment. To respond to this need and to gain a finer-grained understanding of ILI that will contribute to a practical foundation for advances in diagnostics and interventions, we here review the literature for parameter values. We then compare the dynamics of five common upper respiratory viruses implicated in ILI: influenza, respiratory syncytial virus (RSV), rhinovirus, human coronavirus (HCoV), and adenovirus.

We conducted a literature review to establish plausible ranges for model parameters, and developed a deterministic system of ordinary differential equations to model the general dynamics of these five viruses.

## 2 Results of Parameter Literature Review

### 2.1 ILI Viruses

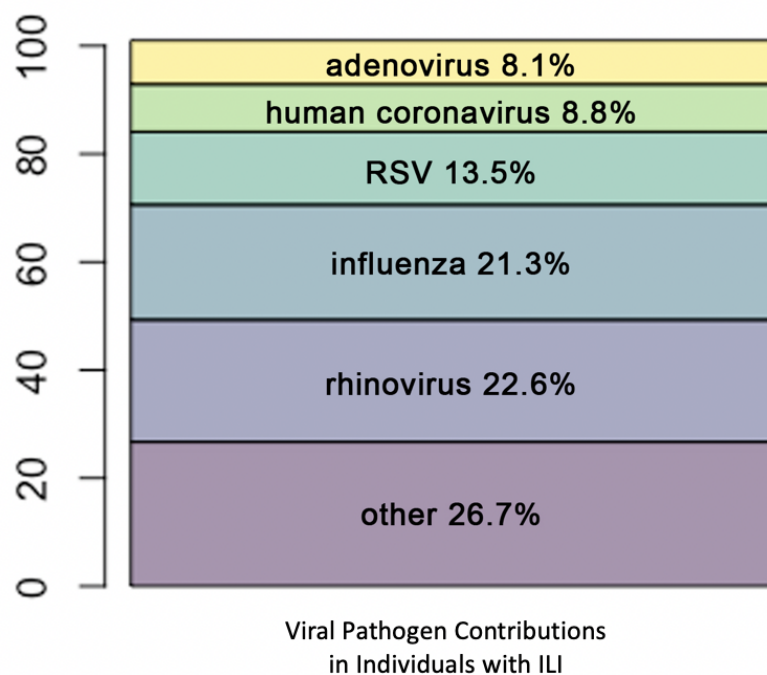
We reviewed the literature for the epidemiological parameters: incubation period, infectious period, hospitalization period, hospitalized proportion, case fatality proportion, and  $R_0$ . We included results from experimental and observational studies, as well as from systematic reviews when there were insufficient

Table 1: Parameters for Influenza-like illness

| Summary of Parameters from Literature Review      | Range (min to max) | Mean        | Standard Deviation | References   |
|---|--------------------|-------------|--------------------|--|
| <b>INCUBATION PERIOD (days)</b>                   |                    |             |                    |  |
| <i>virus</i>                                      | <i>range</i>       | <i>mean</i> | <i>SD</i>          |  |
| influenza   | 1-6.3              | 2.61        | 0.993              | Zaas 2009, Fritz 1999, Couch 1971, Oner 2006, Moser 1979, Kaiser 1999, Kondo 1991, Lessler 2009, Wat 2004  |
| RSV   | 3-8                | 4.5         | 0.894              | Lessler 2009, Zaas 2009, Johnson 1961, Pringle 1993, Tyrell 1993, Wat 2004   |
| rhinovirus  | 0.42-5.5           | 2.36        | 1.10               | Lessler 2009, Reich 2011, Douglas 1967, Avila 2009, Drake 2000, Naclerio 1987, Harris 1996, Zaas 2009, Tyrell 1993, Wat 2004                           |
| human coronavirus                                 | 1.9-14.7           | 5.07        | 2.21               | Lessler 2009, Bradburne 1967, Tyrell 1993, Wat 2004, Valtonen 2019, Assiri 2013, Virlogeux 2016, WHO 2003, Anderson 2004                               |
| adenovirus  | 1-30               | 6.71        | 2.04               | Sendra-Gutierrez 2004, Lessler 2009, Felkin 1999, Commission on Acute Respiratory Diseases 1947, Berger 2010, Tanz 2017, Wat 2004, Robinson 2007       |
| <b>INFECTIOUS PERIOD (days)</b>                   |                    |             |                    |  |
| <i>virus</i>                                      | <i>range</i>       | <i>mean</i> | <i>SD</i>          |  |
| influenza   | 1-9                | 4.58        | 2.56               | Fritz 1999, Couch 1971, Kaiser 1999, Sansone 2019, Cowling 2009, Taylor 2017   |
| RSV   | 1-21               | 7.72        | 1.94               | Hall 2001, Weber 2001, CDC <a href="https://www.cdc.gov/rsv/about/transmission.html">https://www.cdc.gov/rsv/about/transmission.html</a> , Taylor 2017 |
| rhinovirus  | 7-16               | 9.40        | 1.70               | Taylor 2017, Nicholson 1996, Arruda 1997, Douglas 1966, Landry 2004  |
| human coronavirus                                 | 7-35               | 15.20       | 10.30              | Taylor 2017, Kaiser 2005, Chiu 2005, Valtonen 2019, Anderson 2004, Chowell 2004  |
| adenovirus  | 7-17               | 8.20        | 2.89               | Sendra-Gutierrez 2004, Taylor 2017, Hong 2001, Robinson 2007   |
| <b>HOSPITALIZATION PERIOD (days)</b>              |                    |             |                    |  |
| <i>virus</i>                                      | <i>range</i>       | <i>mean</i> | <i>SD</i>          |  |
| influenza   | 3.5-11.3           | 6.36        | 3.27               | Sansone 2019, Kim 1979, Draganescu 2018, Taylor 2017, Broor 2014   |
| RSV   | 2-17.5             | 5.24        | 2.32               | Howard 2000, Morrow 2006, Shay 1999, Taylor 2017, Chiu 2010, Broor 2014  |
| rhinovirus  | 0.4-1.67           | 1.19        | 0.87               | Taylor 2017, Tam 2018, Iwane 2011  |
| human coronavirus                                 | 1.5-11             | 4.96        | 4.27               | Taylor 2017, Chiu 2005, Boivin 2005, Corman 2016   |
| adenovirus  | 3.12-7             | 4.71        | 2.03               | Taylor 2017, Chiu 2010, Peled 2004   |
| <b>HOSPITALIZATION PROPORTION (dimensionless)</b> |                    |             |                    |  |
| <i>virus</i>                                      | <i>range</i>       | <i>mean</i> | <i>SD</i>          |  |
| influenza   | .000035-.062       | 0.00372     | 0.00750            | Iwane 2004, Broor 2014, Millman 2015, Ang 2014, Taylor 2017  |
| RSV   | 0.00034-.29        | 0.021       | 0.0215             | Falsey 2019, Mullooly 2007, Iwane 2004, Broor 2014, Avendano 2003, Taylor 2017, Weber 2001   |
| rhinovirus  | 0.0093-0.024       | 0.0121      | 0.0108             | Taylor 2017, Miller 2016, Lee 2012   |
| human coronavirus                                 | 0.00224-0.52       | 0.188       | 0.241              | Taylor 2017, Bastien 2005, Reina 2014, Chiu 2005   |
| adenovirus  | 0.014-0.95         | 0.43        | 0.39               | Galindo-Fraga 2013, Hilleman 1957, Taylor 2017, Hong 2001  |
| <b>CASE FATALITY PROPORTION (dimensionless)</b>   |                    |             |                    |  |
| <i>virus</i>                                      | <i>range</i>       | <i>mean</i> | <i>SD</i>          |  |
| influenza   | 0.000106-0.0827    | 0.0312      | 0.0415             | Glezen 1982, Cohen 2017, Alonso 2007, Quandelacy 2013, Mendez-Dominguez 2019   |
| RSV   | 0.00031-0.165      | 0.0464      | 0.0627             | Welliver 2010, Howard 2000, Cohen 2017, Tsolia 2003, Avendano 2003, Lee 2013   |
| rhinovirus  | 0-0.125            | 0.0451      | 0.0694             | Nicholson 1996, Fica 2015, Falsey 2002   |
| human coronavirus                                 | 0-0.34             | 0.147       | 0.146              | Ramadan 2019, Chang 2017, Bastien 2005, Reina 2014, Lee 2013, Falsey 2002  |
| adenovirus  | 0.00075-0.166      | 0.103       | 0.0694             | Galindo-Fraga 2013, Wesley 1993, Gerber 2001, Larranaga 2007, Ko 2019, Hong 2001, WHO 2019   |
| <b>R<sub>0</sub> (dimensionless)</b>              |                    |             |                    |  |
| <i>virus</i>                                      | <i>range</i>       | <i>mean</i> | <i>SD</i>          |  |
| influenza   | 1.06-3.4           | 1.68        | 0.871              | Wallinga 2006, de Blasio 2012, Sonthichai 2011, Chowell 2008, Chowell 2010, Biggerstaff 2014   |
| RSV   | 1.2-9.1            | 3.47        | 2.67               | Weber 2001, Reis 2016, Velasco-Hernandez 2015, Duvvuri 2015, Pitzer 2015, Reis 2018, Levy 2018   |
| rhinovirus  | 1.2-1.83           | 1.88        | 0.70               | Reis 2018, Levy 2018, Scully 2018  |
| human coronavirus                                 | 2.7-8              | 4.18        | 2.26               | Majumder 2014, Chang 2017, Leung 2004, Kim 2016, Lee 2013, Lipsitch 2003, Bauch 2005, Riley 2003   |
| adenovirus  | 2.34 (1 value)     | 2.34        | NA                 | Reis 2018  |

studies.  $R_0$  values were estimated from modeling studies. In one case, (SARS-hCoV), we included an estimate for the infectious period, since values were lacking in the literature (Chowell 2004). We also searched the literature for the contribution made by each of the five viruses to the total viral community in people with ILI. Across ten study populations, at least one virus was identified in an average of 62% of individuals with ILI symptoms. Out of these 62% of patients with ILI in whom viruses have been identified,

Figure 1: Viral Composition



adenovirus was identified in 8.1% of samples, human coronavirus in 8.8%, RSV in 13.5%, influenza in 21.3%, and rhinovirus in 22.6%. Coinfection was not taken into account in these estimates.

## 2.2 Human Coronavirus

Table 2: Parameters for HCoV

| Summary of Parameters from Literature Review for Human Coronavirus (HCoV) |             |       |       |  |
|---|-------------|-------|-------|--|
| Parameter   | Range       | Mean  | SD    | References   |
| Incubation Period   | 1.9-14.7    | 5.07  | 2.21  | Lessler 2009, Bradburne 1967, Tyrell 1993, Wat 2004, Valtonen 2019, Assiri 2013, Virlogeux 2016, WHO 2003, Anderson 2004 |
| Infectious Period   | 7-35        | 15.20 | 10.30 | Taylor 2017, Kaiser 205, Chiu 2005, Valtonen 2019, Anderson 2004, Chowell 2004   |
| Hospitalization Period  | 1.5-11.0    | 4.96  | 4.27  | Taylor 2017, Chiu 2005, Boivin 2005, Corman 2016   |
| Hospitalization Proportion  | 0.0024-0.52 | 0.188 | 0.241 | Taylor 2017, Bastien 2005, Reina 2014, Chiu 2005   |
| Case Fatality Proportion  | 0-0.34      | 0.147 | 0.146 | Ramadan 2019, Chang 2017, Bastien 2005, Reina 2014, Lee 2013, Falsey 2002  |
| $R_0$   | 2.7-8       | 4.18  | 2.26  | Majumder 2014, Chang 2017, Leung 2004, Kim 2016, Lee 2013, Lipsitch 2003, Bauch 2005, Riley 2003                         |

In view of the current outbreak of novel coronavirus 2019-nCoV, and given the need for plausible parameters for modeling efforts, we conducted an in-depth literature review for human coronavirus.

2019-nCoV has been identified as a member of genus betacoronavirus, along with SARS and MERS (WHO 2020). Until the genomes of 2019-nCoV have been further characterized, it seems reasonable to suspend assumptions about the epidemiological behavior of the novel virus, and to include all known strains in the parameter sets. Thus, our review includes values for strains 229E, NL63, OC43, HKU1, SARS, and MERS. Means have been collected when possible; when not available, medians have been recorded. Information on the studies, the strains, the sample sizes, and the references is available on pages 26-27 of this paper.

We included values for  $R_0$  only for SARS and MERS, and attempted to include them only for the period before large-scale interventions were implemented, since  $R_0$  is defined as the average number of secondary infections produced when one infected individual is introduced into a fully susceptible population (K. Deitz, 1975). Since the seasonal strains of human coronavirus are endemic in the world, there is, by definition, no fully susceptible population for 229E, NL63, OC43, or HKU1 in which  $R_0$  may be assessed.

Results of our review for human coronavirus include the following mean values: an incubation period of 5.01 days, an infectious period of 15.2 days, a hospitalization period of 4.96 days, a hospitalized proportion of 0.188, a case fatality proportion of 0.147, and an  $R_0$  of 3.7.

### 3 Deterministic Model

#### 3.1 Description of Model Structure

The model diagram (Fig.1) illustrates the progression of influenza-like illness (ILI) in a human population of a hypothetical small city containing 10,000 individuals. We assume density-dependence, that is, for a fixed population of 10,000 humans with negligible migration, the contact rate for individuals remains constant.

The total population ( $N$ ) consists of seven classes: susceptible ( $S$ ), exposed but not infectious ( $E$ ), first infectious class ( $I_1$ ), second infectious class ( $I_2$ ), hospitalized ( $H$ ), recovered ( $R$ ), or dead ( $D$ ). Individuals are considered susceptible until they contact an infectious individual from ( $I_1$ ), ( $I_2$ ), or ( $H$ ). Given contact with an infectious individual, transmission takes place with some probability. After transmission of the virus has occurred, susceptible people move to the exposed class ( $E$ ), where they spend a number of days equal to the mean period of time between infection and the onset of infectiousness (the latent period). We assume here that the latent period equals the incubation period, or the mean period of time between exposure to the virus and the onset of symptoms. After the latent period, they move to the first infectious class ( $I_1$ ). The mean duration of the first infectious period differs according to the underlying virus. Symptoms worsen for some proportion of the first infectious class, who enter the hospital ( $H$ ), where they remain infectious. Individuals who do not enter the hospital remain ill outside the hospital for the duration of the second infectious period ( $I_2$ ). From ( $I_2$ ), the length of which differs according to the underlying virus, where we assume that the progression of the illness is not severe, individuals recover. The duration of hospitalization differs according to the underlying virus. From the hospital, individuals either recover ( $R$ ) or die ( $D$ ). We assume that hospitalized individuals have 75% less contact with susceptible individuals, which results in 75% reduced transmission during hospitalization. We further assume that recovered individuals ( $R$ ) gain full immunity to the virus causing the illness.

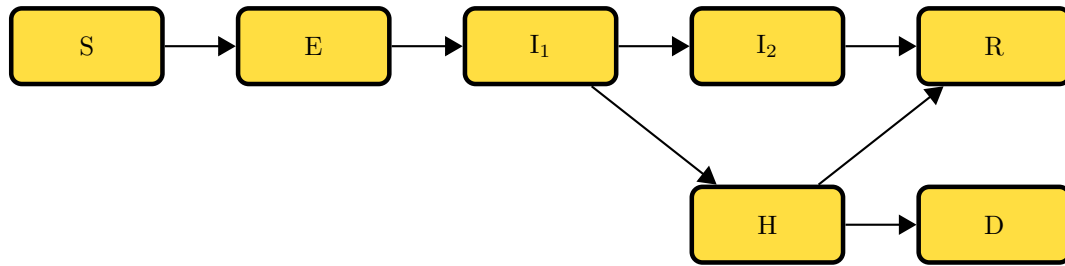


Figure 2: Transfer diagram for ILI virus transmission.

Table 3: Descriptions of state variables

| Variable | Description                                      |
|----------|--|
| $S$      | Number of susceptible individuals                |
| $E$      | Number of exposed (not infectious) individuals   |
| $I_1$    | Number of initially infectious individuals       |
| $I_2$    | Number of infected, non-hospitalized individuals |
| $H$      | Number of hospitalized individuals               |
| $R$      | Number of recovered individuals                  |
| $D$      | Number of dead individuals                       |

Model assumptions include:

- (1) From the initially infectious state, individuals progress to hospital or continued non-hospitalized infectious state.
- (2) From the non-hospitalized infectious state, individuals progress to recovery.
- (3) From the hospitalized state, individuals progress to death or recovery.
- (4) Everyone who recovers gains full immunity.
- (5) Total infected population =  $E + I_1 + I_2 + H$ .
- (6) Total infectious population =  $I_1 + I_2 + H$ .
- (7) The viruses operate independently.
- (8) The population is homogeneously mixed.
- (9) No demographics are included.
- (10) The transmission rate for each virus is calculated from the expression for  $R_0$  below, using the mean  $R_0$  values from the literature.

Table 4: Descriptions and dimensions for parameters

| Parameter  | Description  | Dimension   |
|------------|--|---|
| $\beta$    | basic transmission rate  | $\text{individuals}^{-1} \times \text{time}^{-1}$ |
| $c$        | reduction of transmission in hospital                                    | dimensionless                                     |
| $\gamma_1$ | per capita rate of progress from exposed to infectious state             | $\text{time}^{-1}$                                |
| $\gamma_2$ | per capita rate of progress through initial infectious state             | $\text{time}^{-1}$                                |
| $\gamma_3$ | per capita rate of progress through hospitalized state                   | $\text{time}^{-1}$                                |
| $\gamma_4$ | per capita rate of progress through non-hospitalized infectious state    | $\text{time}^{-1}$                                |
| $p_1$      | proportion of initially infectious population that becomes hospitalized. | dimensionless                                     |
| $p_2$      | proportion of hospitalized population that die                           | dimensionless                                     |

### 3.2 Model Equations

The equations governing common upper respiratory virus dynamics are given by

$$\frac{dS}{dt} = -\beta S(I_1 + I_2 + cH) \quad (1a)$$

$$\frac{dE}{dt} = \beta S(I_1 + I_2 + cH) - \gamma_1 E \quad (1b)$$

$$\frac{dI_1}{dt} = \gamma_1 E - \gamma_2 I_1 \quad (1c)$$

$$\frac{dI_2}{dt} = \gamma_2(1 - p_1)I_1 - \gamma_4 I_2 \quad (1d)$$

$$\frac{dH}{dt} = \gamma_2 p_1 I_1 - \gamma_3 H \quad (1e)$$

$$\frac{dR}{dt} = \gamma_4 I_2 + \gamma_3(1 - p_2)H \quad (1f)$$

$$\frac{dD}{dt} = \gamma_3 p_2 H \quad (1g)$$

The total population is  $N = S + E + I_1 + I_2 + H + R + D$ . Parameters

## 4 Quantities of Interest

### 4.1 Disease-free Equilibrium

We assume that the stable population, representing a hypothetical small city, is  $N = 10000$ . We further assume that the initial value for the Susceptible population is  $S_0 = 10000$ . In the disease-free state, all infected classes are zero, that is,  $E = I_1 = I_2 = H = 0$ . Substituting and setting the derivatives equal to zero, it is evident that in the disease-free state, the other state variables  $R$  and  $D$  will continue to contain zero individuals, and that the Susceptible class  $S$  will remain equal to the total population  $N$ , as follows.

$$\frac{dS}{dt} = -\beta S(0 + 0 + c(0)) = 0 \quad (2a)$$

$$\frac{dE}{dt} = \beta S(0 + 0 + c(0)) - \gamma_1(0) = 0 \quad (2b)$$

$$\frac{dI_1}{dt} = \gamma_1(0) - \gamma_2(0) = 0 \quad (2c)$$

$$\frac{dI_2}{dt} = \gamma_2(1 - p_1)(0) - \gamma_4(0) = 0 \quad (2d)$$

$$\frac{dH}{dt} = \gamma_2 p_1(0) - \gamma_3(0) = 0 \quad (2e)$$

$$\frac{dR}{dt} = \gamma_4(0) + \gamma_3(1 - p_2)(0) = 0 \quad (2f)$$

$$\frac{dD}{dt} = \gamma_3 p_2(0) = 0 \quad (2g)$$

Additionally, if we set any one of E, I<sub>1</sub>, I<sub>2</sub>, or H to zero, the other three state variables representing infected classes must also be zero. In this case, N=S=10000. Thus, where  $x = (S, E, I_1, I_2, H, R, D)$  denotes solutions of the system,  $x_{dfe} = (10000, 0, 0, 0, 0, 0, 0)$  represents the disease-free equilibrium for the system.

## 4.2 Basic Reproduction Number

Assuming a homogeneously mixed population, the basic reproductive number ( $R_0$ ) is defined as the average number of secondary infections produced when one infected individual is introduced into a fully susceptible population (K. Dietz, 1993). Four compartments, latently infected individuals (E), symptomatic and infected individuals (I<sub>1</sub>), symptomatic and infected and non-hospitalized individuals (I<sub>2</sub>), and hospitalized individuals (H), together characterize the total infected population for the ILLI virus system. To calculate  $R_0$  for this system, we derive the next generation matrix (Van den Driessche and Watmough 2002).

Method:

1. Derive the matrix for the transmission term describing everyone entering (E): the "F" matrix;
2. Derive the matrix for the transition terms describing everyone transitioning between infected classes (E, I<sub>1</sub>, I<sub>2</sub>, H): the "V" matrix;
3. Next Generation Matrix (NGM) = (F)(V<sup>-1</sup>);
4. The largest dominant eigenvalue or spectral radius of the NGM = R<sub>0</sub> for the system.

The transmission term for the system is  $\beta S(I_1 + I_2 + cH)$

$$\mathbf{F} = \begin{pmatrix} 0 & \beta S & \beta S & \beta S c \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \quad (3)$$

The transmission terms for the system are  $(-\gamma_1 E), (\gamma_1 E - \gamma_2 I_1), (\gamma_2(1 - p_1)I_1 - \gamma_4 I_2), (\gamma_2 p_1 I_1 - \gamma_3 H)$ .

$$\mathbf{V} = \begin{pmatrix} \gamma_1 & 0 & 0 & 0 \\ -\gamma_1 & \gamma_2 & 0 & 0 \\ 0 & -\gamma_2(1-p_1) & \gamma_4 & 0 \\ 0 & -\gamma_2 p_1 & 0 & \gamma_3 \end{pmatrix} \quad (4)$$

The next generation matrix is

$$\mathbf{FV}^{-1} = \begin{pmatrix} \beta S \left( \frac{1}{\gamma_2} - \frac{(p_1-1)}{\gamma_4} + \frac{cp_1}{\gamma_3} \right) & \beta S \left( \frac{1}{\gamma_2} - \frac{(p_1-1)}{\gamma_4} + \frac{cp_1}{\gamma_3} \right) & \frac{\beta S}{\gamma_4} & \frac{\beta S c}{\gamma_3} \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \quad (5)$$

The spectral radius, or the largest positive eigenvalue of the next generation matrix, is the basic reproductive number of the system at the disease-free equilibrium, as follows.

$$R_0 = \frac{\beta S (cp_1 \gamma_2 \gamma_4 - p_1 \gamma_2 \gamma_3 + \gamma_2 \gamma_3 + \gamma_3 \gamma_4)}{\gamma_2 \gamma_3 \gamma_4} \quad (6)$$

This expression for the basic reproductive number ( $R_0$ ) depends on the parameters  $\beta, c, p_1, \gamma_2, \gamma_3$  and  $\gamma_4$ , and on the initial conditions for the state variables.  $\beta$  is clearly directly proportional to  $R_0$ .

#### CONCEPTUAL METHOD OF DERIVING $R_0$

$$R_0 = P(\text{arriving at } I_1)(R_0 \text{ while in } I_1) + P(\text{arriving at } I_2)(R_0 \text{ while in } I_2) + P(\text{arriving at H})(R_0 \text{ while in H})$$

$$R_0 = \left( \frac{\gamma_1}{\gamma_1} \right) \frac{\beta S I_1}{\gamma_2} + \left( \frac{\gamma_1}{\gamma_1} \right) (1-p_1) \left( \frac{\beta S I_2}{\gamma_4} \right) + \left( \frac{\gamma_1}{\gamma_1} \right) p_1 \left( \frac{\beta S H c}{\gamma_3} \right)$$

$$R_0 = \left( \frac{\beta S I_1}{\gamma_2} \right) + (1-p_1) \left( \frac{\beta S I_2}{\gamma_4} \right) + p_1 \left( \frac{\beta S H c}{\gamma_3} \right)$$

$$R_0 = \left( \frac{\beta S}{\gamma_2} \right) + \left( \frac{(1-p_1)\beta S}{\gamma_4} \right) + \left( \frac{p_1 c \beta S}{\gamma_3} \right)$$

$$R_0 = \frac{\beta S (\gamma_3 \gamma_4 + (1-p_1)\gamma_2 \gamma_3 + p_1 c \gamma_2 \gamma_4)}{\gamma_2 \gamma_3 \gamma_4}$$

$$R_0 = \frac{\beta S (cp_1 \gamma_2 \gamma_4 - p_1 \gamma_2 \gamma_3 + \gamma_2 \gamma_3 + \gamma_3 \gamma_4)}{\gamma_2 \gamma_3 \gamma_4}$$

This result is equivalent to the result obtained, above, by the next generation method.



## 5 Discussion

There are several limitations to this study. First, the model is not age-structured. Second, the assumption that the latent period equals the incubation period may result in an overestimation of the latent period. This is because the beginning of the true infectious period may occur before the onset of symptoms; however, this is difficult to measure and is not generally reported in the studies that report values for the incubation period. Third, a single mortality rate has been modeled for the hospitalized infected and non-hospitalized infected classes. Fourth, many of the studies that generated parameter values evaluated populations treated at clinics or admitted at hospitals. However, a significant proportion of illness and death may occur outside of hospitals and clinics (see Cohen et al. 2017).

Much work remains to be done to elucidate the etiology of ILI.

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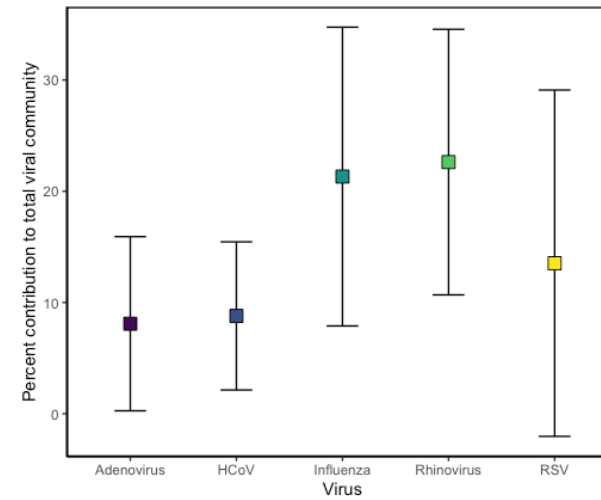
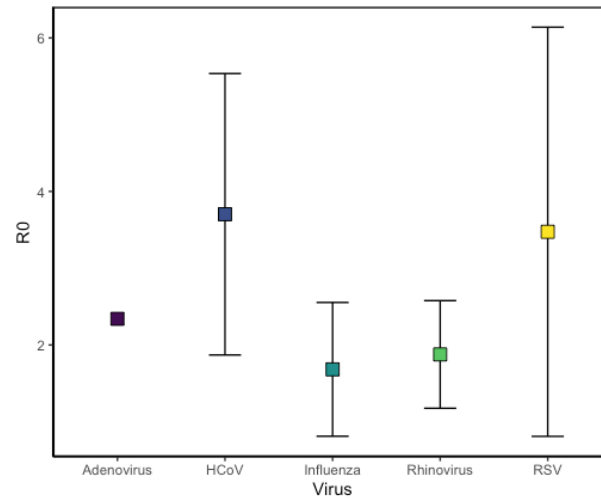
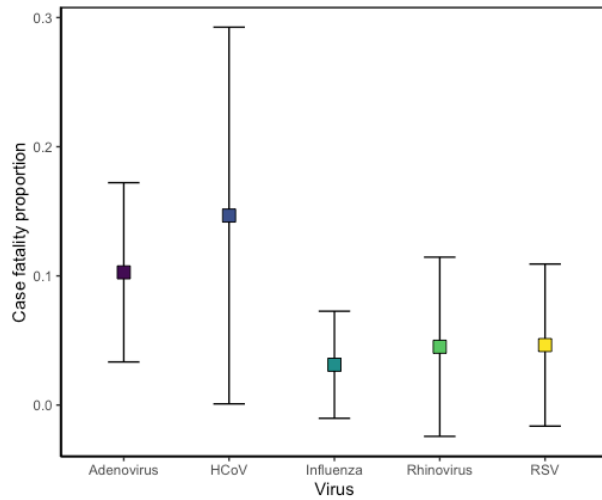
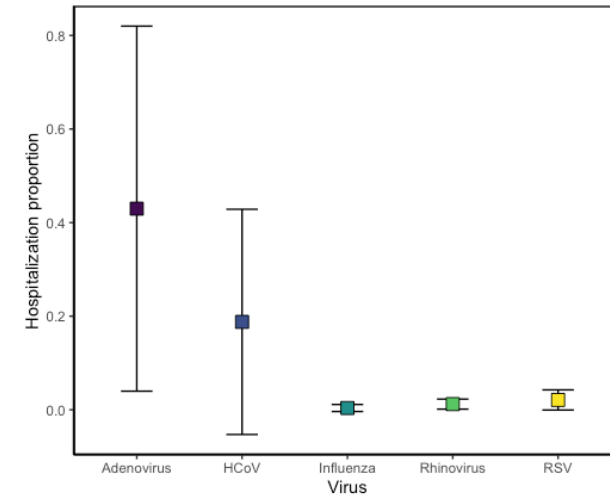
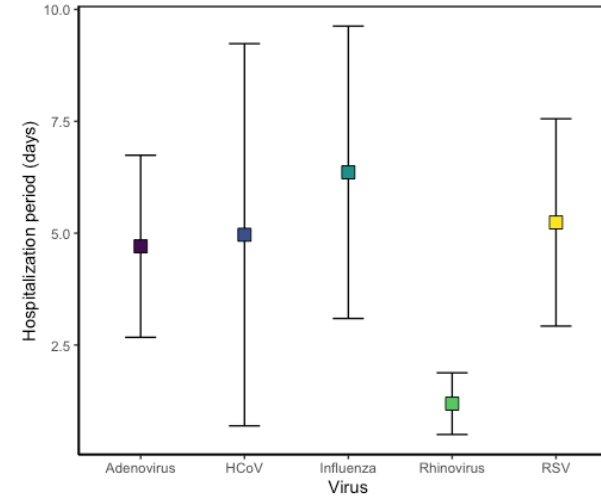
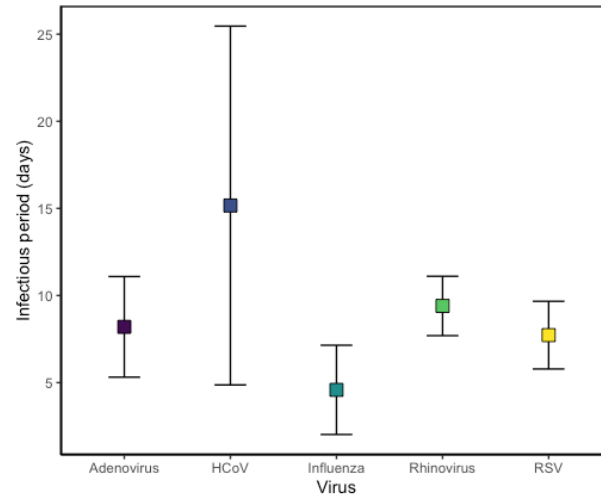
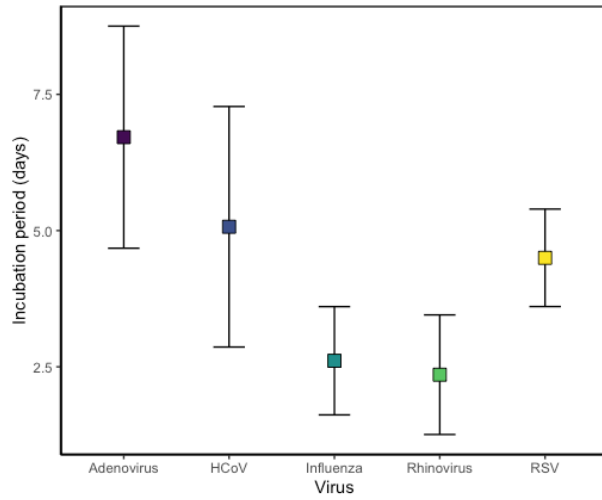
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# ILI Parameter Ranges and Means



**INFLUENZA parameters: incubation period, infectious period, hospitalization period, hospitalization proportion, case fatality, R0**

| parameter              | type of study     | study time     | population                          | sample size | strain           | definition of                         | method | notes                               | patient age     | range                | mean      | citation  |
|------------------------|-------------------|----------------|-------------------------------------|-------------|------------------|---------------------------------------|--------|-------------------------------------|-----------------|----------------------|-----------|---|
| (Influenza A & B)      |                   |                |                                     |             |                  |                                       |        |                                     |                 |                      |           |   |
| incubation period      |                   |                |                                     |             |                  |                                       |        |                                     |                 |                      |           |   |
|                        | experimental      | 30 days        | healthy adults                      | 17          | seasonal         | inoculation to peak symptoms          |        |                                     | adult           | 2-4 days, median 3.3 | 3 days    | Zaas, A.K., Chen, M., Varkey, J., Veldman, T., Hero III, A.O., Lucas, J., Huang, Y., Turner, R., Gilbert, A., Lambkin-Williams, R. and Øien, N.C., 2009. Gene expression signatures diagnose influenza and other symptomatic respiratory viral infections in humans. <i>Cell host &amp; microbe</i> , 6(3), pp.207-217.   |
|                        | experimental      | 8 days         | healthy males                       | 16          | FluA (H1N1)      | inoculation to occurrence of symptoms |        |                                     | 19-35           | 1-3 days             | 2 days    | Fritz, R.S., Hayden, F.G., Calfee, D.P., Cass, L.M., Peng, A.W., Alvord, W.G., Strober, W. and Straus, S.E., 1999. Nasal cytokine and chemokine responses in experimental influenza A virus infection: results of a placebo-controlled trial of intravenous zanamivir treatment. <i>The Journal of infectious diseases</i> , 180(3), pp.586-593.  |
|                        | experimental      | 49 days        | male inmates                        | 43          | FluA (Hong Kong) | inoculation to onset                  |        |                                     | 21-40           | 2-3 days             | 2.5 days  | Couch, R.B., Gordon Douglas Jr, R., Fedson, D.S. and Kasel, J.A., 1971. Correlated studies of a recombinant influenza-virus vaccine. III. Protection against experimental influenza in man. <i>Journal of Infectious Diseases</i> , 124(5), pp.473-480.   |
|                        | observational     |                | admitted to hospital                | 8           | seasonal         | exposure to onset                     |        | exposed to diseased/dead chickens   | 5-15            | 3.7-6.3 days         | 5 days    | Oner, A.F., Bay, A., Arslan, S., Akdeniz, H., Sahin, H.A., Cesur, Y., Epcacan, S., Yilmaz, N., Deger, I., Kizilyildiz, B. and Karsen, H., 2006. Avian influenza A (H5N1) infection in eastern Turkey in 2006. <i>New England Journal of Medicine</i> , 355(21), pp.2179-2185.   |
|                        | observational     |                | airline passengers                  | 54          | FluA(H5N1)       | airline delay to onset                |        |                                     |                 | 1-3 days             | 1.5 days  | Moser, M.R., Bender, T.R., Margolis, H.S., Noble, G.R., Kendal, A.P. and Ritter, D.G., 1979. An outbreak of influenza aboard a commercial airliner. <i>American journal of epidemiology</i> , 110(1), pp.1-6.   |
|                        | experimental      | 8 days         | healthy adults                      | 14          | FluA(H1N1)       | inoculation to onset                  |        |                                     | 19-40           | 2-3 days             | 2.5 days  | Kaiser, L., Briones, M.S. and Hayden, F.G., 1999. Performance of virus isolation and Directigen® Flu A to detect influenza A virus in experimental human infection. <i>Journal of clinical virology</i> , 14(3), pp.191-197.  |
|                        | observational     |                | asthmatic children                  | 20          | NA               |                                       |        |                                     | 43689           | 2-3 days             | 2.5 days  | Kondo, S. and Abe, K., 1991. The effects of influenza virus infection on FEV1 in asthmatic children: the time-course study. <i>Chest</i> , 100(5), pp.1235-1238.  |
|                        | systematic review |                |                                     |             |                  | inoculation to onset of symptoms      |        | range and central tendency          | all             | 1-4 days             | 2 days    | REVIEW: Lessler, J., Reich, N.G., Brookmeyer, R., Perl, T.M., Nelson, K.E. and Cummings, D.A., 2009. Incubation periods of acute respiratory viral infections: a systematic review. <i>The Lancet infectious diseases</i> , 9(5), pp.291-300.   |
|                        | review            | before 2004    | literature                          |             |                  |                                       |        |                                     |                 | 1-4 days             | 2.5       | REVIEW: Wat, D., 2004. The common cold: a review of the literature. <i>European Journal of Internal Medicine</i> , 15(2), pp.79-88.   |
| infectious period      |                   |                |                                     |             |                  |                                       |        |                                     |                 |                      |           |   |
|                        | experimental      | 8 days         | healthy males                       |             | FluA(H1N1)       |                                       |        | mean viral shedding period 4.6 days | 19-35           | 3.1-5.7 days         | 4.6 days  | Fritz, R.S., Hayden, F.G., Calfee, D.P., Cass, L.M., Peng, A.W., Alvord, W.G., Strober, W. and Straus, S.E., 1999. Nasal cytokine and chemokine responses in experimental influenza A virus infection: results of a placebo-controlled trial of intravenous zanamivir treatment. <i>The Journal of infectious diseases</i> , 180(3), pp.586-593.  |
|                        | experimental      | 49 days        | male inmates                        |             | FluA (Hong Kong) |                                       |        |                                     | 21-40           | 2-9 days             | 5.5 days  | Couch, R.B., Gordon Douglas Jr, R., Fedson, D.S. and Kasel, J.A., 1971. Correlated studies of a recombinant influenza-virus vaccine. III. Protection against experimental influenza in man. <i>Journal of Infectious Diseases</i> , 124(5), pp.473-480.   |
|                        | experimental      |                |                                     |             |                  |                                       |        |                                     | 19-40           | 1-8 days             | 4.5 days  | Kaiser, L., Briones, M.S. and Hayden, F.G., 1999. Performance of virus isolation and Directigen® Flu A to detect influenza A virus in experimental human infection. <i>Journal of clinical virology</i> , 14(3), pp.191-197.  |
|                        |                   | 14 days        | ferrets                             | 8           | FluA(H1N1)       |                                       |        | culture + RT-PCR, titer             |                 | 2 days               | 2 days    |   |
|                        | observational     |                | index contacts                      | 350         | seasonal         |                                       |        | culture + RT-PCR                    | all             |                      | 2 days    | Cowling, B.J., Fang, V.J., Riley, S., Peiris, J.M. and Leung, G.M., 2009. Estimation of the serial interval of influenza. <i>Epidemiology (Cambridge, Mass.)</i> , 20(3), p.344.  |
|                        | experimental      | 1 year         | otherwise healthy ILI children      |             | seasonal         |                                       |        |                                     | 6 months-10 yrs |                      | 8.9 days  | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41.   |
|                        | observational     | 1975-1995      | healthy adults                      | 59          | seasonal         | mean duration of illness              |        |                                     | adult           |                      | 6.8 days  | Hall, C.B., Long, C.E. and Schnabel, K.C., 2001. Respiratory syncytial virus infections in previously healthy working adults. <i>Clinical infectious diseases</i> , 33(6), pp.792-796.  |
| hospitalization period |                   |                |                                     |             |                  |                                       |        |                                     |                 |                      |           |   |
|                        | observational     | 31 days (2016) | confirmed FluB outbreak in hospital |             |                  | mean length of hosp. stay             |        |                                     |                 |                      | 11.3 days | Sansone, M., Wiman, A., Karlberg, M.L., Brytting, M., Bohlin, L., Andersson, L.M., Westin, J. and Nordén, R., 2019. Molecular characterization of a nosocomial outbreak of influenza B virus in an acute care hospital setting. <i>Journal of Hospital Infection</i> , 101(1), pp.30-37.  |
|                        | retrospective     | 19 years       | respiratory disease patients        |             |                  |                                       |        |                                     | 0-72 months     |                      | 8 days    | Kim, H.W., Brandt, C.D., Arrobio, J.O., Murphy, B., Chanock, R.M. and Parrott, R.H., 1979. Influenza A and B virus infection in infants and young children during the years 1957-1976. <i>American Journal of Epidemiology</i> , 109(4), pp.464-479.  |
|                        | observational     | 2016-2017      | ILI patients                        |             |                  |                                       |        |                                     | all             | 4-6 days             | 5 days    | Drăgănescu, A., Săndulescu, O., Florea, D., Vlaicu, O., Streinu-Cercel, A., Oțelea, D., Aramă, V., Luminos, M.L., Streinu-Cercel, A., Nițescu, M. and Ivanciuc, A., 2018. The influenza season 2016/17 in Bucharest, Romania—surveillance data and clinical characteristics of patients with influenza-like illness admitted to a tertiary infectious diseases hospital. <i>Brazilian Journal of Infectious Diseases</i> , 22(5), pp.377-386. |
|                        | experimental      | 1 year         | otherwise healthy ILI children      |             | seasonal         |                                       |        |                                     | 6 months-10 yrs |                      | 4 days    | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41.   |

|                            |                         |           |                                 |               |                    |   |                         |                       |           |                |   |   |
|----------------------------|-------------------------|-----------|---------------------------------|---------------|--------------------|---|-------------------------|-----------------------|-----------|----------------|---|---|
|                            | observational           | 2009-2011 | children <5                     | 17            |                    | median length of hospital stay  |                         | < 5                   | 3-4 days  | 3.5 days       | Broor, S., Dawood, F.S., Pandey, B.G., Saha, S., Gupta, V., Krishnan, A., Rai, S., Singh, P., Erdman, D. and Lal, R.B., 2014. Rates of respiratory virus-associated hospitalization in children aged< 5 years in rural northern India. <i>Journal of Infection</i> , 68(3), pp.281-289.   |   |
| hospitalization proportion |                         |           |                                 |               |                    |   |                         |                       |           |                |   |   |
|                            | observational           | 1 season  | children                        |               |                    | number hospitalized out of 1,000  |                         | < 5                   |           | 0.0006         | Iwane, M.K., Edwards, K.M., Szilagyi, P.G., Walker, F.J., Griffin, M.R., Weinberg, G.A., Coulen, C., Poehling, K.A., Shone, L.P., Balter, S. and Hall, C.B., 2004. Population-based surveillance for hospitalizations associated with respiratory syncytial virus, influenza virus, and parainfluenza viruses among young children. <i>Pediatrics</i> , 113(6), pp.1758-1764. |   |
|                            | observational           | 2009-2011 | children <5 in India            | 245           |                    | number hospitalized out of 10,000   |                         | < 5                   |           | 0.0012         | Broor, S., Dawood, F.S., Pandey, B.G., Saha, S., Gupta, V., Krishnan, A., Rai, S., Singh, P., Erdman, D. and Lal, R.B., 2014. Rates of respiratory virus-associated hospitalization in children aged< 5 years in rural northern India. <i>Journal of Infection</i> , 68(3), pp.281-289.   |   |
|                            | retrospective, adjusted | 2003-2013 | all population                  |               |                    | number hospitalized out of 100,000  | PCR, culture, DFA, RIDT | all                   |           | 0.00003-0.0018 | 0.00092   | Millman, A. J., Reed, C., Kirley, P., Aragon, D., Meek, J. I., Farley, M. M., Chaves, S. (2015). Improving Accuracy of Influenza-Associated Hospitalization Rate Estimates. <i>Emerging Infectious Diseases</i> , 21(9), 1595-1601. <a href="https://dx.doi.org/10.3201/eid">https://dx.doi.org/10.3201/eid</a>   |
|                            | observational           | 2004-2008 | all population                  |               |                    | number hospitalized out of 100,000  |                         | <6 months-<br>≥75 yrs |           |                | 0.00028   | Ang, L.W., Lim, C., Lee, V.J.M., Ma, S., Tiong, W.W., Ooi, P.L., Lin, R.T.P., James, L. and Cutter, J., 2014. Influenza-associated hospitalizations, Singapore, 2004–2008 and 2010–2012. <i>Emerging infectious diseases</i> , 20(10), p.1652.  |
|                            | observational           | 2010-2012 | all population                  |               |                    | number hospitalized out of 100,000  |                         | <6 months-<br>≥75 yrs |           |                | 0.0003  | Ang, L.W., Lim, C., Lee, V.J.M., Ma, S., Tiong, W.W., Ooi, P.L., Lin, R.T.P., James, L. and Cutter, J., 2014. Influenza-associated hospitalizations, Singapore, 2004–2008 and 2010–2012. <i>Emerging infectious diseases</i> , 20(10), p.1652.  |
|                            | observational           | 1 year    | otherwise healthy ILI children  | 476           | seasonal           | number hospitalized out of 476  |                         | 6 months-10 yrs       |           |                | 0.019   | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41. |
| case fatality rate         |                         |           |                                 |               |                    |   |                         |                       |           |                |   |   |
|                            | observational           | 2009-2013 | out of all respiratory          | 4378 annually |                    | per person-year   |                         |                       |           |                | 0.00023   | Cohen, C., Walaza, S., Treurnicht, F.K., McMorrow, M., Madhi, S.A., McAnerney, J.M. and Tempia, S., 2017. In-and out-of-hospital mortality associated with seasonal and pandemic influenza and respiratory syncytial virus in South Africa, 2009–2013. <i>Clinical Infectious Diseases</i> , 66(1), pp.95-103.  |
|                            | retrospective           | 1979-2001 | all registered deaths in Brazil | 19 million    | seasonal influenza | Brazil govt. data   |                         | all                   |           |                | 0.003   | Alonso, W.J., Viboud, C., Simonsen, L., Hirano, E.W., Daufenbach, L.Z. and Miller, M.A., 2007. Seasonality of influenza in Brazil: a traveling wave from the Amazon to the subtropics. <i>American journal of epidemiology</i> , 165(12), pp.1434-1442.   |
|                            | retrospective           | 1997-2007 | all U.S.                        |               | seasonal influenza |   |                         | all                   |           |                | 0.07  | Quandefacy, T.M., Viboud, C., Charu, V., Lipsitch, M. and Goldstein, E., 2013. Age-and sex-related risk factors for influenza-associated mortality in the United States between 1997–2007. <i>American journal of epidemiology</i> , 179(2), pp.156-167.  |
|                            | observational           | 2018      | hospitalized ILI patients       |               | seasonal influenza |   |                         | all                   |           |                | 0.0827  | Mendez-Dominguez, N.I., Bobadilla-Rosado, L.O., Fajardo-Ruiz, L.S., Camara-Salazar, A. and Gomez-Carro, S., 2019. Influenza in Yucatan in 2018: Chronology, characteristics and outcomes of ambulatory and hospitalized patients. <i>Brazilian Journal of Infectious Diseases</i> , 23(5), pp.358-362.  |
|                            | retrospective           | 1990-2008 | New Zealand                     |               | seasonal influenza | deaths per 100,000 persons per year   |                         | all                   |           |                | 0.000106  | Kessaram, T., Stanley, J. and Baker, M.G., 2015. Estimating influenza-associated mortality in New Zealand from 1990 to 2008. <i>Influenza and other respiratory viruses</i> , 9(1), pp.14-19.   |
| R0                         |                         |           |                                 |               |                    |   |                         |                       |           |                |   |   |
|                            | from clinical data      |           |                                 |               |                    | Flu   |                         |                       |           |                | 1.73  | Wallinga, J. and Lipsitch, M., 2006. How generation intervals shape the relationship between growth rates and reproductive numbers. <i>Proceedings of the Royal Society B: Biological Sciences</i> , 274(1609), pp.599-604.   |
|                            | estimated               |           |                                 |               |                    | FluA(H1N1)  |                         |                       | 1.06-1.69 |                | 1.35  | de Blasio, B.F., Iversen, B.G. and Tomba, G.S., 2012. Effect of vaccines and antivirals during the major 2009 A (H1N1) pandemic wave in Norway—and the influence of vaccination timing. <i>PLoS One</i> , 7(1), p.e30018.   |
|                            | estimated               |           |                                 |               |                    | FluA(H1N1)  |                         |                       |           |                | 3.4   | Sonthichai, C., Iamsirithaworn, S., Cummings, D.A.T., Shokekird, P., Niramitsantipong, A., Khumket, S., Chittaganpitch, M. and Lessler, J., 2011. Effectiveness of non-pharmaceutical interventions in controlling an influenza A outbreak in a school, Thailand, November 2007. <i>Outbreak, surveillance and investigation reports</i> , 4(2), pp.6-11.                                   |
|                            | estimated               | 1972-1997 | USA, France, Australia          |               | seasonal           | Rp = transmissibility at beginning of epidemic in partially immune population |                         |                       |           |                | 1.3   | Chowell, G.M.A.M., Miller, M.A. and Viboud, C., 2008. Seasonal influenza in the United States, France, and Australia: transmission and prospects for control. <i>Epidemiology &amp; Infection</i> , 136(6), pp.852-864.   |
|                            | estimated               | 1996-2006 | Brazil                          |               | seasonal           |   |                         |                       |           |                | 1.03  | Chowell, G., Viboud, C., Simonsen, L., Miller, M. and Alonso, W.J., 2010. The reproduction number of seasonal influenza epidemics in Brazil, 1996–2006. <i>Proceedings of the Royal Society B: Biological Sciences</i> , 277(1689), pp.1857-1866.   |
|                            | estimated (review)      |           |                                 | 24 studies    | seasonal           |   |                         |                       |           |                | 1.28  | Biggerstaff, M., Cauchemez, S., Reed, C., Gambhir, M. and Finelli, L., 2014. Estimates of the reproduction number for seasonal, pandemic, and zoonotic influenza: a systematic review of the literature. <i>BMC infectious diseases</i> , 14(1), p.480.   |

| parameter         | type of study     | study time  | population   | sample size    | strain | definition of parameter                       | notes  | patient age     | range                | mean      | citation  |
|-------------------|-------------------|-------------|--|----------------|--------|---|--|-----------------|----------------------|-----------|---|
| incubation period |                   |             |  |                |        |   |  |                 |                      |           |   |
|                   | systematic review |             |  | review article |        |   | range and central tendency   |                 | 3-7 days             | 5 days    | REVIEW: Lessler, J., Reich, N.G., Brookmeyer, R., Peri, T.M., Nelson, K.E. and Cummings, D.A., 2009. Incubation periods of acute respiratory viral infections: a systematic review. <i>The Lancet infectious diseases</i> , 9(5), pp.291-300.   |
|                   | experimental      | 30 days     | healthy adults   | 20             | RSV    | inoculation to peak symptoms                  |  | adult           | 4-7 days, median 5.9 | 5.5 days  | Zaas, A.K., Chen, M., Varkey, J., Veldman, T., Hero III, A.O., Lucas, J., Huang, Y., Turner, R., Gilbert, A., Lambkin-Williams, R. and Øien, N.C., 2009. Gene expression signatures diagnose influenza and other symptomatic respiratory viral infections in humans. <i>Cell host &amp; microbe</i> , 6(3), pp.207-217.   |
|                   | experimental      | 10 days     | adult males  | 41             | RSV    |   |  | adult           | 3-7 days             | 4 days    | Johnson KM, Chanock RM, Rifkind D, Dravetz HM, Knight V. 1961. Respiratory syncytial virus infection in adult volunteers. <i>J.A.M.A.</i> 176:663-677, 1961.  |
|                   | experimental      | 10 days     | healthy adults   | 22             | RSV    | inoculation to presence of virus              | ** 3-8 days is length of time virus was present after inoculation                          | 21-50 yrs       | 3-8 days             | 3 days    | Pringle, C.R., Filipiuk, A.H., Robinson, B.S., Watt, P.J., Higgins, P. and Tyrrell, D.A.J., 1993. Immunogenicity and pathogenicity of a triple temperature-sensitive modified respiratory syncytial virus in adult volunteers. <i>Vaccine</i> , 11(4), pp.473-478.  |
|                   | experimental      | 5 days      | adults   | 36             | RSV    | inoculation to peak symptoms                  |  | adult           | 4-5 days             | 5 days    | Tyrell, D.A.J., Cohen, S. and Schilarb, J.E., 1993. Signs and symptoms in common colds. <i>Epidemiology &amp; Infection</i> , 111(1), pp.143-156.   |
|                   | review            | before 2004 | literature   | NA             |        |   |  |                 | 4-5 days             | 4.5 days  | REVIEW: Wat, D., 2004. The common cold: a review of the literature. <i>European Journal of Internal Medicine</i> , 15(2), pp.79-88.   |
| infectious period |                   |             |  |                |        |   |  |                 |                      |           |   |
|                   | observational     | 1975-1995   | healthy adults   | 211            | NA     | mean duration of illness                      |  | adult           |                      | 9.5 days  | Hall, C.B., Long, C.E. and Schnabel, K.C., 2001. Respiratory syncytial virus infections in previously healthy working adults. <i>Clinical infectious diseases</i> , 33(6), pp.792-796.  |
|                   | observational     | <= 1976     | hospitalized infants RSV   | 23             |        | duration of RSV viral shedding                |  | infants         | 1- 21 days           | 6.7 days  | Weber, A., Weber, M. and Milligan, P., 2001. Modeling epidemics caused by respiratory syncytial virus (RSV). <i>Mathematical biosciences</i> , 172(2), pp.95-113.   |
|                   | NA (source: CDC)  | NA          | NA   |                |        | mean duration of contagious period            |  | all             | 3-8 days             | 5.5 days  | CDC, "RSV Transmission," <a href="https://www.cdc.gov/rsv/about/transmission.html">https://www.cdc.gov/rsv/about/transmission.html</a>  |
|                   | experimental      | 1 year      | otherwise healthy ILI children                                     | 235            |        | mean duration of ILI episode                  |  | 6 months-10 yrs |                      | 9.2 days  | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41. |
| hospitalization   |                   |             |  |                |        |   |  |                 |                      |           |   |
|                   | observational     | 1993-1995   | children <= 4  | 10767          | NA     | number of days from admittance to discharge   |  | <= 4 yrs        |                      | 4.9 days  | Howard, T.S., Hoffman, L.H., Stang, P.E. and Simoes, E.A., 2000. Respiratory syncytial virus pneumonia in the hospital setting: length of stay, charges, and mortality. <i>The Journal of pediatrics</i> , 137(2), pp.227-232.  |
|                   | observational     | 2001-2003   | hosp. respiratory  | 413            |        | median duration of hospital stay in days      |  | all             | 6-17.5 days          | 9.5 days  | Morrow, B.M., Hatherill, M., Smuts, H.E., Yeats, J., Pitcher, R. and Argent, A.C., 2006. Clinical course of hospitalised children infected with human metapneumovirus and respiratory syncytial virus. <i>Journal of paediatrics and child health</i> , 42(4), pp.174-178.  |
|                   | observational     | 1980-1996   | hosp. bronchiolitis  | 1648281        |        | median length of hospital stay                |  | < 5 yrs         | 2-5 days             | 3 days    | Shay, D.K., Holman, R.C., Newman, R.D., Liu, L.L., Stout, J.W. and Anderson, L.J., 1999. Bronchiolitis-associated hospitalizations among US children, 1980-1996. <i>Jama</i> , 282(15), pp.1440-1446.   |
|                   | observational     | 1 year      | otherwise healthy ILI children                                     | 235            |        | median duration of hospitalization            |  | 6 months-10 yrs |                      | 6 days    | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41. |
|                   | observational     | 2003-2006   | children in Hong Kong hospitalized for acute respiratory infection |                |        | mean duration of hospitalization              |  | < 18 years      |                      | 4.04 days | Chiu, S.S., Chan, K.H., Chen, H., Young, B.W., Lim, W., Wong, W.H.S. and Peiris, J.M., 2010. Virologically confirmed population-based burden of hospitalization caused by respiratory syncytial virus, adenovirus, and parainfluenza viruses in children in Hong Kong. <i>The Pediatric infectious disease journal</i> , 29(12), pp.1088-1092.  |
|                   | observational     | 2009-2011   | children < 5   | 50             | NA     | median length of hospital stay                |  | < 5             | 3-5 days             | 4 days    | Broor, S., Dawood, F.S., Pandey, B.G., Saha, S., Gupta, V., Krishnan, A., Rai, S., Singh, P., Erdman, D. and Lal, R.B., 2014. Rates of respiratory virus-associated hospitalization in children aged< 5 years in rural northern India. <i>Journal of Infection</i> , 68(3), pp.281-289.   |
| hospitalization   |                   |             |  |                |        |   |  |                 |                      |           |   |
|                   | observational     | 2011-2012   | adults with cardiopulmonary disease or congestive heart failure    | 445            | NA     | proportion hospitalized during study          | *excluded from plot. study pop has advanced pulmonary disease or congestive heart failure. | >50             |                      | 0.29      | Falsey, A.R., Walsh, E.E., Esser, M.T., Shoemaker, K., Yu, L. and Griffin, M.P., 2019. Respiratory syncytial virus-associated illness in adults with advanced chronic obstructive pulmonary disease and/or congestive heart failure. <i>Journal of medical virology</i> , 91(1), pp.65-71.  |
|                   | observational     | 1996-2000   | 3 HMO databases  |                |        | proportion hospitalized per season            |  | all             |                      | 0.062     | Mullooly, J.P., Bridges, C.B., Thompson, W.W., Chen, J., Weintraub, E., Jackson, L.A., Black, S., Shay, D.K. and Vaccine Safety Datalink Adult Working Group, 2007. Influenza-and RSV-associated hospitalizations among adults. <i>Vaccine</i> , 25(5), pp.846-855.   |
|                   | observational     | 2000-2001   | children ARI   | 592            | NA     | proportion hospitalized during study          |  | < 5             |                      | 0.0035    | Iwane, M.K., Edwards, K.M., Szilagyi, P.G., Walker, F.J., Griffin, M.R., Weinberg, G.A., Coulen, C., Poehling, K.A., Shone, L.P., Balter, S. and Hall, C.B., 2004. Population-based surveillance for hospitalizations associated with respiratory syncytial virus, influenza virus, and parainfluenza viruses among young children. <i>Pediatrics</i> , 113(6), pp.1758-1764.               |
|                   | observational     | 2009-2011   | children < 5   | 245            | NA     | proportion hospitalized during study          |  | < 5             |                      | 0.0035    | Broor, S., Dawood, F.S., Pandey, B.G., Saha, S., Gupta, V., Krishnan, A., Rai, S., Singh, P., Erdman, D. and Lal, R.B., 2014. Rates of respiratory virus-associated hospitalization in children aged< 5 years in rural northern India. <i>Journal of Infection</i> , 68(3), pp.281-289.   |
|                   | observational     | 1989-2000   | children < 2   | 4618           | NA     | proportion hospitalized per year during study |  | < 2             |                      | 0.02      | Avendano, L.F., Palomino, M.A. and Larranaga, C., 2003. Surveillance for respiratory syncytial virus in infants hospitalized for acute lower respiratory infection in Chile (1989 to 2000). <i>Journal of clinical microbiology</i> , 41(10), pp.4879-4882.   |

|                    |               |             |                                |               |                                      |                 |                |         |  |
|--------------------|---------------|-------------|--------------------------------|---------------|--------------------------------------|-----------------|----------------|---------|--|
|                    | observational | 1 year      | otherwise healthy ILI children | 235           | number hospitalized out of 235       | 6 months-10 yrs |                | 0.021   | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazzcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, H., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41. |
|                    | observational | <= 1976     | hospitalized infants RSV       | 23            | hospitalization proportion           | infants         |                | 0.016   | Weber, A., Weber, M. and Milligan, P., 2001. Modeling epidemics caused by respiratory syncytial virus (RSV). <i>Mathematical biosciences</i> , 172(2), pp.95-113.  |
| case fatality rate |               |             |                                |               |                                      |                 |                |         |  |
|                    | review        | 1966-2009   | children                       | 36 studies    |                                      | <= 18 yrs       |                | 0.165   | REVIEW: Welliver Sr, R.C., Checchia, P.A., Bauman, J.H., Fernandes, A.W., Mahadevia, P.J. and Hall, C.B., 2010. Fatality rates in published reports of RSV hospitalizations among high-risk and otherwise healthy children. <i>Current medical research and opinion</i> , 26(9), pp.2175-2181.   |
|                    | observational | 1993-1995   | hospitalized children          | 10767         | nationally weighted # deaths/# cases |                 | 0.004 - 0.0075 | 0.0575  | Howard, T.S., Hoffman, L.H., Stang, P.E. and Simoes, E.A., 2000. Respiratory syncytial virus pneumonia in the hospital setting: length of stay, charges, and mortality. <i>The Journal of pediatrics</i> , 137(2), pp.227-232.   |
|                    | observational | 2009-2013   | all respiratory illness        | 4378 annually | deaths per person-year               | all             |                | 0.00031 | Cohen, C., Walaza, S., Treurnicht, F.K., McMorrow, M., Madhi, S.A., McAnerney, J.M. and Tempia, S., 2017. In and out-of-hospital mortality associated with seasonal and pandemic influenza and respiratory syncytial virus in South Africa, 2009-2013. <i>Clinical Infectious Diseases</i> , 66(1), pp.95-103.   |
|                    | observational | 2001-2003   | hosp. respiratory              | 413           | deaths during study                  | < 5 yrs         |                | 0.0015  | Morrow, B.M., Hatherill, M., Smuts, H.E., Yeats, J., Pitcher, R. and Argent, A.C., 2006. Clinical course of hospitalised children infected with human metapneumovirus and respiratory syncytial virus. <i>Journal of paediatrics and child health</i> , 42(4), pp.174-178.   |
|                    | observational | 2000        | hosp. acute bronchiolitis      | 636           | deaths during study                  | < 1 yr          |                | 0.007   | Tsolia, M.N., Kafetzis, D., Danelatou, K., Astra, H., Kallergi, K., Spyridis, P. and Karpathios, T.E., 2003. Epidemiology of respiratory syncytial virus bronchiolitis in hospitalized infants in Greece. <i>European journal of epidemiology</i> , 18(1), pp.55-61.   |
|                    | observational | 1989-2000   | hosp. children < 2             | 4618          | "fatality rate"                      | < 2 yrs         |                | 0.001   | Avendano, L.F., Palomino, M.A. and Larranaga, C., 2003. Surveillance for respiratory syncytial virus in infants hospitalized for acute lower respiratory infection in Chile (1989 to 2000). <i>Journal of clinical microbiology</i> , 41(10), pp.4879-4882.  |
|                    | review        | before 2013 |                                |               | "mortality"                          |                 | .08-.1         | 0.09    | Lee, N., Qureshi, S.T., Other viral pneumonias. <i>Crit Care Clin</i> 29 (2013) 1045-1068  |
| R0                 |               |             |                                |               |                                      |                 |                |         |  |
|                    | estimated     |             |                                |               |                                      |                 | 1.2-2.1        | 1.65    | Weber, A., Weber, M. and Milligan, P., 2001. Modeling epidemics caused by respiratory syncytial virus (RSV). <i>Mathematical biosciences</i> , 172(2), pp.95-113.  |
|                    | estimated     |             |                                |               |                                      |                 |                | 3       | Reis J., Shaman, J., 2016. Retrospective Parameter Estimation and Forecast of Respiratory Syncytial Virus in the United States. <i>PLoS Comput Biol</i> 12(10):e1005133. doi:10.1371/journal.pcbi.1005133  |
|                    | estimated     | 2003-2009   |                                |               |                                      |                 | 2.26-8.9       | 4.6     | Velasco-Hernández, J.X., Núñez-López, M., Comas-García, A., Cherpitel, D.E.N. and Ocampo, M.C., 2015. Superinfection between influenza and RSV alternating patterns in San Luis potosí state, México. <i>PLoS one</i> , 10(3), p.e0115674.   |
|                    | estimated     |             |                                |               |                                      |                 | 1.2-2.1        | 1.65    | Duvvuri, V.R., Granados, A., Rosenfeld, P., Bahl, J., Eshaghi, A. and Gubbay, J.B., 2015. Genetic diversity and evolutionary insights of respiratory syncytial virus A ON1 genotype: global and local transmission dynamics. <i>Scientific reports</i> , 5, p.14268.   |
|                    | estimated     | 1989-2009   |                                |               |                                      |                 | 8.9-9.1        | 9       | Pitzer, V.E., Viboud, C., Alonso, W.J., Wilcox, T., Metcalf, C.J., Steiner, C.A., Haynes, A.K. and Grenfell, B.T., 2015. Environmental drivers of the spatiotemporal dynamics of respiratory syncytial virus in the United States. <i>PLoS pathogens</i> , 11(1), p.e1004591.  |
|                    | estimated     | 2018        |                                |               | R0 at peak timing                    |                 |                | 2.82    | Reis, J. and Shaman, J., 2018. Simulation of four respiratory viruses and inference of epidemiological parameters. <i>Infectious Disease Modelling</i> , 3, pp.23-34.  |
|                    | estimated     | 2012-2017   |                                |               | average R0                           |                 |                | 1.6     | Levy, N., Iv, M. and Yom-Tov, E., 2018. Modeling influenza-like illnesses through composite compartmental models. <i>Physica A: Statistical Mechanics and its Applications</i> , 494, pp.288-293.  |

| parameter              | type of study           | study time        | population   | sample size | strain        | definition of                                  | notes                          | patient age                      | range        | mean      | citation   |
|------------------------|-------------------------|-------------------|--|-------------|---------------|--|--------------------------------|----------------------------------|--------------|-----------|--|
| incubation period      |                         | 2001-2002         |  | 102         |               |  | * excluded from                | elderly (noso)                   | 1-30 days    | 15.5 days | Sendra-Gutiérrez, J.M., Martín-Ríos, D., Casas, I., Sáez, P., Tovar, A. and Moreno, C., 2004. AN OUTBREAK OF   |
|                        | systematic review       |                   |  | review      |               |  | range and central tendency     | all                              | 4-8 days     | 6 days    | Lessler, J., Reich, N.G., Brookmeyer, R., Perl, T.M., Nelson, K.E. and Cummings, D.A., 2009. Incubation periods of acute respiratory viral infections: a systematic review. <i>The Lancet infectious diseases</i> , 9(5), pp.291-300.  |
|                        | anecdotal re adenovirus | July to Sept 1996 |  | 736         | observational | no definition, no citation                     |                                | federal service training academy | 6-9 days     | 7.5 days  | Feikin, D.R., Moroney, J.F., Talkington, D.F., Thacker, W.L., Code, J.E., Schwartz, L.A., Erdman, D.D., Butler, J.C. and Cetron, M.S., 1999. An outbreak of acute respiratory disease caused by Mycoplasma pneumoniae and adenovirus at a federal service training academy: new implications from an old scenario. <i>Clinical infectious diseases</i> , pp.1545-1550.                     |
|                        | experimental            | 1945              | adult males  | 5           | ARD           | inoculation to onset of symptoms               | ARD assumed to be adenovirus   | adult                            | 5-6 days     | 5.5 days  | Commission on Acute Respiratory Diseases, 1947. Experimental transmission of minor respiratory illness to human volunteers by filter-passing agents. I. Demonstration of two types of illness characterized by long and short incubation periods and different clinical features. <i>Journal of Clinical Investigation</i> , 26(5), pp.957-973.  |
|                        | textbook chapter        | NA                |  | NA          |               | no definition                                  |                                |                                  | 4-12 days    | 8 days    | Berger, S., 2010. <i>Infectious Diseases of Bhutan 2010 edition</i> . O'Reilly Media, Inc..  |
|                        | reference chapter       | NA                |  | NA          |               | no definition                                  |                                |                                  | 2-4 days     | 3 days    | Tanz, R.R. "Sore Throat", Kliegman, R.M., Lye, P.S., Bordini, B.J., Toth, H. and Basel, D., 2017. <i>Nelson Pediatric Symptom-Based Diagnosis E-Book</i> . Elsevier Health Sciences.   |
|                        | review                  | before 2004       | literature   |             |               |  |                                |                                  | 4-14 days    | 9 days    | REVIEW: Wat, D., 2004. The common cold: a review of the literature. <i>European Journal of Internal Medicine</i> , 15(2), pp.79-88.  |
|                        | textbook chapter        | NA                |  |             |               |  | in textbook                    |                                  | 2-14 days    | 8 days    | Robinson, C., & Echavarría, M. (2007). Adenoviruses. In P. R. Murray, E. J. Baron, J. Jorgensen, M. Pfaller & M. L. Landry (Eds.), <i>Manual of Clinical Microbiology</i> (9th ed., pp. 1589) ASM Press.   |
| infectious period      |                         |                   |  |             |               |  |                                |                                  |              |           |  |
|                        | observational           | 2001-2002         |  | 102         |               |  |                                | elderly (noso)                   | 17 days max  | 9 days    | Sendra-Gutiérrez, J.M., Martín-Ríos, D., Casas, I., Sáez, P., Tovar, A. and Moreno, C., 2004. AN OUTBREAK OF ADENOVIRUS TYPE 8. <i>Euro Surveill</i> , 9(3), pp.27-30.   |
|                        | observational           | 1 year            | otherwise healthy ILI children                                     | 141         | seasonal      | mean duration of ILI episode                   |                                | 6 months-10 years                |              | 9.2 days  | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutiérrez, R., Lazcano-Ponce, E., Kerdpnich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41. |
|                        | observational           |                   | children positive for adenovirus                                   | 74          |               |  |                                |                                  |              | 10.6 days | Hong, J.Y., Lee, H.J., Piedra, P.A., Choi, E.H., Park, K.H., Koh, Y.Y. and Kim, W.S., 2001. Lower respiratory tract infections due to adenovirus in hospitalized Korean children: epidemiology, clinical features, and prognosis. <i>Clinical infectious diseases</i> , 32(10), pp.1423-1429.  |
|                        | textbook chapter        | NA                | adults   |             |               | viral shedding period after recovery           |                                |                                  | up to 1 week | 4 days    | Robinson, C., & Echavarría, M. (2007). Adenoviruses. In P. R. Murray, E. J. Baron, J. Jorgensen, M. Pfaller & M. L. Landry (Eds.), <i>Manual of Clinical Microbiology</i> (9th ed., pp. 1589) ASM Press.   |
|                        | textbook chapter        | NA                | children   |             |               | viral shedding period following illness        | * excluded from plot           |                                  | 3-6 weeks    | 31.5 days | Robinson, C., & Echavarría, M. (2007). Adenoviruses. In P. R. Murray, E. J. Baron, J. Jorgensen, M. Pfaller & M. L. Landry (Eds.), <i>Manual of Clinical Microbiology</i> (9th ed., pp. 1589) ASM Press.   |
| hospitalization period |                         |                   |  |             |               |  |                                |                                  |              |           |  |
|                        | observational           | 1 year            | otherwise healthy ILI children                                     | 141         | seasonal      | median duration of hospitalization             |                                | 6 months-10 years                |              | 4 days    | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutiérrez, R., Lazcano-Ponce, E., Kerdpnich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41. |
|                        | observational           | 2003-2006         | children in Hong Kong hospitalized for acute respiratory infection |             |               | mean duration of hospitalization               |                                | < 18 years                       |              | 3.12 days | Chiu, S.S., Chan, K.H., Chen, H., Young, B.W., Lim, W., Wong, W.H.S. and Peiris, J.M., 2010. Virologically confirmed population-based burden of hospitalization caused by respiratory syncytial virus, adenovirus, and parainfluenza viruses in children in Hong Kong. <i>The Pediatric infectious disease journal</i> , 29(12), pp.1088-1092.   |
|                        | observational           | 2 years           | immunocompetent children hospitalized due to adenovirus            | 78          |               | mean duration of hospitalization               |                                | 17 ± 10 months                   |              | 7 days    | Peled, N., Nakar, C., Huberman, H., Scherf, E., Samra, Z., Finkelstein, Y., Hoffer, V. and Garty, B.Z., 2004. Adenovirus infection in hospitalized immunocompetent children. <i>Clinical pediatrics</i> , 43(3), pp.223-229.   |
| hospitalization rate   |                         |                   |  |             |               |  |                                |                                  |              |           |  |
|                        |                         |                   |  |             |               |  |                                | < 18                             |              | 0.418     | Galindo-Fraga, A., Ortiz-Hernández, A.A., Ramírez-Venegas, A., Vázquez, R.V., Moreno-Espinosa, S., Llamas-Gallardo, B., Pérez-Patrigeon, S., Salinger, M., Freimanis, L., Huang, C.Y. and Gu, W., 2013. Clinical characteristics and outcomes of influenza and other influenza-like illnesses in Mexico City. <i>International Journal of Infectious Diseases</i> , 17(7), pp.e510-e517.   |
|                        |                         |                   |  |             |               |  |                                | 18-59                            |              | 0.667     | Galindo-Fraga, A., Ortiz-Hernández, A.A., Ramírez-Venegas, A., Vázquez, R.V., Moreno-Espinosa, S., Llamas-Gallardo, B., Pérez-Patrigeon, S., Salinger, M., Freimanis, L., Huang, C.Y. and Gu, W., 2013. Clinical characteristics and outcomes of influenza and other influenza-like illnesses in Mexico City. <i>International Journal of Infectious Diseases</i> , 17(7), pp.e510-e517.   |
|                        | observational           | 1957              | military recruits  |             |               | percent hospitalized due to adenovirus in 1 yr |                                |                                  |              | 0.1       | Hilleman, M.R., Gauld, R.L., BUTLEB, R., Stallones, R.A., Hedberg, C.L., Warfield, M.S. and Anderson, S.A., 1957. Appraisal of occurrence of adenovirus-caused respiratory illness in military populations. <i>American journal of hygiene</i> , 66(1), pp.29-41.  |
|                        | observational           | 1 year            | otherwise healthy ILI children                                     | 141         | seasonal      | percent hospitalized                           |                                | 6 months-10 years                |              | 0.014     | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutiérrez, R., Lazcano-Ponce, E., Kerdpnich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41. |
|                        | observational           | 1990-1998         | children w/ lower respiratory tract infection                      |             |               | percent of study patients hospitalized         |                                |                                  |              | 0.95      | Hong, J.Y., Lee, H.J., Piedra, P.A., Choi, E.H., Park, K.H., Koh, Y.Y. and Kim, W.S., 2001. Lower respiratory tract infections due to adenovirus in hospitalized Korean children: epidemiology, clinical features, and prognosis. <i>Clinical infectious diseases</i> , 32(10), pp.1423-1429.  |
| case fatality rate     |                         |                   |  |             |               |  |                                |                                  |              |           |  |
|                        | observational           |                   |  |             |               |  |                                | 18-59                            |              | 0.067     | Galindo-Fraga, A., Ortiz-Hernández, A.A., Ramírez-Venegas, A., Vázquez, R.V., Moreno-Espinosa, S., Llamas-Gallardo, B., Pérez-Patrigeon, S., Salinger, M., Freimanis, L., Huang, C.Y. and Gu, W., 2013. Clinical characteristics and outcomes of influenza and other influenza-like illnesses in Mexico City. <i>International Journal of Infectious Diseases</i> , 17(7), pp.e510-e517.   |
|                        | observational           |                   | adenovirus infected children                                       |             |               |  | excluded from plot: nosocomial | young children                   |              | 0.67      | Wesley, A.G., Pather, M. and Tait, D., 1993. Nosocomial adenovirus infection in a paediatric respiratory unit. <i>Journal of Hospital Infection</i> , 25(3), pp.183-190.   |
|                        | observational           |                   | pediatric chronic care residents                                   |             |               |  |                                | children                         |              | 0.16      | Gerber, S.I., Erdman, D.D., Pur, S.L., Diaz, P.S., Segreti, J., Kajon, A.E., Belkengren, R.P. and Jones, R.C., 2001. Outbreak of adenovirus genome type 7d2 infection in a pediatric chronic-care facility and tertiary-care hospital. <i>Clinical infectious diseases</i> , 32(5), pp.694-700.  |



|    |               |           |  |    |  |                   |           |  |         |   |
|----|---------------|-----------|--|----|--|-------------------|-----------|--|---------|---|
|    | observational | 1995-1996 | hospitalized infants   |    |  |                   | < 2 years |  | 0.166   | Larrañaga, C., Martínez, J., Palomino, A., Peña, M. and Carrión, F., 2007. Molecular characterization of hospital-acquired adenovirus infantile respiratory infection in Chile using species-specific PCR assays. Journal of clinical virology, 39(3), pp.175-181.                                  |
|    | observational | 2013-2018 | adult patients w/ acute respiratory infection in Korean military hospitals |    |  |                   | adults    |  | 0.00075 | Ko, J.H., Woo, H.T., Oh, H.S., Moon, S.M., Choi, J.Y., Lim, J.U., Kim, D., Byun, J., Kwon, S.H., Kang, D. and Heo, J.Y., 2019. Ongoing outbreak of human adenovirus-associated acute respiratory illness in the Republic of Korea military, 2013 to 2018. Korean J Intern Med, 34(5), pp.1171-1171. |
|    | observational | 1990-1998 | children positive for adenovirus   | 74 |  |                   |           |  | 0.12    | Hong, J.Y., Lee, H.J., Piedra, P.A., Choi, E.H., Park, K.H., Koh, Y.Y. and Kim, W.S., 2001. Lower respiratory tract infections due to adenovirus in hospitalized Korean children: epidemiology, clinical features, and prognosis. Clinical infectious diseases, 32(10), pp.1423-1429.               |
| R0 |               |           |  |    |  |                   |           |  |         |   |
|    | estimated     | 2018      | simulated  |    |  | R0 at peak timing |           |  | 2.34    | Reis, J. and Shaman, J., 2018. Simulation of four respiratory viruses and inference of epidemiological parameters. Infectious Disease Modelling, 3, pp.23-34.   |

| parameter              | type of study        | study time                         | population               | sample size    | strain                 | definition of parameter              | notes             | patient age       | value range   | mean   | citation  |
|------------------------|----------------------|------------------------------------|--------------------------|----------------|------------------------|--------------------------------------|-------------------|-------------------|---------------|--|---|
| incubation period      | review               | pre-2009                           | literature               |                | SARS                   | incubation period                    |                   | all               | 3.6-4.4 days  | 4 days   | Lessler, J., Reich, N.G., Brookmeyer, R., Perl, T.M., Nelson, K.E. and Cummings, D.A., 2009. Incubation periods of acute respiratory viral infections: a systematic review. <i>The Lancet infectious diseases</i> , 9(5), pp.291-300.   |
|                        | experimental         | 1967                               | adults                   | 26             | 229E culture           | inoculation to onset                 |                   | 18-50             | 2-4 days      | 3.3 days   | Bradburne, A.F., Bynoe, M.L. and Tyrrell, D.A., 1967. Effects of a "new" human respiratory virus in volunteers. <i>British medical journal</i> , 3(5568), p.767.  |
|                        | experimental         | June 1986-July 1989                | adults                   | 34             | 229E culture           | inoculation to peak symptoms         |                   | adult             | 3-4 days      | 3.5 days   | Tyrell, D.A.J., Cohen, S. and Schilbar, J.E., 1993. Signs and symptoms in common colds. <i>Epidemiology &amp; Infection</i> , 111(1), pp.143-156.   |
|                        | review               | before 2004                        | literature               |                |                        | incubation period                    |                   | all               | 2-4 days      | 3 days   | Wat, D., 2004. The common cold: a review of the literature. <i>European Journal of Internal Medicine</i> , 15(2), pp.79-88.   |
|                        | observational        | winter 2018                        | Olympic athletes & staff | 112            | 229E,OC43,NL63         | incubation period                    |                   | adult             |               | 3.5 days   | Valtonen, M., Waris, M., Vuorinen, T., Eerola, E., Hakanen, A.J., Mjosund, K., Gronroos, W., Heinonen, O.J. and Ruuskanen, O., 2019. Common cold in Team Finland during 2018 Winter Olympic Games (PyeongChang): epidemiology, diagnosis including molecular point-of-care testing (POCT) and treatment. <i>British journal of sports medicine</i> , 53(17), pp.1093-1098.  |
|                        | observational        | April 1-May 23, 2013               | hospitalized             | 23             | MERS                   | incubation period                    |                   | all               | 1.9-14.7 days | 5.2 days   | Assiri, A., Al-Tawfiq, J.A., Al-Rabeeah, A.A., Al-Rabiah, F.A., Al-Hajjar, S., Al-Barrak, A., Flemban, H., Al-Nassir, W.N., Balkhy, H.H., Al-Hakeem, R.F. and Makhdoom, H.Q., 2013. Epidemiological, demographic, and clinical characteristics of 47 cases of Middle East respiratory syndrome coronavirus disease from Saudi Arabia: a descriptive study. <i>The Lancet infectious diseases</i> , 13(9), pp.752-761. |
|                        | retrospective        | 2015                               | confirmed cases (Korea)  | 36             | MERS                   | incubation period                    | patients who died | all               | 5.2-7.9 days  | 6.4 days   | Virlogeux, V., Park, M., Wu, J.T. and Cowling, B.J., 2016. Association between severity of MERS-CoV infection and incubation period. <i>Emerging infectious diseases</i> , 22(3), p.526.  |
| retrospective          | 2015                 | confirmed cases (Korea)            | 134                      | MERS           | incubation period      | patients who survived                | all               | 6.3-7.8 days      | 7.1 days      | Virlogeux, V., Park, M., Wu, J.T. and Cowling, B.J., 2016. Association between severity of MERS-CoV infection and incubation period. <i>Emerging infectious diseases</i> , 22(3), p.526.   |   |
| review                 | pre-May 2003         | consensus document                 |                          | SARS           | incubation period      |                                      | all               |                   | 10 days       | World Health Organization, 2003. Consensus document on the epidemiology of severe acute respiratory syndrome (SARS) (No. WHO/CDS/CSR/GAR/2003.11). World Health Organization.  |   |
| review                 | 2003-2004            | literature                         |                          | SARS           | incubation period      |                                      | all               | 4.0-5.3 days      | 4.7 days      | Anderson, R.M., Fraser, C., Ghani, A.C., Donnelly, C.A., Riley, S., Ferguson, N.M., Leung, G.M., Lam, T.H. and Hedley, A.J., 2004. Epidemiology, transmission dynamics and control of SARS: the 2002-2003 epidemic. <i>Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences</i> , 359(1447), pp.1091-1105. |   |
| infectious period      |                      |                                    |                          |                |                        |                                      |                   |                   |               |  |   |
| observational          | 1 year               | otherwise healthy ILI children     | 103                      |                |                        | mean duration of ILI episode         |                   | 6 months-10 years |               | 10.1 days  | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41.                           |
| observational          |                      | neonates w/ NL63                   |                          | 229E,OC43,NL63 |                        | duration of illness                  |                   |                   | 1-4 weeks     | 13.46 days   | Kaiser, L., Regamey, N., Rolha, H., Deffernez, C. and Frey, U., 2005. Human coronavirus NL63 associated with lower respiratory tract symptoms in early life. <i>The Pediatric infectious disease journal</i> , 24(11), pp.1015-1017.  |
| observational          | Aug 2001-Aug 2002    | children hospitalized w/ HCoV-NL63 |                          | NL63           |                        | mean duration of fever               |                   | <18 years         | 1-5 days      | 2.6 days   | Chiu, S.S., Hung Chan, K., Wing Chu, K., Kwan, S.W., Guan, Y., Man Poon, L.L. and Peiris, J.S.M., 2005. Human coronavirus NL63 infection and other coronavirus infections in children hospitalized with acute respiratory disease in Hong Kong, China. <i>Clinical infectious diseases</i> , 40(12), pp.1721-1729.  |
| observational          | winter 2018          | Olympic athletes & staff           | 112                      | 229E,OC43,NL6  |                        | duration of illness                  |                   | adults            | 2-25 days     | 10.33 days   | Valtonen, M., Waris, M., Vuorinen, T., Eerola, E., Hakanen, A.J., Mjosund, K., Gronroos, W., Heinonen, O.J. and Ruuskanen, O., 2019. Common cold in Team Finland during 2018 Winter Olympic Games (PyeongChang): epidemiology, diagnosis including molecular point-of-care testing (POCT) and treatment. <i>British journal of sports medicine</i> , 53(17), pp.1093-1098.  |
| review                 | 2003-2004            | literature                         |                          | SARS           | infectiousness         | from Fig. 5                          |                   |                   | 27-35 days    | 31 days  | Anderson, R.M., Fraser, C., Ghani, A.C., Donnelly, C.A., Riley, S., Ferguson, N.M., Leung, G.M., Lam, T.H. and Hedley, A.J., 2004. Epidemiology, transmission dynamics and control of SARS: the 2002-2003 epidemic. <i>Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences</i> , 359(1447), pp.1091-1105.  |
| estimated              | 2002-2003            | literature/model                   |                          | SARS           | mean infectious period |                                      |                   |                   |               | 23.5 days  | Chowell, G., Castillo-Chavez, C., Fenimore, P.W., Kribs-Zaleta, C.M., Ariola, L. and Hyman, J.M., 2004. Model parameters and outbreak control for SARS. <i>Emerging Infectious Diseases</i> , 10(7), p.1258.  |
| onset to               |                      |                                    |                          |                |                        |                                      |                   |                   |               |  |   |
| observational          | April 1-May 23, 2013 | confirmed MERS-CoV                 | 23                       | MERS           |                        | onset of symptoms to ICU admission   |                   | all               | 1-10 days     | 5 days   | Assiri, A., Al-Tawfiq, J.A., Al-Rabeeah, A.A., Al-Rabiah, F.A., Al-Hajjar, S., Al-Barrak, A., Flemban, H., Al-Nassir, W.N., Balkhy, H.H., Al-Hakeem, R.F. and Makhdoom, H.Q., 2013. Epidemiological, demographic, and clinical characteristics of 47 cases of Middle East respiratory syndrome coronavirus disease from Saudi Arabia: a descriptive study. <i>The Lancet infectious diseases</i> , 13(9), pp.752-761. |
| review                 | pre-2017             | literature                         | NA                       | MERS           |                        | onset of symptoms to hospitalization |                   | all               |               | 4 days   | Fehr, A.R., Channappanavar, R. and Perlman, S., 2017. Middle East respiratory syndrome: emergence of a pathogenic human coronavirus. <i>Annual review of medicine</i> , 68, pp.387-399.   |
| observational          | 2013                 | confirmed MERS-CoV                 | 17                       | MERS           |                        | onset of symptoms to hospitalization |                   | all               |               | 3 days   | Al-Tawfiq, J.A., Hinedi, K., Ghandour, J., Khairalla, H., Musleh, S., Ujayli, A. and Memish, Z.A., 2014. Middle East respiratory syndrome coronavirus: a case-control study of hospitalized patients. <i>Clinical Infectious Diseases</i> , 59(2), pp.160-165.  |
| retrospective          | 2002-2003            | 1st 205 probable cases             | 205                      | SARS           |                        | onset of symptoms to isolation       | median            | all               | 2-6 days      | 4 days   | Lipsitch, M., Cohen, T., Cooper, B., Robins, J.M., Ma, S., James, L., Gopalakrishna, G., Chew, S.K., Tan, C.C., Samore, M.H. and Fisman, D., 2003. Transmission dynamics and control of severe acute respiratory syndrome. <i>Science</i> , 300(5627), pp.1966-1970.  |
| observational          | 2014                 | hospitalized confirmed             | 9                        | MERS           |                        | onset to hospitalization             |                   | all               | 0-8 days      | 3 days   | Corman, V.M., Albarak, A.M., Omrani, A.S., Albarak, M.M., Farah, M.E., Almasri, M., Muth, D., Sieberg, A., Meyer, B., Assiri, A.M. and Binger, T., 2016. Viral shedding and antibody response in 37 patients with Middle East respiratory syndrome coronavirus infection. <i>Clinical Infectious Diseases</i> , 62(4), pp.477-483.  |
| hospitalization period |                      |                                    |                          |                |                        |                                      |                   |                   |               |  |   |
| observational          | 1 year               | otherwise healthy ILI children     | 103                      |                |                        | median duration of hospitalization   |                   | 6 months-10 years |               | 1.5 days   | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41.                           |
| observational          | Aug 2001-Aug 2002    | children w/ HCoV-NL63              |                          | NL-63          |                        | mean duration of hospitalization     |                   | <18 years         |               | 2.46 days  | Chiu, S.S., Hung Chan, K., Wing Chu, K., Kwan, S.W., Guan, Y., Man Poon, L.L. and Peiris, J.S.M., 2005. Human coronavirus NL63 infection and other coronavirus infections in children hospitalized with acute respiratory disease in Hong Kong, China. <i>Clinical infectious diseases</i> , 40(12), pp.1721-1729.  |

|                 |                         |                   |   |      |          |                                  |                   |          |  |
|-----------------|-------------------------|-------------------|---|------|----------|----------------------------------|-------------------|----------|--|
|                 | observational           | 2001-2003         | children w/ HcoV-NL hospitalized for acute respiratory tract infections | 12   |          | mean duration of hospitalization | ≤3 years          | 4.9 days | Boivin, G., Baz, M., Côté, S., Gilca, S., Deffrasnes, C., Leblanc, P., Bergeron, M.G., Déry, P. and De Serres, G., 2005. Infections by human coronavirus-NL in hospitalized children. The Pediatric infectious disease journal, 24(12), pp.1045-1048.  |
|                 | observational           | 2014              | hospitalized confirmed  | 37   | MERS     | average time of hospitalization  | all               | 11 days  | Corman, V.M., Albarak, A.M., Omrani, A.S., Albarak, M.M., Farah, M.E., Almasri, M., Muth, D., Sieberg, A., Meyer, B., Assiri, A.M. and Binger, T., 2016. Viral shedding and antibody response in 37 patients with Middle East respiratory syndrome coronavirus infection. Clinical Infectious Diseases, 62(4), pp.477-483.   |
| hospitalization |                         |                   |   |      |          |                                  |                   |          |  |
|                 | observational           | 1 year            | otherwise healthy ILI children  | 103  | seasonal | percent hospitalized             | 6 months-10 years | 0.019    | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazzcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. Journal of Infection, 74(1), pp.29-41. |
|                 | observational           | Jan-Mar 2002      | HcoV-NL63 positive patients   | 19   | NL63     | percent hospitalized             | 1 month-100 years | 0.21     | Bastien, N., Anderson, K., Hart, L., Caesele, P.V., Brandt, K., Milley, D., Hatchette III, T., Weiss, E.C. and Li, Y., 2005. Human coronavirus NL63 infection in Canada. The Journal of infectious diseases, 191(4), pp.503-506.   |
|                 | observational           |                   | coronavirus positive patients w/ clinical respiratory infection         | 48   |          | percent hospitalized             | all               | 0.52     | Reina, J., López-Causapé, C., Rojo-Moliner, E. and Rubio, R., 2014. Clínico-epidemiological characteristics of acute respiratory infections by coronavirus OC43, NL63 and 229E. Revista Clínica Española (English Edition), 214(9), pp.499-504.  |
|                 | observational           | Aug 2001-Aug 2002 | children w/ HcoV-NL63   |      | NL63     | percent hospitalized             | <18 years         | 0.0022   | Chiu, S.S., Hung Chan, K., Wing Chu, K., Kwan, S.W., Guan, Y., Man Poon, L.L. and Peiris, J.S.M., 2005. Human coronavirus NL63 infection and other coronavirus infections in children hospitalized with acute respiratory disease in Hong Kong, China. Clinical infectious diseases, 40(12), pp.1721-1729.   |
| case fatality   |                         |                   |   |      |          |                                  |                   |          |  |
|                 | review                  |                   | confirmed MERS-CoV cases  |      | MERS     | case fatality rate               | all               | 0.33     | Ramadan, N. and Shaib, H. (2019) 'Middle East respiratory syndrome coronavirus (MERS-CoV): A review', <i>Gems</i> , 9(1), pp. 35-42.   |
|                 | retrospective           | 2015              | MERS-CoV South Korea  | 186  | MERS     | case fatality rate               |                   | 0.19     | Chang, H.J., 2017. Estimation of basic reproduction number of the Middle East respiratory syndrome coronavirus (MERS-CoV) during the outbreak in South Korea, 2015. Biomedical engineering online, 16(1), p.79   |
|                 | observational           | Jan-Mar 2002      | HcoV-NL63 positive children   | 19   | NL63     | case fatality rate               |                   | 0.053    | Bastien, N., Anderson, K., Hart, L., Caesele, P.V., Brandt, K., Milley, D., Hatchette III, T., Weiss, E.C. and Li, Y., 2005. Human coronavirus NL63 infection in Canada. The Journal of infectious diseases, 191(4), pp.503-506.   |
|                 | observational           |                   | coronavirus positive patients w/ clinical respiratory infection         | 48   |          | case fatality rate               | all               | 0        | Reina, J., López-Causapé, C., Rojo-Moliner, E. and Rubio, R., 2014. Clínico-epidemiological characteristics of acute respiratory infections by coronavirus OC43, NL63 and 229E. Revista Clínica Española (English Edition), 214(9), pp.499-504.  |
|                 | review                  |                   | MERS-CoV  |      | MERS     | case fatality rate               | 6--16%            | 0.11     | Lee, N., Qureshi, S.T., Other viral pneumonias. Crit Care Clin 29 (2013) 1045–1068   |
|                 | observational           | 1995-2000         | HcoV positive elderly patients w/ underlying conditions                 | 5    |          | case fatality rate               | > 65 years        | 0        | Falsey, A.R., Walsh, E.E. and Hayden, F.G., 2002. Rhinovirus and coronavirus infection-associated hospitalizations among older adults. The Journal of infectious diseases, 185(9), pp.1338-1341.   |
|                 | retrospective           | 2002-2019         | confirmed cases   | 2494 | MERS     | case fatality rate               | all               | 0.344    | WHO, "MERS Situation Update, November 2019," accessed on January 30, 2020. <a href="http://applications.emro.who.int/docs/EMRPUB_CSR-241-2019-EN.pdf?ua=1&amp;ua=1">http://applications.emro.who.int/docs/EMRPUB_CSR-241-2019-EN.pdf?ua=1&amp;ua=1</a>   |
| R0              |                         |                   |   |      |          |                                  |                   |          |  |
|                 | estimated               |                   | MERS-CoV Saudi Arabia   |      | MERS     | R0                               |                   | 4.5      | Majumder, M.S., Rivers, C., Lofgren, E. and Fisman, D., 2014. Estimation of MERS-coronavirus reproductive number and case fatality rate for the spring 2014 Saudi Arabia outbreak: insights from publicly available data. PLoS currents, 6.  |
|                 | estimated               | 2015              | MERS-CoV South Korea  | 186  | MERS     | R0                               |                   | 8        | Chang, H.J., 2017. Estimation of basic reproduction number of the Middle East respiratory syndrome coronavirus (MERS-CoV) during the outbreak in South Korea, 2015. Biomedical engineering online, 16(1), p.79   |
|                 | estimated               |                   | SARS-CoV Hong Kong  |      | SARS     | R0                               |                   | 2.7      | Leung, G.M., Chung, P.H., Tsang, T., Lim, W., Chan, S.K., Chau, P., Donnelly, C.A., Ghani, A.C., Fraser, C., Riley, S. and Ferguson, N.M., 2004. SARS-CoV antibody prevalence in all Hong Kong patient contacts. Emerging infectious diseases, 10(9), p.1653.  |
|                 | estimated               | 2015              | MERS-CoV South Korea  |      | MERS     | R0                               | 0.1351 or 5.3973  | 2.77     | Kim, Y., Lee, S., Chu, C., Choe, S., Hong, S. and Shin, Y., 2016. The characteristics of Middle Eastern respiratory syndrome coronavirus transmission dynamics in South Korea. Osong public health and research perspectives, 7(1), pp.49-55.  |
|                 | estimated               |                   | hCoV  |      |          | R0                               | 2.2-3.7           | 2.95     | Lee, N., Qureshi, S.T., Other viral pneumonias. Crit Care Clin 29 (2013) 1045–1068   |
|                 | estimated               | 2002-2003         | SARS-Singapore/Hong Kong  | 205  | SARS     | R0                               | 2.2-3.6           | 3        | Lipsitch, M., Cohen, T., Cooper, B., Robins, J.M., Ma, S., James, L., Gopalakrishna, G., Chew, S.K., Tan, C.C., Samore, M.H. and Fisman, D., 2003. Transmission dynamics and control of severe acute respiratory syndrome. Science, 300(5627), pp.1966-1970  |
|                 | review                  | 2002-2003         | SARS (literature)   |      | SARS     | R0                               |                   | 3        | Bauch, C.T., Lloyd-Smith, J.O., Coffee, M.P. and Galvani, A.P., 2005. Dynamically modeling SARS and other newly emerging respiratory illnesses: past, present, and future. Epidemiology, pp.791-801.   |
|                 | retrospective/estimated | 2002-2003         | SARS  | 1512 | SARS     | R0                               |                   | 2.7      | Riley, S., Fraser, C., Donnelly, C.A., Ghani, A.C., Abu-Raddad, L.J., Hedley, A.J., Leung, G.M., Ho, L.M., Lam, T.H., Thach, T.Q. and Chau, P., 2003. Transmission dynamics of the etiological agent of SARS in Hong Kong: impact of public health interventions. Science, 300(5627), pp.1961-1966.  |

| parameter                  | type of study                           | study time                | population   | sample size       | strain                  | definition of parameter  | notes                                  | patient age range | value range    | mean  | citation  |
|----------------------------|---|---------------------------|--|-------------------|-------------------------|--|--|-------------------|----------------|---|---|
| incubation period          | systematic review                       | before 2009               | literature   | 8 exp/obs studies |                         |  | range and central tendency             |                   | 2-4 days       | 2 days  | REVIEW: Lessler, J., Reich, N.G., Brookmeyer, R., Perl, T.M., Nelson, K.E. and Cummings, D.A., 2009. Incubation periods of acute respiratory viral infections: a systematic review. <i>The Lancet infectious diseases</i> , 9(5), pp.291-300.   |
|                            | review                                  | before 2011               | literature   |                   |                         | citation network   |  |                   |                |   | REVIEW: Reich NG, Perl TM, Cummings DAT, Lessler J, 2011. Visualizing clinical evidence: citation networks for the incubation periods of respiratory viral infections. <i>PLoS One</i> 6(4), 1-6.   |
|                            | experimental                            | 30 days                   | male prisoners   | 13                | RV type 15              | inoculation to appearance of symptoms  |  | adult             | 2-4 days       | 3 days  | Douglas, RG, Rossen, RD, Butler, WT, Couch, RB, 1967. Rhinovirus neutralizing antibody in tears, parotid saliva, nasal secretions and serum. <i>The Journal of Immunology</i> , 99(2), 297-303.   |
|                            | experimental                            | 30 days                   | asthmatic subjects   | 10                | RV type 16 +allergen    | inoculation to appearance of symptoms  |  | 18 to 55          | 1-5.5 days     | 2.5 days  | Avila, PC, Abisheganaden, JA, Wong, H, Liu, J, Yagi, S, Schnurr, DS, Kishiyama, JL, Boushey, HA, 2009. Effects of allergic inflammation of the nasal mucosa on the severity of rhinovirus 16 cold. <i>Journal of Allergy and Clinical Immunology</i> , 105(5), 923-931.   |
|                            | experimental                            | 30 days                   | asthmatic subjects   | 10                | RV type 16              | inoculation to appearance of symptoms  |  | 18 to 55          | 1-1 days       | 1 days  | Avila et al (above).  |
|                            | experimental                            | 5 days                    | healthy adults   | 21                | RV type 23              | inoculation to appearance of symptoms  |  | 18 to 45          | 2-2 days       | 2 days  | Drake CL, Roehrs TA, Royer H, Koshorek G, Turner RB, Roth T, 2000. Effects of an experimentally induced rhinovirus cold on sleep, performance, and daytime alertness. <i>Physiology and Behavior</i> : 71(1-2), 75-81.  |
|                            | experimental                            | 5 days                    | healthy adults   | 27                | T-39 and HH             | inoculation to peak symptoms   |  | adult             | 2-3 days       | 2.5 days  | Naclerio RM, Proud T, Lichtenstein LM, Kagey-Sobotka A, Hendley JO, Sorrentino J, Gwaltney JM, 1987. Kinins are generated during experimental rhinovirus colds. <i>The Journal of Infectious Diseases</i> : 157(1), 133-142.  |
|                            | experimental                            | 5 days                    | healthy adults   | 18                | T-39                    | inoculation to appearance of symptoms  | earliest possible sore/scratchy throat | adult             | 0.42-0.67 days | 0.55 days   | Harris JM, Gwaltney JM, 1996. Incubation periods of experimental rhinovirus infection and illness. <i>Clinical Infectious Diseases</i> : 23, 1287-90.   |
|                            | experimental                            | 30 days                   | healthy adults   | 20                | HRV                     | inoculation to peak symptoms   |  | adult             | 2-4 days       | 3 days  | Zaas, A.K, Chen, M., Varkey, J., Veldman, T., Hero III, A.O., Lucas, J., Huang, Y., Turner, R., Gilbert, A., Lambkin-Williams, R. and Otten, N.C., 2009. Gene expression signatures diagnose influenza and other symptomatic respiratory viral infections in humans. <i>Cell host &amp; microbe</i> , 6(3), pp.207-217.   |
|                            | experimental                            | 5 days                    | adults   | 193               | RV9 and RV14            | inoculation to peak symptoms   |  | adult             | 2-3 days       | 2.5 days  | Tyrell, D.A.J., Cohen, S. and Schilarb, J.E., 1993. Signs and symptoms in common colds. <i>Epidemiology &amp; Infection</i> , 111(1), pp.143-156.   |
| review                     | before 2004                             | literature                |  |                   |                         |  |  | 2-7 days          | 4.5 days       | REVIEW: Wat, D., 2004. The common cold: a review of the literature. <i>European Journal of Internal Medicine</i> , 15(2), pp.79-88. |   |
| infectious period          | observational                           | 1 year                    | otherwise healthy ILI children                                   | 986               |                         | mean duration of ILI episode   |  | 6 months-10 days  |                | 9.6 days  | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41. |
|                            | observational                           | winters 1992-3 and 1993-4 | elderly patients w/ single rhinovirus infection                  | 96                |                         | median duration of illness   | excluded from plot                     | elderly           |                | 16 days   | Nicholson, K.G., Kent, J., Hammersley, V. and Cancio, E., 1996. Risk factors for lower respiratory complications of rhinovirus infections in elderly people living in the community: prospective cohort study. <i>Bmj</i> , 313(7065), pp.1119-1123.  |
|                            | observational                           | Sept-Oct 1994             | HSV culture-positive adults                                      |                   |                         | median duration of cold episode  |  | adult             |                | 11 days   | Arruda, E., Pitkäranta, A.N.N.E., Witek, T.J., Doyle, C.A. and Hayden, F.G., 1997. Frequency and natural history of rhinovirus infections in adults during autumn. <i>Journal of clinical microbiology</i> , 35(11), pp.2864-2868.  |
|                            | experimental                            |                           | healthy adult males  | 32                | inoculation w/ NIH 1734 | viral shedding period  |  | adult             |                | 10 days   | Douglas Jr, R.G., Cate, T.R., Gerone, P.J. and Couch, R.B., 1966. Quantitative rhinovirus shedding patterns in volunteers. <i>American Review of Respiratory Disease</i> , 94(2), pp.159-167.   |
|                            | textbook chapter                        |                           |  |                   |                         | average length of symptoms   |  | all               |                | 7 days  | Landry, Marie Louise. <i>Rhinoviruses</i> . In P. R. Murray, E. J. Baron, J. Jorgensen, M. Pfaller & M. L. Landry (Eds.), <i>Manual of Clinical Microbiology</i> (9th ed., pp. 1405) ASM Press.   |
| hospitalization period     | observational                           | 1 year                    | otherwise healthy ILI children                                   | 986               |                         | median duration of hospitalization   |  | 6 months-10 years |                | 1.5 days  | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41. |
|                            | retrospective                           | Jan 2014-Apr 2015         | hospitalized children  | 198               |                         | diff. btw. length of hospital stay for HRV positive vs. no respiratory virus |  | children          |                | 0.4 days  | Tam, P.Y.I., Zhang, L. and Cohen, Z., 2018. Clinical characteristics and outcomes of human rhinovirus positivity in hospitalized children. <i>Annals of thoracic medicine</i> , 13(4), p.230.   |
|                            | observational                           | 2003-2005                 | RSV positive children hospitalized for acute respiratory illness | 332               |                         | median length of stay  |  | < 5 years         |                | 1.67 days   | Iwane, M.K., Prill, M.M., Lu, X., Miller, E.K., Edwards, K.M., Hall, C.B., Griffin, M.R., Staat, M.A., Anderson, L.J., Williams, J.V. and Weinberg, G.A., 2011. Human rhinovirus species associated with hospitalizations for acute respiratory illness in young US children. <i>Journal of Infectious Diseases</i> , 204(11), pp.1702-1710.  |
| hospitalization proportion | observational                           | 1 year                    | otherwise healthy ILI children                                   | 986               |                         | percent hospitalized   |  | 6 months-10 years |                | 0.024   | Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazcano-Ponce, E., Kerdpanich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41. |
|                            | observational                           | 2008-2010                 | US adults seen in hospital, ED, or outpatient clinic             |                   |                         | rhinovirus associated hospitalization per year                               |  | adult             |                | 0.003   | Miller, E.K., Linder, J., Kraft, D., Johnson, M., Lu, P., Saville, B.R., Williams, J.V., Griffin, M.R. and Talbot, H.K., 2016. Hospitalizations and outpatient visits for rhinovirus-associated acute respiratory illness in adults. <i>Journal of Allergy and Clinical Immunology</i> , 137(3), pp.734-743.  |
|                            | observational                           | 1998-2001                 | ILI infants  |                   |                         | percent hospitalized out of infants with HRV                                 |  | infant            |                | 0.0093  | Lee, W.M., Lemanske Jr, R.F., Evans, M.D., Vang, F., Pappas, T., Gangnon, R., Jackson, D.J. and Gern, J.E., 2012. Human rhinovirus species and season of infection determine illness severity. <i>American journal of respiratory and critical care medicine</i> , 186(9), pp.886-891.  |
| case fatality proportion   | observational                           |                           | elderly patients w/ single RSV infection                         | 96                |                         | percent of patients who died   |  | elderly           |                | 0.0104  | Nicholson, K.G., Kent, J., Hammersley, V. and Cancio, E., 1996. Risk factors for lower respiratory complications of rhinovirus infections in elderly people living in the community: prospective cohort study. <i>Bmj</i> , 313(7065), pp.1119-1123.  |
|                            | observational                           | 2012                      | elderly patients w/ RSV-associated respiratory infection         | 32                |                         | percent of patients who died   |  | elderly           |                | 0.125   | Fica, A., Dabanch, J., Andrade, W., Bustos, P., Carvajal, I., Ceroni, C., Triantafilo, V., Castro, M. and Fasce, R., 2015. Clinical relevance of rhinovirus infections among adult hospitalized patients. <i>Brazilian Journal of Infectious Diseases</i> , 19(2), pp.118-124.  |
|                            | observational                           | 1995-2000                 | RSV positive elderly patients w/ underlying conditions           | 4                 |                         | percent of patients who died   |  | > 65 years        |                | 0   | Faisey, A.R., Walsh, E.E. and Hayden, F.G., 2002. Rhinovirus and coronavirus infection-associated hospitalizations among older adults. <i>The Journal of infectious diseases</i> , 185(9), pp.1338-1341.  |
| R0                         | estimated                               | 2018                      | simulated  |                   |                         | R0 at peak timing  |  |                   |                | 2.6   | Reis, J. and Shaman, J., 2018. Simulation of four respiratory viruses and inference of epidemiological parameters. <i>Infectious Disease Modelling</i> , 3, pp.23-34.   |
|                            | estimated                               | 2012-2017                 | simulated  |                   |                         | average R0 value   |  |                   |                | 1.2   | Levy, N., Iv, M. and Yom-Tov, E., 2018. Modeling influenza-like illnesses through composite compartmental models. <i>Physica A: Statistical Mechanics and its Applications</i> , 494, pp.288-293.   |
|                            | estimated from non-invasive observation |                           | wild chimpanzees   |                   |                         | average R0   |  |                   |                | 1.83  | Scully, E.J., Basnet, S., Wrangham, R.W., Muller, M.N., Otali, E., Hyeroba, D., Grindle, K.A., Pappas, T.E., Thompson, M.E., Machanda, Z. and Watters, K.E., 2018. Lethal respiratory disease associated with human rhinovirus C in wild chimpanzees. <i>Uganda</i> , 2013. <i>Emerging infectious diseases</i> , 24(2), p.267.   |

| COMPOSITION OF ILI literature review   |                  |                                |  |                |  |               |            |        |             |        |               |   |
|--|------------------|--------------------------------|--|----------------|--|---------------|------------|--------|-------------|--------|---------------|---|
| NOTE: 55-74% (average 62%) of patients with ILI who were sampled had viruses detected (Sentilhes, Taylor, Galindo-Fraga, Nandi, Varghese, Mahony, Graat, van Gageldonk-Lafeber, Van Beek, Van Asten)   |                  |                                |  |                |  |               |            |        |             |        |               |   |
| Citation   | year(s) of study | Sample Size                    | Positive samples   | age range      | population   | influenza A/B | adenovirus | HcoV   | rhinovirus* | RSV    | coinfection   | % of ILI patients with detected viruses |
| Sentilhes, A.C., Choumlivong, K., Celhay, O., Sisouk, T., Phonekeo, D., Vongphrachanh, P., Brey, P. and Buchy, P., 2013. Respiratory virus infections in hospitalized children and adults in Lao PDR. <i>Influenza and other respiratory viruses</i> , 7(6), pp.1070-1078.   | 8/2009-10/2010   | 292                            | % of 162 positive. 140 single virus detected; 22 coinfections detected | all, med 2.2   | hospitalized for acute lower respiratory infection | 13.00%        | 6.00%      | 4.00%  | 35.00%      | 26.00% | 8.00%         | 55.00%                                  |
| and Klimov, A., 2012. Multisite virological influenza surveillance in India: 2004–2008. <i>Influenza and other respiratory viruses</i> , 6(3), pp.196-203.   | 9/2004-12/2008   | 13928                          | only influenza   | all, med 14.66 | ILI and SARI                                       | 4.43%         | NA         | NA     | NA          | NA     | NA            |   |
| Laguna-Torres, V.A., Gómez, J., Ocaña, V., Aguilar, P., Saldarraga, T., Chavez, E., Perez, J., Zamalloa, H., Forshey, B., Paz, I. and Gomez, E., 2009. Influenza-like illness sentinel surveillance in Peru. <i>PLoS one</i> , 4(7), p.e6118.  | 6/2006-5/2008    | % of 6835 ILI                  | 2688 positive  | all, med 13    | ILI only   | 34.80%        | 1.80%      | NA     | 0.50%       | 0.60%  | 0.90%         |   |
| A., 2016. Epidemiology and etiology of influenza-like-illness in households in Vietnam; it's not all about the kids!. <i>Journal of Clinical Virology</i> , 82, pp.126-132.  | 2008-2013        | 945                            | % of 271 positive  | all            | ILI  | 17.00%        | NA         | 8.00%  | 28.00%      | 3.00%  | NA-all single | 62.30%                                  |
| Taylor, S., Lopez, P., Weckx, L., Borja-Tabora, C., Ulloa-Gutierrez, R., Lazcano-Ponce, E., Kerdpnich, A., Weber, M.A.R., de Los Santos, A.M., Tinoco, J.C. and Safadi, M.A.P., 2017. Respiratory viruses and influenza-like illness: epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample. <i>Journal of Infection</i> , 74(1), pp.29-41.     | 2/2010-8/2011    | 6266                           | % of 3717 ILI. 2958 pos.   | 6 mo- 10 yrs   | children w/ ILI                                    | 15.80%        | 9.80%      | 5.60%  | 41.50%      | 9.70%  | not clear     |   |
| Dia, N., Sarr, F.D., Thiam, D., Sarr, T.F., Espié, E., OmarBa, I., Coly, M., Niang, M. and Richard, V., 2014. Influenza-like illnesses in Senegal: not only focus on influenza viruses. <i>PLoS One</i> , 9(3), p.e93227.  | 2012-2013        | 1038 pos. patients             | % of 1678 viruses  | all            | ILI patients                                       | 19.00%        | 22.00%     | 2.00%  | 19.00%      | 9.00%  | not clear     |   |
| Freytmuth, F., Vabret, A., Rozenberg, F., Dina, J., Petitjean, J., Gouarin, S., Legrand, L., Corbet, S., Brouard, J. and Lebon, P., 2005. Replication of respiratory viruses, particularly influenza virus, rhinovirus, and coronavirus in HuH7 hepatocarcinoma cell line. <i>Journal of medical virology</i> , 77(2), pp.295-301.   | 1999-2002        | 5258 total                     | 1797   | <18            | hosp. children                                     | 18.30%        | 6.50%      | 1.90%  | 15.10%      | 44.00% | not clear     |   |
| Louie, J.K., Hacker, J.K., Gonzales, R., Mark, J., Maselli, J.H., Yagi, S. and Drew, W.L., 2005. Characterization of viral agents causing acute respiratory infection in a San Francisco University Medical Center Clinic during the influenza season. <i>Clinical Infectious Diseases</i> , 41(6), pp.822-828.  | Jan-Mar 2002     | 266 diag. acute resp infection | 103 positive   | >=18           | ARI diagnosis                                      | 52.40%        | 23.30%     | 1.90%  | 23.30%      | 11.60% |               |   |
| Fowlkes, A., Giorgi, A., Erdman, D., Temte, J., Goodin, K., Di Lonardo, S., Sun, Y., Martin, K., Feist, M., Linz, R. and Boulton, R., 2013. Viruses associated with acute respiratory infections and influenza-like illness among outpatients from the Influenza Incidence Surveillance Project, 2010–2011. <i>The Journal of infectious diseases</i> , 209(11), pp.1715-1725.                 | 8/2010-7/2011    | 4212                           | 2443   | all            | ARI & ILI  | 21.20%        | 5.70%      | 7.30%  | 21.10%      | 6.20%  | not clear     |   |
| Galindo-Fraga, A., Ortiz-Hernández, A.A., Ramirez-Venegas, A., Vázquez, R.V., Moreno-Espinosa, S., Llamas-Gallardo, B., Pérez-Patrigeon, S., Salinger, M., Freimanis, L., Huang, C.Y. and Gu, W., 2013. Clinical characteristics and outcomes of influenza and other influenza-like illnesses in Mexico City. <i>International Journal of Infectious Diseases</i> , 17(7), pp.e510-e517.       | same             | 913                            | 821 viruses in 678 subjects  | ALL            | ILI  | 24.00%        | 9.00%      | 14.40% | 25.30%      | 10.30% | 11.90%        | 64.00%                                  |
| Nandi, T., Khanna, M., Pati, D.R., Kumar, B. and Singh, V., 2018. Epidemiological surveillance and comparative analysis of patients with influenza like illness and other respiratory viruses. <i>International Journal of Infectious Diseases</i> , 73, p.203.  |                  | 100                            | % of 100 patients  | all            | ILI  | 36.78%        | NA         | 2.83%  | 5.66%       | NA     |               | 68.85%                                  |
| Varghese, B.M., Dent, E., Chilver, M., Cameron, S. and Stocks, N.P., 2018. Epidemiology of viral respiratory infections in Australian working-age adults (20–64 years): 2010–2013. <i>Epidemiology &amp; Infection</i> , 146(5), pp.619-626.   | 2010-2013        | 3201                           | 1789 positive  | 20-64          |  | NA            | 1.30%      | NA     | 18.60%      | 3.10%  | not clear     | 55.80%                                  |
| Mahony, J.B., Petrich, A. and Smieja, M., 2011. Molecular diagnosis of respiratory virus infections. <i>Critical reviews in clinical laboratory sciences</i> , 48(5-6), pp.217-249.  |                  |                                |  |                |  | NA            | NA         | NA     |             | 54.42% |               |   |
| BOLLAERTS, K., Antoine, J., Van Casteren, V., Ducoffre, G., HENS, N. and Quoilin, S., 2013. Contribution of respiratory pathogens to influenza-like illness consultations. <i>Epidemiology &amp; Infection</i> , 141(10), pp.2196-2204.  | 2004-2008        | ??                             |  | all            |  | NA            | NA         | NA     |             | NA     |               |   |
| Graat, J.M., Schouten, E.G., Heijnen, M.L.A., Kok, F.J., Pallast, E.G., de Greeff, S.C. and Dorigo-Zetsma, J.W., 2003. A prospective, community-based study on virologic assessment among elderly people with and without symptoms of acute respiratory infection. <i>Journal of clinical epidemiology</i> , 56(12), pp.1218-1223.   | Oct 98-Oct 99    | 652                            | 107 episodes in 97 subjects  | >=60 yrs       | ILI  | 7.00%         | 0.00%      | 17.00% | 32.00%      | 0.00%  |               | 58.00%                                  |
| Buecher, C., Mardy, S., Wang, W., Duong, V., Vong, S., Naughtin, M., Vabret, A., Freymuth, F., Deubel, V. and Buchy, P., 2010. Use of a multiplex PCR/RT-PCR approach to assess the viral causes of influenza-like illnesses in Cambodia during three consecutive dry seasons. <i>Journal of medical virology</i> , 82(10), pp.1762-1772.  | 2005-2007        | 234                            | 83   | all            | ILI  | NA            | 3.60%      | 21.70% | 43.40%      | 7.20%  | yes           |   |
| van Gageldonk-Lafeber, A.B., Heijnen, M.L.A., Bartelds, A.I., Peters, M.F., van der Plas, S.M. and Wilbrink, B., 2005. A case-control study of acute respiratory tract infection in general practice patients in The Netherlands. <i>Clinical Infectious Diseases</i> , 41(4), pp.490-497.   | 2000-2003        | 645                            | 156  | all            | ARTI incl ILI                                      | NA            | NA         | 7.00%  | 24.00%      | NA     | 3.00%         | 58.00%                                  |
| van Beek, J., Veenhoven, R.H., Bruin, J.P., Van Bortel, R.A., de Lange, M.M., Meijer, A., Sanders, E.A., Rots, N.Y. and Luytjes, W., 2017. Influenza-like illness incidence is not reduced by influenza vaccination in a cohort of older adults, despite effectively reducing laboratory-confirmed influenza virus infections. <i>The Journal of infectious diseases</i> , 216(4), pp.415-424. | 2011/12          | 1992                           | 141  | 60-89          | ILI  | 18.90%        | NA         | 18.20% | 8.40%       | 4.90%  |               | 64.90%                                  |
| van Beek, J., Veenhoven, R.H., Bruin, J.P., Van Bortel, R.A., de Lange, M.M., Meijer, A., Sanders, E.A., Rots, N.Y. and Luytjes, W., 2017. Influenza-like illness incidence is not reduced by influenza vaccination in a cohort of older adults, despite effectively reducing laboratory-confirmed influenza virus infections. <i>The Journal of infectious diseases</i> , 216(4), pp.415-424. | 2012/13          | 2368                           | 260  | 60-89          | ILI  | 34.20%        | NA         | 11.30% | 21.10%      | 6.50%  |               | 73.80%                                  |
| van Asten, L., van den Wijngaard, C., van Pelt, W., van de Kasstele, J., Meijer, A., van der Hoek, W., Kretzschmar, M. and Koopmans, M., 2012. Mortality attributable to 9 common infections: significant effect of influenza A, respiratory syncytial virus, influenza B, norovirus, and parainfluenza in elderly persons. <i>The Journal of infectious diseases</i> , 206(5), pp.628-639.    | 2000-2001        | 592                            | 361  | < 5            | hosp ARI children                                  | 3.00%         |            |        |             | 20.00% |               | 61.00%                                  |
| Iwane, M.K., Edwards, K.M., Szilagyi, P.G., Walker, F.J., Griffin, M.R., Weinberg, G.A., Coulen, C., Poehling, K.A., Shone, L.P., Balter, S. and Hall, C.B., 2004. Population-based surveillance for hospitalizations associated with respiratory syncytial virus, influenza virus, and parainfluenza viruses among young children. <i>Pediatrics</i> , 113(6), pp.1758-1764.                  |                  |                                |  |                |  |               |            |        |             |        |               |   |
| *Rhinovirus included other enteroviruses in many studies.  |                  |                                |  |                |  |               |            |        |             |        |               |   |