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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 under-lying 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

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Table 1: Parameters for Influenza-like illness

Summary of Parameters from Literature Review	Range (min to max)	Mean	Standard Deviation	References
INCUBATION PERIOD (days)				
virus	*range*	*mean*	*SD*	
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
INFECTIOUS PERIOD (days)				
virus	*range*	*mean*	*SD*	
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 https://www.cdc.gov/rsv/about/transmission.html, 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 205, Chiu 2005, Valtonen 2019, Anderson 2004, Chowell 2004
adenovirus	7-17	8.20	2.89	Sendra-Gutierrez 2004, Taylor 2017, Hong 2001, Robinson 2007
HOSPITALIZATION PERIOD (days)				
virus	*range*	*mean*	*SD*	
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
HOSPITALIZATION PROPORTION (dimensionless)				
virus	*range*	*mean*	*SD*	
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
CASE FATALITY PROPORTION (dimensionless)				
virus	*range*	*mean*	*SD*	
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
R_0 (dimensionless)				
virus	*range*	*mean*	*SD*	
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,

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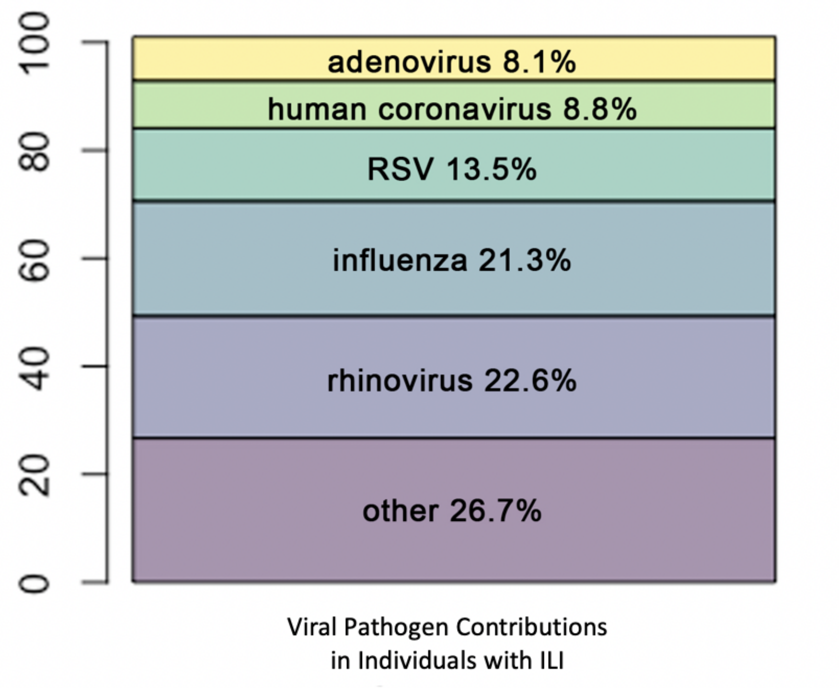
Figure 1: Viral Composition



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.

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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 sec-ondary 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 R0 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). Individ-uals 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.

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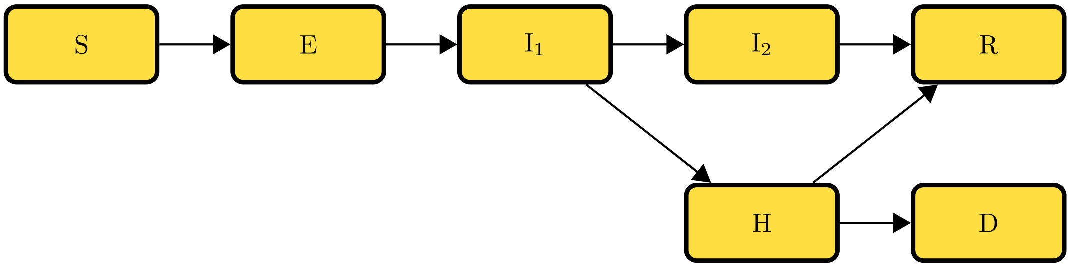

Figure 2: Transfer diagram for ILI virus transmission.

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.

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Table 4: Descriptions and dimensions for parameters

Parameter	Description	Dimension
β	basic transmission rate	$individuals^{-1} \times time^{-1}$
c	reduction of transmission in hospital	dimensionless
γ_1	per capita rate of progress from exposed to infectious state	$time^{-1}$
γ_2	per capita rate of progress through initial infectious state	$time^{-1}$
γ_3	per capita rate of progress through hospitalized state	$time^{-1}$
γ_4	per capita rate of progress through non-hospitalized infectious state	$time^{-1}$
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

$$\frac{dS}{dt} = -\beta S(I_1 + I_2 + cH) \tag{1a}$$
$$\frac{dE}{dt} = \beta S(I_1 + I_2 + cH) - \gamma_1 E \tag{1b}$$
$$\frac{dI_1}{dt} = \gamma_1 E - \gamma_2 I_1 \tag{1c}$$
$$\frac{dI_2}{dt} = \gamma_2(1 - p_1)I_1 - \gamma_4 I_2 \tag{1d}$$
$$\frac{dH}{dt} = \gamma_2 p_1 I_1 - \gamma_3 H \tag{1e}$$
$$\frac{dR}{dt} = \gamma_4 I_2 + \gamma_3(1 - p_2)H \tag{1f}$$
$$\frac{dD}{dt} = \gamma_3 p_2 H \tag{1g}$$

The total population is $\mathrm{N = S + E + I_1 + I_2 + H + R + D}$. 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.

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$$\frac{dS}{dt} = -\beta S(0 + 0 + c(0)) = 0 \tag{2a}$$
$$\frac{dE}{dt} = \beta S(0 + 0 + c(0)) - \gamma_1(0) = 0 \tag{2b}$$
$$\frac{dI_1}{dt} = \gamma_1(0) - \gamma_2(0) = 0 \tag{2c}$$
$$\frac{dI_2}{dt} = \gamma_2(1 - p_1)(0) - \gamma_4(0) = 0 \tag{2d}$$
$$\frac{dH}{dt} = \gamma_2 p_1(0) - \gamma_3(0) = 0 \tag{2e}$$
$$\frac{dR}{dt} = \gamma_4(0) + \gamma_3(1 - p_2)(0) = 0 \tag{2f}$$
$$\frac{dD}{dt} = \gamma_3 p_2(0) = 0 \tag{2g}$$

Additionally, if we set any one of E, I_1, I_2, 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_1), symptomatic and infected and non-hospitalized individuals (I_2), and hospitalized individuals (H), together characterize the total infected population for the ILI 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_1, I_2, H): the "V" matrix;
3. Next Generation Matrix (NGM) = $(F)(V^{-1})$;
4. The largest dominant eigenvalue or spectral radius of the NGM = R0 for the system.
The transmission term for the system is $\beta S(I_1 + I_2 + cH)$

$$\mathbf{F} = \begin{pmatrix} 0 & \beta S & \beta S & \beta Sc \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \tag{3}$$

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

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$$\mathbf{V} = \begin{pmatrix} \gamma_1 & 0 & 0 & 0 \\ -\gamma_1 & \gamma_2 & 0 & 0 \\ 0 & -\gamma_2(1-p_1) & \gamma 4 & 0 \\ 0 & -\gamma_2 p_1 & 0 & \gamma 3 \end{pmatrix} \tag{4}$$

The next generation matrix is

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

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.

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

This expression for the basic reproductive number (R_0) depends on the parameters $\beta, c, p_1, \gamma_2, \gamma_3$ and γ_4, and on the initial conditions for the state variables. β is clearly directly proportional to R_0.

CONCEPTUAL METHOD OF DERIVING R0

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

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

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

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

$$R_0 = \frac{\beta S(\gamma_3\gamma_4 + (1-p_1)\gamma_2\gamma_3 + p_1 c\gamma_2\gamma 4)}{\gamma_2\gamma_3\gamma_4}$$

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

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

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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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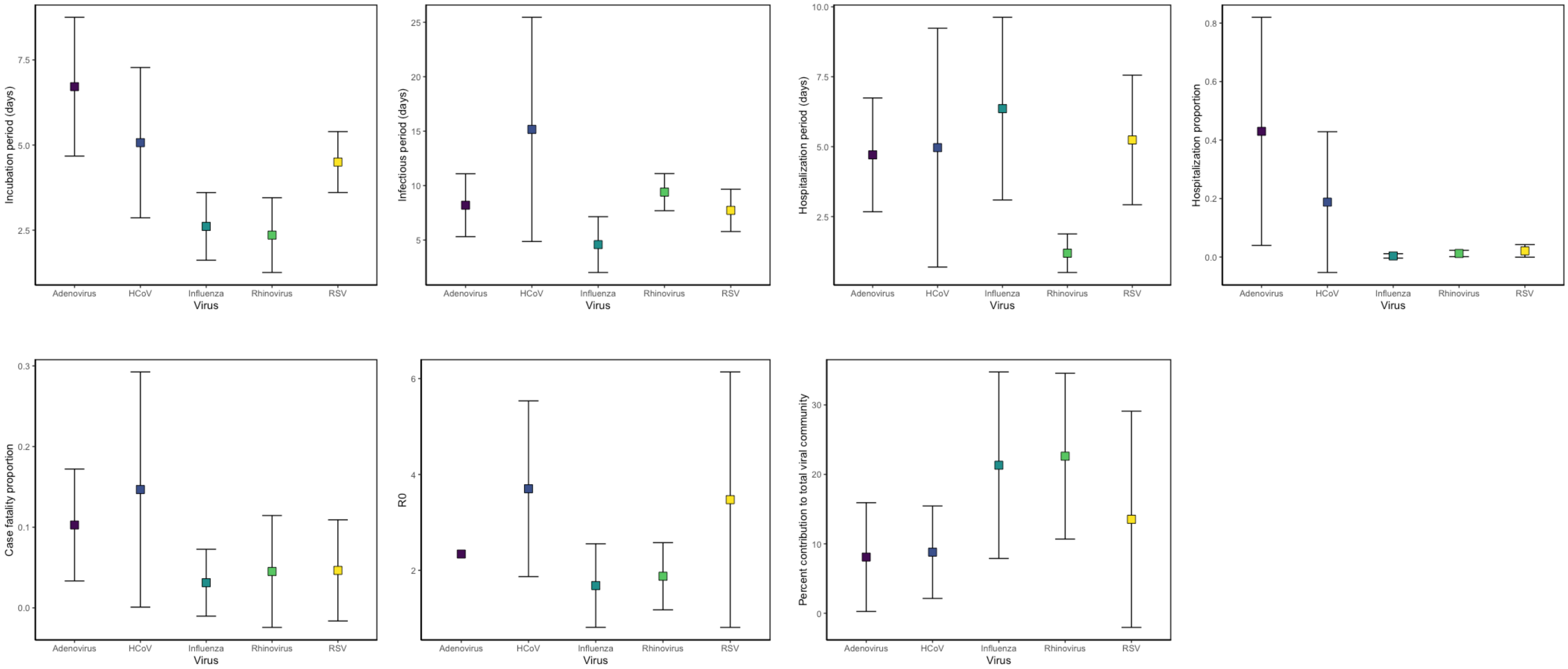
ILI Parameter Ranges and Means



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. Cell host & microbe, 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. The Journal of infectious diseases, 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. Journal of Infectious Diseases, 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. New England Journal of Medicine, 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. American journal of epidemiology, 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. Journal of clinical virology, 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. Chest, 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. The Lancet infectious diseases, 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. European Journal of Internal Medicine, 15(2), pp.79-88.
infectious period												
	experimental	8 days	healthy males		FluA(H1N1)		virus titer	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. The Journal of infectious diseases, 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. Journal of Infectious Diseases, 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. Journal of clinical virology, 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. Epidemiology (Cambridge, Mass.), 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. Journal of Infection, 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. Clinical infectious diseases, 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, Å., 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. Journal of Hospital Infection, 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. American Journal of Epidemiology, 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., Oţelea, D., Aramă, V., Luminos, M.L., Streinu-Cercel, A., Niţescu, 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. Brazilian Journal of Infectious Diseases, 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. Journal of Infection, 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. Journal of Infection, 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. Pediatrics, 113(6), pp.1758-1764.
	observational	2009-2011	children <5 in India	245		numer 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. Journal of Infection, 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. Emerging Infectious Diseases, 21(9), 1595-1601. https://dx.doi.org/10.3201/eid
	observational	2004-2008	all population			number hospitalized out of 100,000			<6 months-≥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. Emerging infectious diseases, 20(10), p.1652.
	observational	2010-2012	all population			number hospitalized out of 100,000			<6 months-≥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. Emerging infectious diseases, 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. Journal of Infection, 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. Clinical Infectious Diseases, 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. American journal of epidemiology, 165(12), pp.1434-1442.
	retrospective	1997-2007	all U.S.		seasonal influenza				all		0.07	Quandelacy, 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. American journal of epidemiology, 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. Brazilian Journal of Infectious Diseases, 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. Influenza and other respiratory viruses, 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. Proceedings of the Royal Society B: Biological Sciences, 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. PLoS One, 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. Outbreak, surveillance and investigation reports, 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. Epidemiology & Infection, 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. Proceedings of the Royal Society B: Biological Sciences, 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. BMC infectious diseases, 14(1), p.480.

RSV parameters: incubation period, infectious period, hospitalization period, hospitalization rate, case fatality rate, R0

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., Perl, T.M., Nelson, K.E. and Cummings, D.A., 2009. Incubation periods of acute respiratory viral infections: a systematic review. The Lancet infectious diseases, 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. Cell host & microbe, 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. J.A.M.A. 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. Vaccine, 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. Epidemiology & Infection, 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. European Journal of Internal Medicine, 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. Clinical infectious diseases, 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). Mathematical biosciences, 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," https://www.cdc.gov/rsv/about/transmission.html
	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. Journal of Infection, 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. The Journal of pediatrics, 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. Journal of paediatrics and child health, 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. Jama, 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. Journal of Infection, 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. The Pediatric infectious disease journal, 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. Journal of Infection, 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. Journal of medical virology, 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. Vaccine, 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. Pediatrics, 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. Journal of Infection, 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). Journal of clinical microbiology, 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., 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. Journal of Infection, 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). Mathematical biosciences, 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. Current medical research and opinion, 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. The Journal of pediatrics, 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. Clinical Infectious Diseases, 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. Journal of paediatrics and child health, 42(4), pp.174-178.
	observational	2000	hosp. acute bronchiolotis	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. European journal of epidemiology, 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). Journal of clinical microbiology, 41(10), pp.4879-4882.
	review	before 2013				"mortality"			.08-.1	0.09	Lee, N., Qureshi, S.T., Other viral pneumonias. Crit Care Clin 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). Mathematical biosciences, 172(2), pp.95-113.
	estimated									3	Reis J., Shaman, J., 2016. RetrospectiveParameterEstimationand Forecastof RespiratorySyncytialVirusin the UnitedStates.PLoSComputBiol 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. PloS one, 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. Scientific reports, 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. PLoS pathogens, 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. Infectious Disease Modelling, 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. Physica A: Statistical Mechanics and its Applications, 494, pp.288-293.

ADENOVIRUS parameters: incubation period, infectious period, hospitalization period, reduction of transmission in hospital, hospitalization rate, case fatality rate, R0
NOTE: adenovirus in the elderly produces keratoconjunctivitis, not a respiratory infection

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-Rios, 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. The Lancet infectious diseases, 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. Clinical infectious diseases, 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. Journal of Clinical Investigation, 26(5), pp.957-973.
	textbook chapter	NA		NA		no defnition			4-12 days	8 days	Berger, S., 2010. Infectious Diseases of Bhutan 2010 edition. " 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. Nelson Pediatric Symptom-Based Diagnosis E-Book. Elsevier Health Sciences.
	review	before 2004	literature						4-14 days	9 days	REVIEW: Wat, D., 2004. The common cold: a review of the literature. European Journal of Internal Medicine, 15(2), pp.79-88.
	textbook chapter	NA					in textbook		2-14 days	8 days	Robinson, C., & Echavarria, M. (2007). Adenoviruses. In P. R. Murray, E. J. Baron, J. Jorgensen, M. Pfaller & M. L. Landry (Eds.), Manual of Clinical Microbiology (9th ed., pp. 1589) ASM Press.
infectious period											
	observational	2001-2002		102				elderly (noso)	17 days max	9 days	Sendra-Gutiérrez, J.M., Martín-Rios, D., Casas, I., Sáez, P., Tovar, A. and Moreno, C., 2004. AN OUTBREAK OF ADENOVIRUS TYPE 8. Euro Surveill, 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-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. Journal of Infection, 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. Clinical infectious diseases, 32(10), pp.1423-1429.
	textbook chapter	NA	adults			viral shedding period after recovery			up to 1 week	4 days	Robinson, C., & Echavarria, M. (2007). Adenoviruses. In P. R. Murray, E. J. Baron, J. Jorgensen, M. Pfaller & M. L. Landry (Eds.), Manual of Clinical Microbiology (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., & Echavarria, M. (2007). Adenoviruses. In P. R. Murray, E. J. Baron, J. Jorgensen, M. Pfaller & M. L. Landry (Eds.), Manual of Clinical Microbiology (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-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. Journal of Infection, 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. The Pediatric infectious disease journal, 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. Clinical pediatrics, 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., Llamosas-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. International Journal of Infectious Diseases, 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., Llamosas-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. International Journal of Infectious Diseases, 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. American journal of hygiene, 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-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. Journal of Infection, 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. Clinical infectious diseases, 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., Llamosas-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. International Journal of Infectious Diseases, 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. Journal of Hospital Infection, 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. Clinical infectious diseases, 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.

HUMAN CORONAVIRUS parameters: incubation period, infectious period, onset of symptoms to hospitalization, hospitalization period, hospitalization proportion, case fatality, R0

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. The Lancet infectious diseases, 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. British medical journal, 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 Schilarb, J.E., 1993. Signs and symptoms in common colds. Epidemiology & Infection, 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. European Journal of Internal Medicine, 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., Grönroos, 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. British journal of sports medicine, 53(17), pp.1093-1098.
	observational	April 1-May 23, 1013	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. The Lancet infectious diseases, 13(9), pp.752-761.
	retrospective	2015	confirmed cased (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. Emerging infectious diseases, 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. Emerging infectious diseases, 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. Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences, 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. Journal of Infection, 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., Roiha, H., Deffernez, C. and Frey, U., 2005. Human coronavirus NL63 associated with lower respiratory tract symptoms in early life. The Pediatric infectious disease journal, 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. Clinical infectious diseases, 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., Grönroos, 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. British journal of sports medicine, 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. Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences, 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., Arriola, L. and Hyman, J.M., 2004. Model parameters and outbreak control for SARS. Emerging Infectious Diseases, 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. The Lancet infectious diseases, 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. Annual review of medicine, 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. Clinical Infectious Diseases, 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. Science, 300(5627), pp.1966-1970
	observational	2014	hospitalized confirmed	9	MERS	onset to hospitalization		all	0-8 days	3 days	Corman, V.M., Albarrak, A.M., Omrani, A.S., Albarrak, 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 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. Journal of Infection, 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. Clinical infectious diseases, 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, R., Deffrasnes, C., Leblanc, É., 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., Albarrak, A.M., Omrani, A.S., Albarrak, 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., 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. 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., Caeseele, 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-Molinero, E. and Rubio, R., 2014. Clinico-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', Germs, 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., Caeseele, 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-Molinero, E. and Rubio, R., 2014. Clinico-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. http://applications.emro.who.int/docs/EMRPUB-CSR-241-2019-EN.pdf?ua=1&ua=1&ua=1
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.

RHINOVIRUS parameters: incubation period, infectious period, hospitalization period, hospitalization proportion, case fatality, R0

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. The Lancet infectious diseases, 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. PLoS One 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. The Journal of Immunology, 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. Journal of Allergy and Clinical Immunology, 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. Physiology and Behavior: 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 D, Lichtenstein LM, Kagey-Sobotka A, Hendley JO,, Sorrentino J, Gwaltney JM, 1987. Kinins are generated during experimental rhinovirus colds. Th Journal of Infectious Diseases: 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. Clinical Infectious Diseases: 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 Øien, N.C., 2009. Gene expression signatures diagnose influenza and other symptomatic respiratory viral infections in humans. Cell host & microbe, 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. Epidemiology & Infection, 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. European Journal of Internal Medicine, 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. Journal of Infection, 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. Bmj, 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. Journal of clinical microbiology, 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. American Review of Respiratory Disease, 94(2), pp.159-167.
	textbook chapter					average length of symptoms		all		7 days	Landry, Marie Louise. *Rhinoviruses* . In P. R. Murray, E. J. Baron, J. Jorgensen, M. Pfaller & M. L. Landry (Eds.), Manual of Clinical Microbiology (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. Journal of Infection, 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. Annals of thoracic medicine, 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. Journal of Infectious Diseases, 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. Journal of Infection, 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. Journal of Allergy and Clinical Immunology, 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. American journal of respiratory and critical care medicine, 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. Bmj, 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. Brazilian Journal of Infectious Diseases, 19(2), pp.118-124.
	observational	1995-2000	RSV positive elderly patients w/ underlying conditions	4		percent of patients who died		> 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.
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. Infectious Disease Modelling, 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. Physica A: Statistical Mechanics and its Applications, 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, Uganda, 2013. Emerging infectious diseases, 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. Influenza and other respiratory viruses, 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. Influenza and other respiratory viruses, 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., Saldarriaga, T., Chavez, E., Perez, J., Zamalloa, H., Forshey, B., Paz, I. and Gomez, E., 2009. Influenza-like illness sentinel surveillance in Peru. PloS one, 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!. Journal of Clinical Virology, 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., 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.	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. PLoS One, 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	
Freymuth, 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. Journal of medical virology, 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. Clinical Infectious Diseases, 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. The Journal of infectious diseases, 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., Ramírez-Venegas, A., Vázquez, R.V., Moreno-Espinosa, S., Llamosas-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. International Journal of Infectious Diseases, 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. International Journal of Infectious Diseases, 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. Epidemiology & Infection, 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. Critical reviews in clinical laboratory sciences, 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. Epidemiology & Infection, 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. Journal of clinical epidemiology, 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. Journal of medical virology, 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. Clinical Infectious Diseases, 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 Boxtel, 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. The Journal of infectious diseases, 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 Boxtel, 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. The Journal of infectious diseases, 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 Kassteele, 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. The Journal of infectious diseases, 206(5), pp.628-639.	2000-2001	592	361	< 5	hosp ARI children	3.00%				20.00%		61.00%
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*Rhinovirus included other enteroviruses in many studies.