Supplemental Information— Data Supporting MERS and SARS R_0

Several R_0 values were found in the literature and were used to calculate the approximate R_0 in the early stages, late stages, and throughout the outbreaks of MERS and SARS. Values were greatest early on, due to the major role in the outbreak played by poor control measures and rapid transmission in hospitals. As cases were identified and control measures were implemented, R_0 values dropped.

As described further below, the values and ranges calculated for MERS R_0 were 0.54 [0.45 to 0.63] for the full outbreak, 0.70 [0.45 to 0.88] for early stages and 0.36 [0.32 to 0.45] for late stages. The values and ranges calculated for SARS R_0 were 1.47 [no range] for a full outbreak, 1.59 [0.80 to 2.7] for early stages and 0.57 [0.14 to 1.0] for late stages. Values were calculated as an average of the R_0 presented by each relevant paper, giving equal weight to each methodology. The use of a weighting approach was not feasible, as many of the papers used overlapping data sets. The aim was to increase accuracy by drawing results from multiple methodologies.

Data for MERS were drawn from several papers. A study by Cauchemez et al. (2014) used branching process theory with a negative binomial distribution to estimate the R_0 value for 111 confirmed and probable cases reported by the WHO by August 2013.[1] These cases spanned 21 clusters. R_0 values were given before and after June 1, 2013, which was used as the cutoff between early stages and late stages for this instance.

Chowell et al. (2014) used a stochastic compartmental transmission model and matched this to MERS case data from April to October 2013 using a Markov-Chain-Monte-Carlo estimation technique.[2] This study corrected for observation bias, assuming that all primary cases were severe enough to warrant hospitalization but only 57% of secondary cases presented with symptoms. R_0 values were reported for index and secondary cases with the correction (yielding the same value for both types) and without the correction (yielding different values for the two types). Averages of the values for index cases and secondary cases with and without the correction and for the full outbreak were used for the early stage, late stage, and full outbreak R_0 calculations.

Breban et al. (2013) used Bayesian analysis on 55 cases confirmed by June 21, 2013.[3] These authors reported an optimistic scenario and a pessimistic one, which differed in the classification of ambiguous cases as index or secondary. The average of the two scenarios was taken as the early stage R_0. Additionally, the study found an R_0 value for prepandemic SARS, using the same method, which used for early stage R_0 calculations for SARS.

SARS results were drawn from several papers, in addition to the one by Breban (2013) which covered both SARS and MERS. A separate study by Chowell (2004) used a similar method, estimating epidemiological parameters and applying them to a transmission equation.[4] R_0 values were found for clusters in Toronto, Hong Kong, and Singapore. The average of these three was taken as the value for full outbreak R_0.

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[1] Cauchemez S *et al* (2014) Middle East respiratory syndrome coronavirus: quantification of the extent of the epidemic, surveillance biases, and transmissibility. The Lancet Infectious diseases 14: 50-56

[2] Chowell G *et al* (2014) Synthesizing data and models for the spread of MERS-CoV, 2013: key role of index cases and hospital transmission. Epidemics 9: 40-51

[3] Breban R *et al* (2013) Interhuman transmissibility of Middle East respiratory syndrome coronavirus: estimation of pandemic risk. Lancet 382: 694-699

[4] Chowell G *et al* (2004) Model parameters and outbreak control for SARS. Emerging infectious diseases 10: 1258-1263

Massad et al. (2005) modeled the outbreaks in Toronto and Hong Kong using epidemiological parameters.[5] The aim was to predict the benefits of intervention strategies. R_0 values for the beginning of the outbreaks in Hong Kong and Toronto were calculated. The average of these was used in early stage R_0 calculations

Riley et al. (2003) mapped data on 1512 SARS cases in Hong Kong to a stochastic transmission model.[6] This paper reported the value at the beginning of the outbreak, which was used for early stage R_0 calculations. Several values were reported were later in the outbreak, lowered as a result of improved control measures, and the average of these was used for late stage R_0 calculations.

The synthesis of data from several sources allows improved accuracy in the calculations for R_0 values at various points in the MERS and SARS outbreaks. These calculated values confirm that transmission is highest at the start of an outbreak and lower at the later stages, due largely to improved control measures, with the full outbreak R_0 falling between the two extremes.

Table S1. R_0 Values as Reported in the Literature

Pathogen	Study	Overall Outbreak R_0	Early Outbreak R_0	Late Outbreak R_0
MERS	Cauchemez et al. (2014)[7]	0.63 [0.47-0.85]	0.74 [0.53-1.03] 0.83 [0.67-1.08]	0.32 [0.14-0.65]
MERS	Chowell et al. (2014)[8]	0.45 [0.29-0.61]	0.88 [0.58-1.20] 0.45 [0.29-0.61]	0.36 [0.24-0.51] 0.45 [0.29-0.61]
MERS	Breban et al. (2013)[9]	ND	0.69 [0.50-0.92] 0.60 [0.42-0.80]	ND
SARS	Breban et al. (2013)[10]	ND	0.80 [0.54-1.13]	ND
SARS	Chowell et al. (2004)[11]	0.86 [0.24-1.18] 1.70 [0.44-2.29] 1.83 [0.47-2.47]	ND	ND
SARS	Massad et al. (2005)[12]	ND	1.2 1.32	ND
SARS	Riley et al. (2003)[13]	ND	2.7 [2.2-3.7]	1.0 [.07-1.2] 0.14 [0.09-0.35]

[5] Massad E *et al* (2005) Forecasting versus projection models in epidemiology: the case of the SARS epidemics. Medical hypotheses 65: 17-22

[6] Riley S *et al* (2003) Transmission dynamics of the etiological agent of SARS in Hong Kong: impact of public health interventions. Science 300: 1961-1966

[7] Cauchemez S *et al* (2014) Middle East respiratory syndrome coronavirus: quantification of the extent of the epidemic, surveillance biases, and transmissibility. The Lancet Infectious diseases 14: 50-56

[8] Chowell G *et al* (2014) Synthesizing data and models for the spread of MERS-CoV, 2013: key role of index cases and hospital transmission. Epidemics 9: 40-51

[9] Breban R *et al* (2013) Interhuman transmissibility of Middle East respiratory syndrome coronavirus: estimation of pandemic risk. Lancet 382: 694-699

[10] Ibid.

[11] Chowell G *et al* (2004) Model parameters and outbreak control for SARS. Emerging infectious diseases 10: 1258-1263

[12] Massad E *et al* (2005) Model parameters and outbreak control for SARS. Emerging infectious diseases. Medical hypotheses 65: 17-22

[13] Riley S *et al* (2003) Transmission dynamics of the etiological agent of SARS in Hong Kong: impact of public health interventions. *Science* 300**:** 1961-1966