REFERENCE TABLE OF PREVIOUS PANDEMICS AND MAJOR EPIDEMICS

Time period	Pathogen	Global cases (attack rate)			Global deaths			UK cases	UK deaths	Case fatality rate[a]	Transmission route	Asymptomatic infection widespread?[b]
		Upper	Mid	Lower	Upper	Mid	Lower					
1889-94	Uncertain. Human coronavirus OC43 or possibly influenza	(~60% based on limited data, increased to >90% in endemic state[c])			Not known	1m	Not known	Became endemic (>90%)	132,000	0.1-0.28%	Respiratory	Unknown but probable
1918-20	Influenza - H1N1	N/A	Became endemic (>90%)[d]	500m[e]	100m	50m	17.4m	Became endemic (>90%)	228,000	2.5-10%	Respiratory	Yes
1957-59	Influenza - H2N2	N/A	Became endemic (>90%)[f]	N/A	1.5m	1.1m	700,000	Became endemic (>90%)	5,000[g]	0.017-0.1%	Respiratory	Yes
1968-70[h]	Influenza - H3N2	N/A	Became endemic (>90%)	N/A	4m	2m	1m	Became endemic (>90%)	37,500[i]	0.1-0.2%	Respiratory	Yes
1977-78	Influenza - H1N1	N/A	Became endemic (>90%)	N/A	Not known	700,000	Not known	Became endemic (>90%)	6,000[i]	<0.1%	Respiratory	Yes
1981-	Retrovirus - HIV	113m	84.2m cumulative 38.4m now (0.7%)	64m	48.6m	40.1m[j]	33.6m	165,338	25,296	~99% [untreated]	Blood-borne / sexual	Yes
2002-03	Coronavirus - SARS-CoV-1	Not known[k]	8,096 (<0.001%)	N/A[l]	Not known[k]	774	N/A[l]	4	0	9.6%	Respiratory	No
2009-10	Influenza - H1N1	Became endemic. (First wave ~24%)[m] [491,382 official][o]			575,000	284,000	18,449 [official][o]	Became endemic[n] [28,456 official][o]	457 [official][o]	0.01-0.02%	Respiratory	Yes
2012-	Coronavirus - MERS-CoV	Not known[k]	2,519 (<0.001%)	N/A[l]	Not known[k]	866	N/A[l]	5	3	34.3%	Respiratory	Not initially, but more reports over time
2013-16	Ebola virus - EBOV	34,477[p]	28,616 (<0.001%)	N/A[l]	Not known[k]	11,310	N/A[l]	3	0	62.9%	Contact	No. ~5%, no evidence of onward transmission
2019-	Coronavirus - SARS-CoV-2	N/A	Becoming endemic as of Jun 2023 (>90%)	766m [official][o]	30.6m[q]	22m	17.7m [6.9m official][o]	Becoming endemic (>90%) [22m official][o]	225,668 [official][o]	0.67-1.18% [infection fatality rate]	Respiratory	Yes

Caveats:

1) All figures are **approximate**. They are **estimates** sourced from published scientific articles listed in the references, which in the process of summarising available data, also mask widely varying experiences in different countries or groups. Methodological quality varies, so the original references should be checked where estimates are being reused, and they may not be strictly comparable.

2) The influence of prior immunity on case fatality rate and the age distribution of infection is complex and has not been summarised here.

3) All references are from before 2020 to show the pre-covid knowledge base, apart from those for covid-19 itself. One paper does not necessarily indicate a scientific consensus, but public health authorities did have a duty to be aware of this selected evidence as part of their epidemic intelligence role and, where relevant, to summarise these references, within the context of the overall scientific literature, for political decision-makers.

4) The classical definition of a pandemic as an epidemic ocurring worldwide or over a very wide area has been used, regardless of whether an official declaration was made. SARS-CoV-1, MERS-CoV, and the 2013-2016 Ebola outbreak are sometimes described as pandemics as they could be considered to meet this definition, but they are more often described as epidemics.

5) Two notable subtypes of highly pathogenic avian influenza have not yet caused sustained human to human transmission: H5N1 (globally prevalent in birds, 879 reported human cases since 1997 emergence in Hong Kong, 53% case fatality rate) and H7N9 (persists in bird populations in China, 1,568 reported human cases since 2013 emergence in China, 39% case fatality rate).

6) Also not included are vector-borne infections, pandemics of plant or animal diseases, pandemics occurring before the development of modern germ theory (such as the Black Death) and the seven cholera pandemics from 1817 to the present.

See page 3 for footnotes a-q, and page 4 for a glossary of terms.

REFERENCE TABLE OF PREVIOUS PANDEMICS AND MAJOR EPIDEMICS   Prepared by the UK Covid-19 Inquiry, 9th June 2023

Time period	Pathogen	Possible origin country / region and others affected	Date declared a pandemic	Notes
1889-94	Uncertain. Human coronavirus OC43 or possibly influenza	Central Asia to global	No global health authority at the time	Also known as "Russian flu". 132,000 deaths in Britain and Ireland alone (Smith, 1995), so 1 million globally is probably a significant underestimate.
1918-20	Influenza - H1N1	USA (or, less likely, China / France) to global	No global health authority at the time	Also known as "Spanish flu"
1957-59	Influenza - H2N2	China to global	11 Oct 1957	Also known as "Asian flu"
1968- [h]	Influenza - H3N2	Hong Kong or China to global	No official pandemic announcement	Also known as "Hong Kong flu". 500,000 cases in Hong Kong alone.
1977-78	Influenza - H1N1	China or Russia to global	No official pandemic announcement	Not zoonotic. Also called "Russian Flu". Most likely origin is from a live-attenuated vaccine trial using stored samples from a H1N1 strain which went extinct in the 1950s.
1981-	Retrovirus - HIV	West Central Africa to global	No official pandemic announcement	Molecular clock studies find that emergence was in the late 19th / early 20th century. First recognised cases were in the USA in 1981.
2002-03	Coronavirus - SARS-CoV-1	China to Hong Kong, Canada & 27 other countries incl. UK	15 Mar 2003	First case detected in November 2002 but not initially shared with WHO. ProMED mail alert 10 Feb 2002. March 2003 WHO issued a travel advisory rather than a pandemic announcement.
2009-10	Influenza - H1N1	Mexico to global. First detected in the USA.	25 Apr 2009 11 Jun 2009	PHEIC Pandemic Also known as "Swine flu".
2012-	Coronavirus - MERS-CoV	Saudi Arabia to S. Korea & 25 other countries incl. UK	Ten WHO EC meetings, no PHEIC	Cases have largely been linked directly to animal husbandry and/or hospital transmission rather than spreading in the community more widely.
2013-16	Ebola virus - EBOV	Guinea to Liberia, Sierra Leone, & 7 other countries incl. UK	08 Aug 2014	PHEIC
2019-	Coronavirus - SARS-CoV-2	China to global	30 Jan 2020 11 Mar 2020	PHEIC Pandemic

Footnotes:

a   Case fatality rate at the beginning of the outbreak is shown. It almost always falls over time due to increasing population immunity and improvements in medical countermeasures. Case definitions do vary: cases may be classed as probable or confirmed; many studies (especially for the older pandemics) only use symptoms in the case definition; some use symptoms and a positive test; and some include asymptomatic contacts who test positive. The global CFR, calculated simply from offically reported cases and deaths, can be more unreliable if there is a lot of underreporting, so some CFRs (e.g. for the 1889 pandemic) are taken from smaller outbreak reports.

b   For all the outbreaks on the list marked "Yes", asymptomatic infection was frequently present, and onward transmission from asymptomatic or presymptomatic infected people had been documented pre-covid. In general, determining what **proportion** of onward transmission was from asymptomatic people is more challenging. This had been achieved for HIV, where the majority of transmission is from asymptomatic people - see Hollingsworth et al 2008. There was no strong scientific consensus on this for influenza, but evidence from 2009 onwards suggested that asymptomatic infection was common (Hayward et al 2014, Leung et al 2015, Ip et al 2016), and although symptomatic people shed greater quantities of virus, asymptomatic people have more social contacts as they do not stay home due to feeling unwell, leading to a significant contribution to onward transmission (33% according to Van Kerckhove et al 2014).

c   Human coronavirus OC43 infects nearly everyone in childhood. See definition of endemic in the glossary, and Severance et al 2008 and Zhou et al 2013.

d   Typically, ~10% of adults and ~20% of children are infected with seasonal endemic influenza every year, so very few escape without being infected at some point in their lives. See Somes et al 2018 and Bodewes et al 2011.

e   Clinically diagnosed, symptomatic disease. Relies on contemporary data, see Taubenberger & Morens, 2006.

f   H2N2 is now extinct, having been outcompeted by H3N2.

g   Excess respiratory deaths from England and Wales.

h   Described as a "smouldering" pandemic, H3N2 continued to cause elevated mortality for a longer than previous flu pandemics, and is now responsible for the majority of seasonal flu cases.

i   Excess respiratory and cardiovascular deaths (acute influenza can also cause cardiovascular death) from England and Wales.

j   HIV death estimates compiled by the WHO up to 2021.

k   There may have been illnesses and deaths not recognised as being due to the infection, so a significant undercount is possible.

l   Confirmed cases and deaths are unlikely to be a significant overcount in these infections.

m   The pandemic strain of H1N1pdm09 has remained in circulation, with particularly intense transmission amongst 5-19 year olds (first wave 47% across 19 countries in Van Kerkhove et al 2013). Data on cumulative incidence for this strain up to 2020 was not available, but in 2020 (i.e. after 10 seasons) it was likely to be approaching 90%. The official counts shown for global figures are cases and deaths reported to the WHO.

n   Baguelin 2011 et al estimate that there were 10.81 million cases in people aged 1-44 years in England during the second wave alone, with 5-14 years olds having the highest attack rate of 59%. Good estimates are difficult to obtain, but with the H1N1 pandemic strain co-circulating as seasonal flu with H3N2, it seems likely that cumulative incidence in the UK by 2020 was also approaching 90%.

o   Official counts - as reported to the WHO if global cases / deaths, or by UK governmental bodies if UK cases / deaths.

p   Estimate of underreporting by ~17% in Scarpino et al 2015.

q   Excess deaths estimates from the Economist have been used, as the WHO excess deaths estimate only extends to December 2021.

Glossary

Term	Explanation
Asymptomatic infection	Where an infected person can test positive but is not experiencing symptoms. The relative contribution of people without symptoms to onward transmission, and the overall force of infection, is harder to measure than the presence of asymptomatic infection.
Attack rate	The proportion of a population who become infected. This is often subject to greater uncertainty than deaths, mostly due to some infected people having few or no symptoms, limited testing capacity, and use of imperfect tests or case definitions.
CFR	Case fatality rate (or ratio or, most accurately, risk) is the proportion of people with a confirmed case of infection who are known have died of that infection. It will usually be calculated based on a specified population, for example, all infected patients admitted to a hospital, or notified to a particular health authority.
Endemic	An infection that is constantly present in a particular population, with a reasonably stable incidence rate. The incidence can be high (such as human coronavirus OC43) or low (such as tuberculosis in European countries), and endemic disease can still have a high fatality rate.
Epidemic	"An increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area." Centers for Disease Control and Prevention (2012) Principles of Epidemiology in Public Health Practice. Third edition. Atlanta, GA.
IFR	Infection fatality rate (or risk) is the true proportion of all infected individuals, including those without symptoms, who die because of the infection. The CFR may differ from this for many reasons, including biases in testing, and misattribution of the cause of death. It is usually much lower than the CFR. It requires high-quality data that has only become available in later pandemics.
Pandemic	"An epidemic occurring over a very wide area, crossing international boundaries, and usually affecting a large number of people." Porta, M.S. et al. (eds) (2014) A Dictionary of Epidemiology. Sixth edition. Oxford: Oxford University Press.
PHEIC	Public Health Emergency of International Concern, declared by the World Health Organisation. "An extraordinary event which is determined to constitute a public health risk to other States through the international spread of disease and to potentially require a coordinated international response", formulated when a situation arises that is "serious, sudden, unusual, or unexpected", which "carries implications for public health beyond the affected state's national border" and "may require immediate international action". One step short of declaring a pandemic.
Respiratory transmission	Including any transmission route described as airborne, aerosol, or droplet. Distinct theoretical subcategories within respiratory transmission are not supported by good evidence, and did not exist during the earlier pandemics on this list such as the 1918 pandemic. There are a spectrum of particle sizes emitted from the mouth and nose with varying abilities to remain airborne and transmit disease, based on environmental factors as well as pathogen species.
WHO EC	The World Health Organisation's Emergency Committee of international experts who advise the Director General on whether to declare a PHEIC.

References:

Time period	Pathogen	References
1889-94	Human coronavirus OC43 or possibly influenza	**Vijgen** L et al. (2005) Complete genomic sequence of human coronavirus OC43: molecular clock analysis suggests a relatively recent zoonotic coronavirus transmission event. J Virol. 79 (3) pp.1595-604. Available at: https://doi.org/10.1128/JVI.79.3.1595-1604.2005 *[HCoV-OC43 as the likely cause]* **Severance** EG et al. (2008) Development of a Nucleocapsid-Based Human Coronavirus Immunoassay and Estimates of Individuals Exposed to Coronavirus in a U.S. Metropolitan Population. Clinical and Vaccine Immunology, 15(12), pp. 1805–1810. Available at: https://doi.org/10.1128/CVI.00124-08. *[Attack rate >90%]* **Zhou** W et al. (2013) First infection by all four non-severe acute respiratory syndrome human coronaviruses takes place during childhood. BMC Infectious Diseases, 13(1), p. 433. Available at: https://doi.org/10.1186/1471-2334-13-433. *[Attack rate >90% in endemic state, with some waning of antibodies]* **Smith** FB. (1995) The Russian Influenza in the United Kingdom, 1889-1894. Social History of Medicine. 8 (1) pp55-73. Available at: https://doi.org/10.1093/shm/8.1.55 *[England, Wales and Ireland had 132,000 excess deaths. Origin likely Central Asia (Bokhara)]* **Valleron** AJ et al. (2010) Transmissibility and geographic spread of the 1889 influenza pandemic. PNAS. 107 (19) 8778-8781. Available at: https://doi.org/10.1073/pnas.1000886107 *[Case fatality ratio and attack rate, from European and American datasets]* **Nickol** ME et al. (2019) A year of terror and a century of reflection: perspectives on the great influenza pandemic of 1918–1919. BMC Infectious diseases. 19 (117). Available at: https://doi.org/10.1186/s12879-019-3750-8 *[1 million global deaths]*
1918-20	Influenza - H1N1	**Taubenberger** JK, Morens DM. (2006). 1918 Influenza: The mother of all pandemics. Rev Biomed. 17: 69-79. Available from: https://doi.org/10.3201%2Feid1201.050979. *[Lower global cases estimate, lower and higher CFR estimates (higher is from total deaths / total cases)]* **Bodewes**, R. et al. (2011) 'Prevalence of Antibodies against Seasonal Influenza A and B Viruses in Children in Netherlands', Clinical and Vaccine Immunology, 18(3), pp. 469–476. Available at: https://doi.org/10.1128/CVI.00396-10. *[>80% infected by age 7 in endemic state]* **Somes**, M.P. et al. (2018) 'Estimating the annual attack rate of seasonal influenza among unvaccinated individuals: A systematic review and meta-analysis', Vaccine, 36(23), pp. 3199–3207. Available at: https://doi.org/10.1016/j.vaccine.2018.04.063. *[10-20% infected per year in endemic state]* **Johnson**, N.P.A.S. and Mueller, J. (2002) 'Updating the Accounts: Global Mortality of the 1918-1920 "Spanish" Influenza Pandemic', Bulletin of the History of Medicine, 76(1), pp. 105–115. Available at: https://www.jstor.org/stable/44446153 (Accessed: 23 April 2023). *[Upper and mid global deaths estimates]* **Spreeuwenberg** P, Kroneman M and Paget J. (2018) Reassessing the Global Mortality Burden of the 1918 Influenza Pandemic, American Journal of Epidemiology, 187(12), pp. 2561–2567. Available at: https://doi.org/10.1093/aje/kwy191. *[Lower global deaths estimate]* **Spinney**, L. (2017) 'Counting the Dead', in Pale Rider. Vintage, p. 169. *[UK mortality rate estimate]*, pp. 153-165 *[discussion of possible origin countries]*, p. 309 *[global case fatality ratio]*. **Office for National Statistics** (2015) UK Population Estimates 1851 to 2014. *[Population estimate for 1918 to calculate death count from Spinney]*. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/adhocs/004356ukpopulationestimates1851to2014 (Accessed: 17 May 2023). **Nguyen-Van-Tam** J. S., & Bresee J. (2013). Pandemic preparedness and response. In Webster, R.G. et al. (eds) (2013) Textbook of influenza. 2nd edition. Chichester, West Sussex, UK; Hoboken, NJ: p454. Wiley-Blackwell. *[Lower case fatality ratio estimate, global]* On asymptomatic infection and transmission for influenza viruses generally: **Hayward**, A.C. et al. (2014) 'Comparative community burden and severity of seasonal and pandemic influenza: results of the Flu Watch cohort study', The Lancet Respiratory Medicine, 2(6), pp. 445–454. Available at: https://doi.org/10.1016/S2213-2600(14)70034-7. *[The majority of influenza infections were asymptomatic in a large sample of 5448 person-seasons' follow-up, weighted to be nationally representative]* **Ip**, D.K.M. et al. (2016) 'Viral shedding and transmission potential of asymptomatic and pauci-symptomatic influenza virus infections in the community', Clinical Infectious Diseases, p. ciw841. Available at: https://doi.org/10.1093/cid/ciw841. *[235 secondary cases, 11% asymptomatic infection, 13% with only one symptom]* **Leung**, N.H.L. et al. (2015) 'Review Article: The Fraction of Influenza Virus Infections That Are Asymptomatic', Epidemiology, 26(6), pp. 862–872. Available at: https://doi.org/10.1097/EDE.0000000000000340. *[11 outbreak reports find 16% asymptomatic, 5 serology studies with adjustment find 65-85% asymptomatic]* **Van Kerckhove**, K. et al. (2013) 'The Impact of Illness on Social Networks: Implications for Transmission and Control of Influenza', American Journal of Epidemiology, 178(11), pp. 1655–1662. Available at: https://doi.org/10.1093/aje/kwt196. *[33% of transmission is from asymptomatic people due to more social contact despite lower infectiousness compared to symptomatic people]*

Time period	Pathogen	References
1957-59	Influenza - H2N2	**Babu**, T.M. et al. (2018) 'Population Serologic Immunity to Human and Avian H2N2 Viruses in the United States and Hong Kong for Pandemic Risk Assessment', The Journal of Infectious Diseases, 218(7), pp. 1054–1060. Available at: https://doi.org/10.1093/infdis/jiy291. *[Became endemic between 1957 and 1968]* **Viboud**, C. et al. (2016) 'Global Mortality Impact of the 1957–1959 Influenza Pandemic', Journal of Infectious Diseases, 213(5), pp. 738–745. Available at: https://doi.org/10.1093/infdis/jiv534. *[Global deaths and UK deaths (in supplement)]* **Payne**, A.M.M. (1958) 'Symposium on the Asian Influenza Epidemic, 1957', Proceedings of the Royal Society of Medicine, 51(12), pp. 1009–1018. Available at: https://doi.org/10.1177/003591575805101205. *[Origin, case fatality ratio estimates most frequently between 1 in 6,000 and 1 in 2,000]* **Taubenberger** JK, Morens DM. (2006). 1918 Influenza: The mother of all pandemics. Rev Biomed. 17: 69-79. Available from: https://doi.org/10.3201%2Feid1201.050979 *[Reports that H2N2 became extinct, case fatality ratio less than 0.1%]* **New York Times**, Oct 12 1957. Asian Flu is World-Wide. Available from: https://www.nytimes.com/1957/10/12/archives/asian-flu-is-worldwide.html *[WHO declaration]*
1968- [h]	Influenza - H3N2	**Jester**, B.J., Uyeki, T.M. and Jernigan, D.B. (2020) 'Fifty Years of Influenza A(H3N2) Following the Pandemic of 1968', American Journal of Public Health, 110(5), pp. 669–676. Available at: https://doi.org/10.2105/AJPH.2019.305557. *[Became endemic]* **European Centre for Disease Prevention and Control** (2017) Questions and answers on influenza pandemics. Available at: https://www.ecdc.europa.eu/en/pandemic-influenza/facts/questions-and-answers (Accessed: 4 June 2023). *[High and low global deaths estimates, higher CFR estimate]* **Oxford**, J.S. (2000) 'Influenza A pandemics of the 20th century with special reference to 1918: virology, pathology and epidemiology', Reviews in Medical Virology, 10(2), pp. 119–133. Available at: https://doi.org/10.1002/(SICI)1099-1654(200003/04)10:2<119::AID-RMV272>3.0.CO;2-O. *[Mid global deaths estimate]* **Tillett**, H.E., Smith, J.W.G. and Gooch, C.D. (1983) 'Excess Deaths Attributable to Influenza in England and Wales: Age at Death and Certified Cause', International Journal of Epidemiology, 12(3), pp. 344–352. Available at: https://doi.org/10.1093/ije/12.3.344. *[UK deaths]* **Nguyen-Van-Tam** J. S., & Bresee J. (2013). Pandemic preparedness and response. In Webster, R.G. et al. (eds) (2013) Textbook of influenza. 2nd edition. Chichester, West Sussex, UK; Hoboken, NJ: p455. Wiley-Blackwell. *[Lower CFR estimate]* **Viboud**, C. et al. (2005) 'Multinational Impact of the 1968 Hong Kong Influenza Pandemic: Evidence for a Smoldering Pandemic', The Journal of Infectious Diseases, 192(2), pp. 233–248. Available at: https://doi.org/10.1086/431150. *[Origin, alternative UK excess deaths from pneumonia / influenza (51.2/100k=24.6k) not in table]* **Cockburn**, W.C., Delon, P.J. and Ferreira, W. (1969) 'Origin and progress of the 1968-69 Hong Kong influenza epidemic', Bulletin of the World Health Organization, 41(3), pp. 345–348. *[Origin possibly in China]*
1977-78	Influenza - H1N1	**Michaelis**, M., Doerr, H.W. and Cinatl, J. (2009) 'Novel swine-origin influenza A virus in humans: another pandemic knocking at the door', Medical Microbiology and Immunology, 198(3), pp. 175–183. Available at: https://doi.org/10.1007/s00430-009-0118-5. *[Global deaths estimate (table 1)]* **Tillett**, H.E., Smith, J.W.G. and Gooch, C.D. (1983) 'Excess Deaths Attributable to Influenza in England and Wales: Age at Death and Certified Cause', International Journal of Epidemiology, 12(3), pp. 344–352. Available at: https://doi.org/10.1093/ije/12.3.344. *[UK deaths]* **Webster**, R.G. et al. (eds) (2013) Textbook of influenza. 2nd edition. p21. Chichester, West Sussex, UK; Hoboken, NJ: Wiley-Blackwell. *[Became endemic]* **Rozo**, M. and Gronvall, G.K. (2015) 'The Reemergent 1977 H1N1 Strain and the Gain-of-Function Debate', mBio. Edited by M.R. Denison, 6(4), pp. e01013-15. Available at: https://doi.org/10.1128/mBio.01013-15. *[Not zoonotic, live vaccine trial most likely origin]*

Time period	Pathogen	References
1981-	Retrovirus - HIV	**World Health Organization** (no date) HIV: Global situation and trends, Global Health Observatory. Available at: https://www.who.int/data/gho/data/themes/hiv-aids (Accessed: 24 April 2023). *[Global cases and deaths]* **UK Health Security Agency** (no date) Country and region HIV data tables, GOV.UK. Available at: https://www.gov.uk/government/statistics/hiv-annual-data-tables (Accessed: 17 May 2023). *[UK cases and deaths to Dec 2019]* **Grabar**, S. et al. (2009) 'Prevalence and comparative characteristics of long-term nonprogressors and HIV controller patients in the French Hospital Database on HIV', AIDS, 23(9), pp. 1163–1169. Available at: https://doi.org/10.1097/QAD.0b013e32832b44c8. *[<1% are controllers / non-progressors, can survive without treatment]* **Li**, Y. et al. (2000) 'Improving survival following AIDS in Australia, 1991–1996', AIDS, 14(15), p. 2349. Available at: http://dx.doi.org/10.1097/00002030-200010200-00016 *[Median survival time increased from 6.6 months to 27.7 months during the early phase of the pandemic]* **Todd**, J. et al. (2007) 'Time from HIV seroconversion to death: a collaborative analysis of eight studies in six low and middle-income countries before highly active antiretroviral therapy', AIDS, 21(Suppl 6), pp. S55–S63. Available at: https://doi.org/10.1097/01.aids.0000299411.75269.e8. *[Median survival later became ~10 years]* **Hollingsworth**, T.D., Anderson, R.M. and Fraser, C. (2008) 'HIV-1 Transmission, by Stage of Infection', The Journal of Infectious Diseases, 198(5), pp. 687–693. Available at: https://doi.org/10.1086/590501. *[Asymptomatic transmission]* **Worobey**, M. et al. (2008) 'Direct evidence of extensive diversity of HIV-1 in Kinshasa by 1960', Nature, 455(7213), pp. 661–664. Available at: https://doi.org/10.1038/nature07390. *[Origin]*
2002-03	Coronavirus - SARS-CoV-1	**World Health Organization** (2003) Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003. Available at: https://www.who.int/publications/m/item/summary-of-probable-sars-cases-with-onset-of-illness-from-1-november-2002-to-31-july-2003 (Accessed: 24 April 2023). *[Global cases and deaths, UK cases and deaths, case fatality ratio]* . **Leung**, G.M. et al. (2006) 'Seroprevalence of IgG antibodies to SARS-coronavirus in asymptomatic or subclinical population groups', Epidemiology and Infection, 134(2), pp. 211–221. Available at: https://doi.org/10.1017/S0950268805004826. *[Asymptomatic infection rare, seroprevalence ~0.2% in close contacts]* **ProMED-mail** (2003) 'PNEUMONIA - CHINA (GUANGDONG): RFI', ProMED-mail, 10 February. Available at: https://promedmail.org/promed-post/?id=20030210.0357 (Accessed: 22 May 2023). *[Origin]* **World Health Organization** (2003) Consensus document on the epidemiology of severe acute respiratory syndrome (SARS). WHO/CDS/CSR/GAR/2003.11. World Health Organization. Available at: https://apps.who.int/iris/handle/10665/70863 (Accessed: 24 April 2023). *[Travel advisory]* **Xu**, R.-H. et al. (2004) 'Epidemiologic Clues to SARS Origin in China', Emerging Infectious Diseases, 10(6), pp. 1030–1037. Available at: https://doi.org/10.3201/eid1006.030852. *[Origin]*

Time period	Pathogen	References
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2012-	Coronavirus - MERS-CoV	**World Health Organisation Regional Office for the Eastern Mediterranean** (2020) MERS situation update Jan 2020. Available at: https://applications.emro.who.int/docs/EMCSR254E.pdf (Accessed: 24 April 2023). *[Global cases, deaths and CFR]* **World Health Organisation** (2019) MERS Global Summary and Assessment of Risk. Available at: https://apps.who.int/iris/bitstream/handle/10665/326126/WHO-MERS-RA-19.1-eng.pdf (Accessed: 17 May 2023). *[UK cases]* **Public Health England** (2013) Middle East respiratory syndrome coronavirus (MERS-CoV): update, GOV.UK. Available at: https://www.gov.uk/government/news/middle-east-respiratory-syndrome-coronavirus-mers-cov-update (Accessed: 17 May 2023). *[UK deaths]* **Al-Tawfiq**, J.A. and Gautret, P. (2019) 'Asymptomatic Middle East Respiratory Syndrome Coronavirus (MERS-CoV) infection: Extent and implications for infection control: A systematic review', Travel Medicine and Infectious Disease, 27, pp. 27–32. Available at: https://doi.org/10.1016/j.tmaid.2018.12.003. *[Asymptomatic infection]* **Mullen**, L. et al. (2020) 'An analysis of International Health Regulations Emergency Committees and Public Health Emergency of International Concern Designations', BMJ Global Health, 5(6), p. e002502. Available at: https://doi.org/10.1136/bmjgh-2020-002502. *[WHO meetings]*
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Time period	Pathogen	References
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