**COVID-19 Asymptomatic Infection Supplement: as of March 26, 2020**

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**Are there studies that reliably estimate the proportion of SARS/COV2 that are asymptomatic (no symptoms, mild symptoms not requiring hospitalization, severe symptoms requiring hospitalization)?**

In peer-reviewed papers, the actual and estimated asymptomatic ratios **range from 18%-50%** (see #1-3). Note that this is the proportion of total cases that are asymptomatic, not proportion of transmission from asymptomatic cases. The most reliable / strongest study design is the Diamond Princess Cruise Ship (a closed cohort that found ~18% asymptomatic, see #2). There are also some cross-sectional population-based studies underway (news reports only as yet). However, we note the available research has important limitations: a) we do not know operating characteristics of the tests, b) ‘asymptomatic’ is not universally defined, c) HCW studies did not test those without symptoms (see #4), d) people with severe symptoms, who die or are in the hospital are likely not included in cross-sectional surveys (see #5 and #6), e) research skews toward older individuals (e.g., nursing homes, cruise ships) and is not based on population approaches to testing, f) local spread can shift from one demographic group to another (e.g., young to old in Germany), making these estimates time-dependent in some settings (i.e., confounding). Of note, Buzzfeed News reports that Iceland is doing large-scale testing of all persons, and the chief epidemiologist is quoted as saying the **preliminary data suggests 50% of persons are asymptomatic** (see #5). Additionally, news reports on a large-scale testing campaign in Vo, Italy suggest **50% of persons were asymptomatic** (see #6). What proportion of these people will eventually develop symptoms – i.e., were pre-symptomatic – is not known. Early reports from the Diamond Princess were that nearly 50% of the passengers with positive tests were asymptomatic, but most of these eventually developed symptoms. This is also the case for the nursing home outbreak in Washington State, where most of the people who were initially asymptomatic eventually developed symptoms.

More information is needed to understand how those with asymptomatic infections contribute to overall transmission. This includes a distinction between asymptomatic (never having symptoms) and presymptomatic (will go on to develop symptoms) infections. One study on [Presymptomatic Transmission of SARS-CoV-2 — Singapore, January 23–March 16, 2020](https://www.cdc.gov/mmwr/volumes/69/wr/mm6914e1.htm?s_cid=mm6914e1_w) found seven COVID-19 epidemiologic clusters in which presymptomatic transmission likely occurred were identified, and 10 such cases within these clusters accounted for 6.4% of the 157 locally acquired cases.

1. [Seattle long-term care skilled nursing facility study](https://www.cdc.gov/mmwr/volumes/69/wr/mm6913e1.htm?s_cid=mm6913e1_w). “Following identification of a case of coronavirus disease 2019 (COVID-19) in a health care worker, 76 of 82 residents of an SNF were tested for SARS-CoV-2; 23 (30.3%) had positive test results (average age of positive cases 80.7 years [SD: 8.4]), **approximately half – 13 – were asymptomatic or pre-symptomatic on the day of testing; 10 of these 13 developed symptoms on subsequent days.**
2. In Yokohama, Japan, the Diamond Princess cruise ship (N = 3,711) underwent a 2-week quarantine. 634 persons on board tested positive, and 75% were age 60 or older. The **estimated asymptomatic proportion of COVID-19 was** [**17.9% (95%CrI: 15.5–20.2%)**](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7078829/).
3. The asymptomatic proportion **was estimated at 30.8% (95% confidence interval (CI): 7.7%, 53.8%)** [among Japanese nationals (N = 565)](https://www.ncbi.nlm.nih.gov/pubmed/32179137) who were evacuated from Wuhan, China on chartered flights.
4. Spectrum of illness: About 9700 Health Care Workers (HCW) (median age 49 years: IQR: 22-66 years) at [two hospitals in the Netherlands](https://www.medrxiv.org/content/10.1101/2020.03.23.20041913v1) were cross sectionally screened for symptoms consistent with COVID. Those who reported fever or mild respiratory symptoms in the prior 10 days were voluntarily tested for SARS CoV2 infection. 86 of the 1353 healthcare workers (6.4%) tested positive via PCR for SARS/COV2. Among the 86, 92% (N=79) exhibited symptoms of fever and/or coughing and/or shortness of breath. Only 46 (53.5%) had fever. A limitation of this report is that screening of health care workers was based on presence of fever or mild respiratory symptoms in last 10 days, and **no data was collected on HCWs without these symptoms**.
5. News report\*\*Preliminary [data from Iceland](https://www.covid.is/data). Iceland is performing large-scale, population testing to understand prevalence. Thorolfur Guðnason, Iceland’s chief epidemiologist, [told BuzzFeed News](https://www.buzzfeed.com/albertonardelli/coronavirus-testing-iceland): "Early results from deCode Genetics indicate that a low proportion of the general population has contracted the virus and that **about half of those who tested positive are non-symptomatic**. The **other half displays very moderate cold-like symptoms**." Per the data available online: 25 of the 1,000 confirmed cases in the survey were hospitalized.
6. News report\*\* A mass testing campaign was carried out in Vo, Italy (N ~3,300) found that 50% of persons with COVID-19 were asymptomatic.
	* <https://www.ft.com/content/0dba7ea8-6713-11ea-800d-da70cff6e4d3>
	* <https://www.theguardian.com/commentisfree/2020/mar/20/eradicated-coronavirus-mass-testing-covid-19-italy-vo>
7. [Researchers used observations of reported infection](https://science.sciencemag.org/content/early/2020/03/24/science.abb3221) within China, in conjunction with mobility data, a networked dynamic metapopulation model and Bayesian inference. Estimated **86% of all infections were undocumented (95% CI: [82%–90%])** prior to 23 January 2020 travel restrictions. *Note: undocumented not asymptomatic.* Per person, the transmission rate of undocumented infections was 55% of documented infections ([46%–62%]), yet, due to their greater numbers, undocumented infections were the infection source for 79% of documented cases.
8. Used individual-case data from mainland China and cases detected outside mainland China to [estimate the time between onset of symptoms and a) death or b) hospital discharge](https://www.medrxiv.org/content/10.1101/2020.03.09.20033357v1). Estimated average duration from onset-of-symptoms to death to be 17.8 days (95% credible interval, crI 16.9,19.2 days) and from onset-of-symptoms to hospital discharge to be 22.6 days (95% crI 21.1,24.4 days). Adjusting for demography and under-ascertainment of milder cases in Wuhan, the estimate of the case fatality ratio in China is 1.38% (95% crI 1.23%,1.53%) with substantially higher values in older ages.

**Are there studies that reliable estimate the infectious period for those with asymptomatic infections?**

* [Presumed Asymptomatic Carrier Transmission of COVID-19](https://jamanetwork.com/journals/jama/article-abstract/2762028) reports the epidemiological and clinical data of 24 asymptomatic COVID-19 infections identified from the screening of close contacts in Nanjing, Jiangsu Province. “The **median communicable period**, defined as the interval from the first day of positive nucleic acid tests to the first day of continuous negative tests, **was 9.5 days** (up to 21 days among the 24 asymptomatic cases)”