# Evidence Search Service Results of your search request

## Prolonged incubation periods in COVID-19

**ID of request:** 24704  
**Date of request:** 10th August, 2020  
**Date of completion:** 12th August, 2020

If you would like to request any articles or any further help, please contact:  Jason Curtis at [jason.curtis1@nhs.net](mailto:jason.curtis1@nhs.net)

Please acknowledge this work in any resulting paper or presentation as: Evidence search: Prolonged incubation periods in COVID-19. Jason Curtis. (12th August, 2020). SHREWSBURY, UK: Shrewsbury and Telford Health Libraries.

**Sources searched**  
EMBASE (2)  
Google Scholar (2)  
MEDLINE (8)

**Date range used** (5 years, 10 years): 2020 -   
**Limits used** (gender, article/study type, etc.): English-language only, adults only   
**Search terms and notes** (full search strategy for database searches below):

Relevant natural language and controlled vocabulary terms were selected and combined. Final result sets were de-duplicated and reviewed for relevance by the searcher, irrelevant results being discarded.

Searched: Medline, EMBASE, Google Scholar, TRIP Database, Cochrane Library, UpToDate, CEBM COVID-19 search bank

Google Scholar search strategy: "(covid-19 OR coronavirus) prolonged incubation"

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### [B. Search History](#SearchHistory)

## A. Original Research

1. **A Case of COVID-19 with Ultra-Long Incubation Period**  
   Wang Y. Infection Control and Hospital Epidemiology 2020;:1-7.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=4e675c5248dc800cb3e7dd20501c8855)

1. **Clinical Progression of COVID-19 Patient with Extended Incubation Period, Delayed RT-PCR Time-to-positivity, and Potential Role of Chest CT-scan.**  
   Burhan Erlina Acta medica Indonesiana 2020;52(1):80-83.

Coronavirus Disease 2019 (COVID-19), previously called 2019-nCoV, is a novel disease caused by SARS- CoV-2 which was first identified as outbreak of unknown respiratory illness in Wuhan, China. COVID- 19 was declared as global health emergency by WHO on March 11, 2020 and quickly elevated to global pandemic on 11 March 2020. COVID-19 symptom is highly various in each patient, with fever, fatigue, shortness of breath, and cough as the main presenting symptoms. Patient with COVID-19 may shows severe symptom with severe pneumonia and ARDS, mild symptom resembling simple upper respiration tract infection, or even completely asymptomatic. Approximately 80% of cases is mild. However the number may changes as more people are getting tested. Some experts are estimating that up to 50% of all cases may be asymptomatic carrier.

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[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=48939060b558b658ef4e24adafdf8f02)

1. **Does SARS-CoV-2 has a longer incubation period than SARS and MERS?**  
   Jiang Xuan Journal of medical virology 2020;92(5):476-478.

The outbreak of a novel coronavirus (SARS-CoV-2) since December 2019 in Wuhan, the major transportation hub in central China, became an emergency of major international concern. While several etiological studies have begun to reveal the specific biological features of this virus, the epidemic characteristics need to be elucidated. Notably, a long incubation time was reported to be associated with SARS-CoV-2 infection, leading to adjustments in screening and control policies. To avoid the risk of virus spread, all potentially exposed subjects are required to be isolated for 14 days, which is the longest predicted incubation time. However, based on our analysis of a larger dataset available so far, we find there is no observable difference between the incubation time for SARS-CoV-2, severe acute respiratory syndrome coronavirus (SARS-CoV), and middle east respiratory syndrome coronavirus (MERS-CoV), highlighting the need for larger and well-annotated datasets.

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[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=b472eff846f8d18816a61d2ae2ba153f)

1. **Estimation of incubation period distribution of COVID-19 using disease onset forward time: a novel cross-sectional and forward follow-up study.**  
   Qin Jing medRxiv : the preprint server for health sciences 2020;:No page numbers.

BackgroundThe current outbreak of coronavirus disease 2019 (COVID-19) has quickly spread across countries and become a global crisis. However, one of the most important clinical characteristics in epidemiology, the distribution of the incubation period, remains unclear. Different estimates of the incubation period of COVID-19 were reported in recent published studies, but all have their own limitations. In this study, we propose a novel low-cost and accurate method to estimate the incubation distribution.MethodsWe have conducted a cross-sectional and forward follow-up study by identifying those asymptomatic individuals at their time of departure from Wuhan and then following them until their symptoms developed. The renewal process is hence adopted by considering the incubation period as a renewal and the duration between departure and symptom onset as a forward recurrence time. Under mild assumptions, the observations of selected forward times can be used to consistently estimate the parameters in the distribution of the incubation period. Such a method enhances the accuracy of estimation by reducing recall bias and utilizing the abundant and readily available forward time data.FindingsThe estimated distribution of forward time fits the observations in the collected data well. The estimated median of incubation period is 8·13 days (95% confidence interval [CI]: 7·37-8·91), the mean is 8·62 days (95% CI: 8·02-9·28), the 90th percentile is 14·65 days (95% CI: 14·00-15·26), and the 99th percentile is 20·59 days (95% CI: 19·47, 21·62). Compared with results in other studies, the incubation period estimated in this study is longer.InterpretationBased on the estimated incubation distribution in this study, about 10% of patients with COVID-19 would not develop symptoms until 14 days after infection. Further study of the incubation distribution is warranted to directly estimate the proportion with long incubation periods.

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1. **Incubation period and other epidemiological characteristics of 2019 novel coronavirus infections with right truncation: A statistical analysis of publicly available case data**  
   Linton N.M. Journal of Clinical Medicine 2020;9(2):No page numbers.

The geographic spread of 2019 novel coronavirus (COVID-19) infections from the epicenter of Wuhan, China, has provided an opportunity to study the natural history of the recently emerged virus. Using publicly available event-date data from the ongoing epidemic, the present study investigated the incubation period and other time intervals that govern the epidemiological dynamics of COVID-19 infections. Our results show that the incubation period falls within the range of 2-14 days with 95% confidence and has a mean of around 5 days when approximated using the best-fit lognormal distribution. The mean time from illness onset to hospital admission (for treatment and/or isolation) was estimated at 3-4 days without truncation and at 5-9 days when right truncated. Based on the 95th percentile estimate of the incubation period, we recommend that the length of quarantine should be at least 14 days. The median time delay of 13 days from illness onset to death (17 days with right truncation) should be considered when estimating the COVID-19 case fatality risk.<br/>Copyright &#xa9; 2020 by the authors. Licensee MDPI, Basel, Switzerland.

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[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=06287cfcc1b1f5c8717ba692298b2ef1)

1. **Longer incubation period of coronavirus disease 2019 (COVID-19) in older adults.**  
   Kong Tak-Kwan Aging medicine (Milton (N.S.W)) 2020;3(2):102-109.

ObjectiveThe aim of this study was to explore any age-related change in the incubation period of COVID-19, specifically any difference between older (aged ≥65 years) and younger adults.MethodsBased on online data released officially by 21 Chinese cities from January 22 to February 15, 2020, the incubation period of COVID-19 patients who had travelled to Hubei was studied according to age. Previous studies were reviewed and compared.ResultsThe study recruited 136 COVID-19 patients who had travelled to Hubei during January 5-31, 2020, stayed for 1-2 days, and returned with symptom onset during January 10-February 6, 2020. The median age was 50.5 years (range 1-86 years), and 22 patients (16.2%) were aged ≥65 years. The age-stratified incubation period was U-shaped with higher values at extremes of age. The median COVID-19 incubation period was 8.3 (90% confidence interval [CI], 7.4-9.2) days for all patients, 7.6 (90% CI, 6.7-8.6) days for younger adults, and 11.2 (90% CI, 9.0-13.5) days for older adults. The 5th/25th/75th/90th percentiles were 2.3/5.3/11.3/14.2 days for all, 2.0/5.0/10.5/13.2 days for younger adults, and 3.1/7.8/14.4/17.0 days for older adults. There were 11 published studies on COVID-19 incubation periods up to March 30, 2020, reporting means of 1.8-7.2 days, and medians of 4-7.5 days, but there was no specific study on the effect of age on incubation period. One study showed that severe COVID-19 cases, which included more elderly patients, had longer incubation periods.ConclusionBased on 136 patients with a travel history to Hubei, the epicenter of COVID-19, the COVID-19 incubation period was found to be longer in older adults. This finding has important implications for diagnosis, prevention, and control of COVID-19.

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1. **Statistical and network analysis of 1212 COVID-19 patients in Henan, China.**  
   Wang Pei International journal of infectious diseases : IJID : official publication of the International Society for Infectious Diseases 2020;95:391-398.

BACKGROUNDCOVID-19 is spreading quickly all over the world. Publicly released data for 1212 COVID-19 patients in Henan of China were analyzed in this paper.METHODSVarious statistical and network analysis methods were employed.RESULTSWe found that COVID-19 patients show gender (55% vs 45%) and age (81% aged between 21 and 60) preferences; possible causes were explored. The estimated average, mode and median incubation periods are 7.4, 4 and 7 days. Incubation periods of 92% of patients were no more than 14 days. The epidemic in Henan has undergone three stages and has shown high correlations with the numbers of patients recently returned from Wuhan. Network analysis revealed that 208 cases were clustering infected, and various People's Hospitals are the main force in treating COVID-19.CONCLUSIONSThe incubation period was statistically estimated, and the proposed state transition diagram can explore the epidemic stages of emerging infectious disease. We suggest that although the quarantine measures are gradually working, strong measures still might be needed for a period of time, since ∼7.45% of patients may have very long incubation periods. Migrant workers or college students are at high risk. State transition diagrams can help us to recognize the time-phased nature of the epidemic. Our investigations have implications for the prevention and control of COVID-19 in other regions of the world.

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1. **The difference in the incubation period of 2019 novel coronavirus (SARS-CoV-2) infection between travelers to Hubei and nontravelers: The need for a longer quarantine period.**  
   Leung Char Infection control and hospital epidemiology 2020;41(5):594-596.

Data collected from the individual cases reported by the media were used to estimate the distribution of the incubation period of travelers to Hubei versus that of nontravelers. Because a longer and more volatile incubation period has been observed in travelers, the duration of quarantine should be extended to 3 weeks.

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1. **The Estimations of the COVID-19 Incubation Period: A Scoping Reviews of the Literature**  
   Zaki 2020;:preprint.

Background: A novel coronavirus (COVID-19) has taken the world by storm. The disease has spread very swiftly worldwide. A timely clue which includes the estimation of the incubation period among COVID-19 patients can allow governments and healthcare authorities to act accordingly. Objectives: to undertake a review and critical appraisal of all published/preprint reports that offer an estimation of incubation periods for COVID-19. Eligibility criteria: This research looked for all relevant published articles between the dates of December 1, 2019, and April 25, 2020, i.e. those that were related to the COVID-19 incubation period. Papers were included if they were written in English, and involved human participants. Papers were excluded if they were not original (e.g. reviews, editorials, letters, commentaries, or duplications). Sources of evidence: COVID-19 Open Research Dataset supplied by Georgetown’s Centre for Security and Emerging Technology as well as PubMed and Embase via Arxiv, medRxiv, and bioRxiv. Charting methods: A data-charting form was jointly developed by the two reviewers (NZ and EA), to determine which variables to extract. The two reviewers independently charted the data, discussed the results, and updated the data-charting form. Results and conclusions: screening was undertaken 44,000 articles with a final selection of 25 studies referring to 18 different experimental projects related to the estimation of the incubation period of COVID-19. The majority of extant published estimates offer empirical evidence showing that the incubation period for the virus is a mean of 7.8 days, with a median of 5.01 days, which falls into the ranges proposed by the WHO (0 to 14 days) and the ECDC (2 to 12 days). Nevertheless, a number of authors proposed that quarantine time should be a minimum of 14 days and that for estimates of mortality risks a median time delay of 13 days between illness and mortality should be under consideration. It is unclear as to whether any correlation exists between the age of patients and the length of time they incubate the virus.

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1. **The Incubation Period of Coronavirus Disease 2019 (COVID-19) From Publicly Reported Confirmed Cases: Estimation and Application.**  
   Lauer Stephen A. Annals of internal medicine 2020;172(9):577-582.

BackgroundA novel human coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was identified in China in December 2019. There is limited support for many of its key epidemiologic features, including the incubation period for clinical disease (coronavirus disease 2019 [COVID-19]), which has important implications for surveillance and control activities.ObjectiveTo estimate the length of the incubation period of COVID-19 and describe its public health implications.DesignPooled analysis of confirmed COVID-19 cases reported between 4 January 2020 and 24 February 2020.SettingNews reports and press releases from 50 provinces, regions, and countries outside Wuhan, Hubei province, China.ParticipantsPersons with confirmed SARS-CoV-2 infection outside Hubei province, China.MeasurementsPatient demographic characteristics and dates and times of possible exposure, symptom onset, fever onset, and hospitalization.ResultsThere were 181 confirmed cases with identifiable exposure and symptom onset windows to estimate the incubation period of COVID-19. The median incubation period was estimated to be 5.1 days (95% CI, 4.5 to 5.8 days), and 97.5% of those who develop symptoms will do so within 11.5 days (CI, 8.2 to 15.6 days) of infection. These estimates imply that, under conservative assumptions, 101 out of every 10 000 cases (99th percentile, 482) will develop symptoms after 14 days of active monitoring or quarantine.LimitationPublicly reported cases may overrepresent severe cases, the incubation period for which may differ from that of mild cases.ConclusionThis work provides additional evidence for a median incubation period for COVID-19 of approximately 5 days, similar to SARS. Our results support current proposals for the length of quarantine or active monitoring of persons potentially exposed to SARS-CoV-2, although longer monitoring periods might be justified in extreme cases.Primary Funding SourceU.S. Centers for Disease Control and Prevention, National Institute of Allergy and Infectious Diseases, National Institute of General Medical Sciences, and Alexander von Humboldt Foundation.

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[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=b87295ebce979845e47c08610b62d890)

1. **The Incubation Period of Severe Acute Respiratory Syndrome Coronavirus 2:A Systematic Review**  
   Zhiyao L. 2020;:preprint.

While the novel coronavirus continues to spread worldwide, the reported incubation period has varied between studies and is imprecise due to limited data. A literature search with certain selection criteria was conducted on May 30, 2020. In total, sixty-four articles were included, and 854 individual-level data were extracted from 30 studies for pooled analysis. Of these studies, 72% of them reported a median or mean incubation period of 4-7 days, while our estimated median was 4.9 days (95% confidence interval [CI]: 4.6-5.2). However, the inclusion of 81 asymptomatic and presymptomatic patients, as well as 31 cases with incubation periods exceeding 14 days, led to our estimation of 97.5th percentile with 19.2 days (95% CI: 17.4-21.4), beyond the currently suggested 14-day quarantine period. Therefore, we appeal to prolong the quarantine duration, especially for areas that have insufficient testing resources, to protect susceptible populations from being infected.

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1. **Transmission and clinical characteristics of coronavirus disease 2019 in 104 outside-Wuhan patients, China.**  
   Qiu Chengfeng Journal of medical virology 2020;:No page numbers.

Cases of coronavirus disease 2019 (COVID-19) emigrating from Wuhan escalated the risk of spreading the disease in other cities. This report focused on outside-Wuhan patients to assess the transmission and clinical characteristics of this illness. Contact investigation was conducted on each patient who was admitted to the assigned hospitals in Hunan Province (geographically adjacent to Wuhan) from 22 January to 23 February 2020. Cases were confirmed by the polymerase chain reaction test. Demographic, clinical, and outcomes were collected and analyzed. Of the 104 patients, 48 (46.15%) were cases who immigrated from Wuhan; 93 (89.42%) had a definite contact history with infection. Family clusters were the major body of patients. Transmission along the chain of three "generations" was observed. Five asymptomatic infected cases were found and two of them infected their relatives. Mean age was 43 (range, 8-84) years, and 49 (47.12%) were male. The median incubation period was 6 (range, 1-32) days, which of 8 patients ranged from 18 to 32 days, 96 (92.31%) were discharged, and 1 (0.96%) died. The average hospital stay was 10 (range, 8-14) days. Family but not community transmission became the main body of infections in the two centers, suggesting the timely control measures after the Wuhan shutdown worked well. Asymptomatic transmission demonstrated here warned us that it may lead to the widespread of COVID-19. A 14-day quarantine may need to be prolonged.

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### Guidance on searching within online documents

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**Portable Document Format / pdf / Adobe**  
Click on the Search button (illustrated with binoculars). This will open up a search window. Type in the term you need to find and links to all of the references to that term within the document will be displayed in the window. You can jump to each reference by clicking it.

**Word documents**  
Select Edit from the menu, the Find and type in your term in the search box which is presented. The search function will locate the first use of the term in the document. By pressing 'next' you will jump to further references.

## B. Search History

|  | **Source** | **Criteria** | **Results** |
| --- | --- | --- | --- |
| 1. | Medline | exp CORONAVIRUS/ | 12178 |
| 2. | Medline | exp "CORONAVIRUS INFECTIONS"/ | 10589 |
| 3. | Medline | (coronavirus OR "corona virus" OR covid19 OR covid-19 OR wuhan OR hubei OR "novel coronavirus" OR "2019-nCoV" OR "SARS-Cov").ti,ab | 19704 |
| 4. | Medline | (1 OR 2 OR 3) | 61933 |
| 5. | Medline | "INFECTIOUS DISEASE INCUBATION PERIOD"/ OR "TIME FACTORS"/ | 1184799 |
| 6. | Medline | (incubat\*).ti | 9027 |
| 7. | Medline | (presymptomatic OR pre-symptomatic OR "incubation period").ti,ab | 16711 |
| 8. | Medline | (5 OR 6 OR 7) | 1206580 |
| 9. | Medline | (4 AND 8) | 1485 |
| 10. | Medline | (prolonged OR long OR longer OR delay\*).ti,ab | 2488437 |
| 11. | Medline | (9 AND 10) | 263 |
| 12. | Medline | 11 [DT FROM 2020] [Languages English] | 142 |
| 13. | EMBASE | exp CORONAVIRUS/ | 17303 |
| 14. | EMBASE | exp "CORONAVIRUS INFECTIONS"/ | 17997 |
| 15. | EMBASE | (coronavirus OR "corona virus" OR covid19 OR covid-19 OR wuhan OR hubei OR "novel coronavirus" OR "2019-nCoV" OR "SARS-Cov").ti,ab | 56997 |
| 16. | EMBASE | "INCUBATION TIME"/ OR "TIME FACTOR"/ | 80521 |
| 17. | EMBASE | (incubat\*).ti | 8233 |
| 18. | EMBASE | (presymptomatic OR pre-symptomatic OR "incubation period").ti,ab | 21261 |
| 19. | EMBASE | (prolong\* OR long OR longer OR delay\*).ti,ab | 3356657 |
| 20. | EMBASE | (13 OR 14 OR 15) | 68020 |
| 21. | EMBASE | (16 OR 17 OR 18) | 103239 |
| 22. | EMBASE | (19 AND 20 AND 21) | 153 |
| 23. | EMBASE | 22 [DT FROM 2020] [English language] | 101 |

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