

EVIDENCE SEARCH REPORT

RESEARCH QUESTION: What Proportion of disease transmission is due to asymptomatic, pre-symptomatic and symptomatic cases?	UNIQUE IDENTIFIER: LAB040701v2-01 ESR
REQUESTED RESOURCES: <ul style="list-style-type: none"> • Medline • CINAHL • medRxiv • Opened Journals • PubMed • PHAC COVID-19 • CMA Joule • LitCOVID • WHO Global Research on COVID-19 	
LIMITS/EXCLUSIONS/INCLUSIONS: English, last 2 years	
DATE: MAY 8, 2020	
LIBRARIAN: Brianna Howell-Spooner Brianna.howell-spooner@saskhealthauthority.ca	REQUESTOR: Dr. Bruce Reeder Bruce.reeder@usask.ca
TEAM: LAB	
CITE AS: Howell-Spooner, B. What proportion of disease transmission is due to asymptomatic, pre-symptomatic and symptomatic cases? 2020 May 8; Document no.: LAB040701v2-01 ESR. In: COVID-19 Rapid Evidence Reviews [Internet]. SK: SK COVID Evidence Support Team, c2020. 25 p. (CEST evidence search report)	

LIBRARIAN NOTES/COMMENTS

Search results from weekly alerts set up to search for new articles published since April 7, 2020.

The search strategies from Medline and PubMed are the same search strategies as in the original evidence search for this question.

A search strategy was included for the shared citation library of PHAC, medRxiv, and WHO Global Research on COVID-19 databases which had not been put together until after the original evidence search.

Citations from the alert results were selected by the Librarian and passed on to the research scientist and team lead of the lab group.

DISCLAIMER

This information is provided as a service by the Saskatchewan Health Authority and University of Saskatchewan Libraries. Professional librarians conduct searches of the literature. Results are subject to the limitations of the databases and the specificity, broadness and appropriateness of the search parameters presented by the requester. The Libraries do not represent in any matter that retrieved citations are complete, accurate or otherwise to be relied upon. The search results are only valid as of the date and time at which the search is conducted. The Libraries do not accept responsibility for any loss or damage arising from the use of, or reliance on, search results.

SEARCH RESULTS

To obtain full-text articles email library@saskhealthauthority.ca.

SUMMARIES, GUIDELINES & OTHER RESOURCES

Blog

- **Centre for Evidence-Based Medicine**
 - COVID-19: What proportion are asymptomatic? [updated 2020, April 6] available from <https://www.cebm.net/2020/04/covid-19-what-proportion-are-asymptomatic/>

Report

- **WHO**
 - Coronavirus disease 2019 (COVID-19) Situation Report – 73 [updated 2020, April 2] available from https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200402-sitrep-73-covid-19.pdf?sfvrsn=5ae25bc7_2

ARTICLES FROM THE LIBRARY DATABASES

Note: References are sorted by year (newest to oldest)

New Articles

Pubmed – 1 May, 2020

1. Nagashima M, Kumagai R, Yoshida I, et al. Characteristics of SARS-CoV-2 isolated from asymptomatic carrier in Tokyo. *Jpn J Infect Dis.* 2020. DOI: 10.7883/yoken.JJID.2020.137
DOI: 10.7883/yoken.JJID.2020.137

Medline – 1 May, 2020

1. Arons MM, Hatfield KM, Reddy SC, et al. Presymptomatic SARS-CoV-2 Infections and Transmission in a Skilled Nursing Facility. *N Engl J Med.* 2020;24:24.

ABSTRACT: BACKGROUND: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection can spread rapidly within skilled nursing facilities. After identification of a case of Covid-19 in a skilled nursing facility, we assessed transmission and evaluated the adequacy of symptom-based screening to identify infections in residents.

METHODS: We conducted two serial point-prevalence surveys, 1 week apart, in which assenting residents of the facility underwent nasopharyngeal and oropharyngeal testing for SARS-CoV-2, including real-time reverse-transcriptase polymerase chain reaction (rRT-PCR), viral culture, and sequencing. Symptoms that had been present during the preceding 14 days were recorded. Asymptomatic residents who tested positive were reassessed 7 days later. Residents with SARS-CoV-2 infection were categorized as symptomatic with typical symptoms (fever, cough, or shortness of breath), symptomatic with only atypical symptoms, presymptomatic, or asymptomatic.

RESULTS: Twenty-three days after the first positive test result in a resident at this skilled nursing facility, 57 of 89 residents (64%) tested positive for SARS-CoV-2. Among 76 residents who participated in point-prevalence surveys, 48 (63%) tested positive. Of these 48 residents, 27 (56%) were asymptomatic at the time of testing; 24 subsequently developed symptoms (median time to onset, 4 days). Samples from these 24 presymptomatic residents had a median rRT-PCR cycle threshold value of 23.1, and viable virus was recovered from 17 residents. As of April 3, of the 57 residents with SARS-CoV-2 infection, 11 had been hospitalized (3 in the intensive care

unit) and 15 had died (mortality, 26%). Of the 34 residents whose specimens were sequenced, 27 (79%) had sequences that fit into two clusters with a difference of one nucleotide.

CONCLUSIONS: Rapid and widespread transmission of SARS-CoV-2 was demonstrated in this skilled nursing facility. More than half of residents with positive test results were asymptomatic at the time of testing and most likely contributed to transmission. Infection-control strategies focused solely on symptomatic residents were not sufficient to prevent transmission after SARS-CoV-2 introduction into this facility.

URL: <https://www.nejm.org/doi/full/10.1056/NEJMoa2008457>

2. Gandhi M, Yokoe DS, Havlir DV. Asymptomatic Transmission, the Achilles' Heel of Current Strategies to Control Covid-19. N Engl J Med. 2020;24:24.

URL: <https://www.nejm.org/doi/full/10.1056/NEJMe2009758>

3. Jiang X, Luo M, Zou Z, et al. Asymptomatic SARS-CoV-2 infected case with viral detection positive in stool but negative in nasopharyngeal samples lasts for 42 days. J Med Virol. 2020;24:24.

ABSTRACT: Coronavirus disease 2019 (COVID-19), caused by a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has spread rapidly around the world. Currently, the identification of this disease is mainly conducted by using nasopharyngeal swabs^[1], but the presence of SARS-CoV-2 RNA in feces of COVID-19 patients indicates the possibility of transmission via fecal-oral route^[2-4]. This article is protected by copyright. All rights reserved.

URL: <https://onlinelibrary.wiley.com/doi/abs/10.1002/jmv.25941>

4. Lu D, Sang L, Du S, et al. Asymptomatic COVID-19 infection in late pregnancy indicated no vertical transmission. J Med Virol. 2020;24:24.

ABSTRACT: **OBJECTIVE:** This study is to investigate the clinical characteristics of late pregnancy with asymptomatic 2019 novel coronavirus disease (COVID-19) infection, evaluate the outcome of maternal and fetal prognosis, and identify the evidence of intrauterine vertical transmission.

METHODS: A 22 years old pregnant woman with asymptomatic COVID-19 infection who was admitted to our hospital on Feb 11, 2020 was enrolled in this study. Clinical data including laboratory test results and chest computed tomography (CT) scanning were collected and reviewed.

RESULTS: Diagnosis of late pregnancy with asymptomatic COVID-19 infection was made. Lumbar anesthesia for cesarean section was performed and a female baby was delivered uneventfully, with the Apgar score of 9-10 points. Three times of COVID-19 nucleic acid test for the baby was negative after delivery. The puerpera returned to normal after the operation and two times of throat swab COVID-19 nucleic acid test were all negative after antiviral therapy.

CONCLUSION: We reported an asymptomatic COVID-19 pregnant woman with detailed clinical information and our result indicated that for late pregnant women with asymptomatic COVID-19 infection, there might be no intrauterine infection caused by vertical transmission. This article is protected by copyright. All rights reserved.

URL: <https://onlinelibrary.wiley.com/doi/full/10.1002/jmv.25927>

5. Luo Y, Trevathan E, Qian Z, et al. Asymptomatic SARS-CoV-2 Infection in Household Contacts of a Healthcare Provider, Wuhan, China. Emerg Infect Dis. 2020;26(8):24.

ABSTRACT: We found that all 5 asymptomatic household contacts of a Wuhan, China, physician with coronavirus disease had severe acute respiratory syndrome coronavirus 2 detected by PCR. The index patient and 2 contacts also had abnormal chest computed tomography scans. Asymptomatic infected household contacts of healthcare workers with coronavirus disease might be underrecognized.

URL: https://wwwnc.cdc.gov/eid/article/26/8/20-1016_article

6. Sun T, Weng D. Estimating the Effects of Asymptomatic and Imported Patients on COVID-19 Epidemic Using Mathematical Modeling. J Med Virol. 2020;24:24.

ABSTRACT: The epidemic of COVID-19 has been a serious threat to public health worldwide. Data from January 23 to March 31 at Jiangsu and Anhui provinces in China were collected. We developed an adjusted model with two novel features: the asymptomatic population and threshold behavior in recovery. Unbiased parameter estimation identified faithful model fitting. Our model predicted that the epidemic for asymptomatic patients was similar in both provinces. The latent periods and outbreak sizes are extremely sensitive to strongly controlled interventions such as isolation and quarantine for both asymptomatic and imported cases. We predicted that asymptomatic patients serve as a more severe factor with faster outbreaks and larger outbreak sizes compared with imported patients. Therefore, we argued that the currently strict interventions should be continuously implemented and unraveling the asymptomatic pool is critically important before preventive strategy such as vaccines. This article is protected by copyright. All rights reserved.

URL: <https://onlinelibrary.wiley.com/doi/abs/10.1002/jmv.25939>

7. Teheran AA, Camero G, Prado R, et al. Presumptive asymptomatic COVID-19 carriers' estimation and expected person-to-person spreading among repatriated passengers returning from China. Travel Med Infect Dis. 2020:101688.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7194508/>

PubMed – 24 Apr, 2020

1. Jiang XL, Zhang XL, Zhao XN, et al. Transmission potential of asymptomatic and paucisymptomatic SARS-CoV-2 infections: a three-family cluster study in China. J Infect Dis. 2020. DOI: 10.1093/infdis/jiaa206

ABSTRACT: Data concerning the transmission of SARS-CoV-2 in asymptomatic and paucisymptomatic patients are lacking. We report a three-family cluster of infections involving asymptomatic and paucisymptomatic transmission. Eight (53%) of 15 members from three families were confirmed with SARS-CoV-2 infection. Of eight patients, three were asymptomatic and one was paucisymptomatic. An asymptomatic mother transmitted the virus to her son, and a paucisymptomatic father transmitted the virus to his three-month-old daughter. SARS-CoV-2 was detected in the environment of one household. The complete genomes of SARS-CoV-2 from the patients were >99.9% identical and were clustered with other SARS-CoV-2 sequences reported from China and other countries.

DOI: 10.1093/infdis/jiaa206

2. Pan Y, Yu X, Du X, et al. Epidemiological and clinical characteristics of 26 asymptomatic SARS-CoV-2 carriers. J Infect Dis. 2020. DOI: 10.1093/infdis/jiaa205

ABSTRACT: **BACKGROUND:** We retrospectively analysed 26 persistently asymptomatic severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) carriers. **METHODS:** Epidemiological and clinical characteristics from the 26 asymptomatic patients with positive results for SARS-CoV-2 RNA testing were obtained. **RESULTS:** Twenty-two patients (84.6%) correlated with clustering occurrence. The median period from contact to diagnosis and the last positive nucleic acid test was 19 (8-24 days) and 21.5 days (10-36 days), respectively. The median period from diagnosis to negative nucleic acid test was significantly different between patients with normal or atypical chest computed tomography (CT) findings (n=16, 61.5%; 7.5 days [2-20 days]) and patients with typical ground-glass or patchy opacities on CT (n=10, 38.5%; 12.5 days [8-22 days]; P<0.01). Seven patients (70.0%) with initial positive nucleic acid test results had a negative result simultaneously with improved CT findings. Obvious improvement in CT findings was observed in three patients (30.0%) despite positive nucleic acid test results. **CONCLUSION:** In asymptomatic patients, changes in biochemical and inflammatory variables are small and changes on chest CT can occur. It is worth noting the long existence of SARS-CoV-2 in some asymptomatic patients and false-negative results need to be considered in SARS-CoV-2 nucleic acid test.

DOI: 10.1093/infdis/jiaa205

3. Rahimi F, Talebi Bezin Abadi A. Challenges of managing the asymptomatic carriers of SARS-CoV-2. Travel Med Infect Dis. 2020:101677. DOI: 10.1016/j.tmaid.2020.101677

ABSTRACT: After an outbreak in Wuhan, China, a growing number of countries are now suffering from an epidemic by SARS-CoV-2, which causes COVID-19. Undoubtedly, reports of the skyrocketing global spread of COVID-19 has shocked people globally, from Japan to the United States. Presently, the World Health Organization indicates that the fatality rate due to COVID-19 is about 2%, inferring that many positive subjects may potentially overcome the illness with mild influenza-like symptoms and no need for hospitalization at intensive-care units. Because COVID-19 is completely new to the human immune system, many throughout the world are likely vulnerable to becoming sick after their initial exposure to SARS-CoV-2. Besides hospitalized cases, many individuals are likely asymptomatic but potentially carry the virus. While our knowledge about carriers and their virus shedding is deficient, some studies modelling the viral transmission have considered the potential contribution of the asymptomatic carriers. Protocols for managing asymptomatic cases, for example for controlling them to restrict their contact with healthy people at public places or private residences, have not been established. In-house quarantine may as well be applicable to asymptomatic cases if they could be identified and diagnosed. Presumably now, the asymptomatic subjects potentially contribute to the transmission of COVID-19 without their knowledge, intention, or being diagnosed as carriers. Thus, managing the asymptomatic subjects, who can carry and likely transmit the virus, is a major healthcare challenge while the pandemic is looming.

DOI: 10.1016/j.tmaid.2020.101677

4. Zhang J, Wu S, Xu L. Asymptomatic carriers of COVID-19 as a concern for disease prevention and control: more testing, more follow-up. Biosci Trends. 2020. DOI: 10.5582/bst.2020.03069

ABSTRACT: Following a containment phase of two months, China has transitioned to the mitigation phase. However, China still faces the risk of COVID-19 spreading due to not only to sporadic new cases and imported cases but also asymptomatic carriers. According to daily reports from the National Health Commission of the People's Republic of China from March 31, 2020 to April 7, 2020, the number of new asymptomatic cases reported daily greatly exceeded that of new imported cases. As of 24:00 on April 7, there were a total of 1,095 asymptomatic cases with COVID-19 under medical observation on the Chinese mainland, including 358 imported cases. A growing number of studies have indicated that asymptomatic carriers are infectious to an extent and can potentially transmit COVID-19. At present, China's measures for managing asymptomatic carriers are 14 days of centralized quarantine and observation; in principle, people with two consecutive negative nucleic acid tests (at an interval of at least 24 hours) can be released from quarantine. However, asymptomatic carriers will not be included in confirmed cases unless they develop clinical manifestations while in quarantine. As "silent spreaders", asymptomatic carriers warrant attention as part of disease prevention and control. The testing and follow-up of asymptomatic carriers should be expanded to include people in close contact with patients with confirmed COVID-19 and asymptomatic cases, clusters of outbreaks, and key areas and populations with a high risk of infection.

DOI: 10.5582/bst.2020.03069

Medline – 24 Apr 2020

1. He D, Zhao S, Lin Q, et al. The relative transmissibility of asymptomatic cases among close contacts. Int J Infect Dis. 2020;18:18.

ABSTRACT: Asymptomatic transmission of the coronavirus disease 2019 is an important topic. A recent study in China showed that transmissibility of the asymptomatic cases is comparable to that of symptomatic cases. Here we showed that the conclusion may depend on how we interpret the data. To the best of our knowledge, this is the first time the relative transmissibility of asymptomatic COVID-19 cases is quantified.

URL: [https://www.ijidonline.com/article/S1201-9712\(20\)30250-2/fulltext](https://www.ijidonline.com/article/S1201-9712(20)30250-2/fulltext)

2. Huang L, Zhang X, Zhang X, et al. Rapid asymptomatic transmission of COVID-19 during the incubation period demonstrating strong infectivity in a cluster of youngsters aged 16-23 years outside Wuhan and characteristics of young patients with COVID-19: A prospective contact-tracing study. J Infect. 2020;10:10.

ABSTRACT: BACKGROUND: The outbreak of coronavirus-disease-2019 (COVID-19) has rapidly spread to many places outside Wuhan. Previous studies on COVID-19 mostly included older hospitalized-adults. Little information on infectivity among and characteristics of youngsters with COVID-19 is available.

METHODS: A cluster of 22 close-contacts of a 22-year-old male (Patient-Index) including youngsters with laboratory-confirmed COVID-19 and hospitalized close-contacts testing negative for severe-acute-respiratory-syndrome-coronavirus-2 (SARS-CoV-2) in Anhui Province, China was prospectively-traced.

RESULTS: Since January 23, 2020, we enrolled a cluster of eight youngsters with COVID-19 (median age [range], 22 [16-23] years; six males) originating from Patient-Index returning from Wuhan to Hefei on January 19. Patient-Index visited his 16-year-old female cousin in the evening on his return, and met 15 previous classmates in a get-together on January 21. He reported being totally asymptomatic and were described by all his contacts as healthy on January 19-21. His very first symptoms were itchy eyes and fever developed at noon and in the afternoon on January 22, respectively. Seven youngsters (his cousin and six classmates) became infected with COVID-19 after a-few-hour-contact with Patient-Index. None of the patients and contacts had visited Wuhan (except Patient-Index), or had any exposure to wet-markets, wild-animals, or medical-institutes within three months. For affected youngsters, the median incubation-period was 2 days (range, 1-4). The median serial-interval was 1 day (range, 0-4). Half or more of the eight COVID-19-infected youngsters had fever, cough, sputum production, nasal congestion, and fatigue on admission. All patients had mild conditions. Six patients developed pneumonia (all mild; one bilateral) on admission. As of February 20, four patients were discharged.

CONCLUSIONS: SARS-CoV-2-infection presented strong infectivity during the incubation-period with rapid transmission in this cluster of youngsters outside Wuhan. COVID-19 developed in these youngsters had fast onset and various nonspecific atypical manifestations, and were much milder than in older patients as previously reported.

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7194554/>

Shared Library – 22 Apr, 2020

1. Keeley AJ, Evans C, Colton H, et al. Roll-out of SARS-CoV-2 testing for healthcare workers at a large NHS Foundation Trust in the United Kingdom, March 2020. Eurosurveillance. 2020;25(14):2000433. DOI: doi:https://doi.org/10.2807/1560-7917.ES.2020.25.14.2000433

ABSTRACT: Sheffield Teaching Hospitals NHS Foundation Trust (STH) is one of the UK's largest foundation trusts, employing ca 17,000 individuals and providing a range of hospital and community services. On 17 March 2020, STH commenced testing of symptomatic staff for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), coordinated by the Occupational Health department. Staff members presenting with an influenza-like illness (defined as a reported fever AND one of: cough, sore throat, runny nose, myalgia, headache) or persistent cough, were directed to self-swab in the on-site assessment pods previously used for testing of ambulatory patients in the community. Written and pictorial instructions were provided to staff to self-swab the back of the oropharynx and then insert the same swab 4–6 cm to the back of the nasopharynx. The Sigma-Virocult swabs (Medical Wire, Corsham, UK), containing viral transport medium, were transported to the hospital laboratory at least four times daily. Nucleic acid extraction was performed using MagNA Pure 96 (Roche Life Sciences, Basel, Switzerland). Real-time RT-PCR was performed using the ABI LightCycler (Applied Biosystems, Foster City, United States) with primers and probes specific for both RNA-dependent RNA polymerase (RdRP) and envelope (E) genes [2]. Samples with positive amplification curves for both RdRP and E, or samples with an E amplification curve alone and a cycle threshold less than 35, were considered positive. Samples with E amplification alone but a cycle threshold of 35 or greater were considered indeterminate and sent away for further testing. RNAaseP was used as an internal control to ensure good cellular content of the sample. The majority of test results were

communicated to staff on the same or the next day. Staff with a negative SARS-CoV-2 test were able to return to work if they felt well enough to do so. The policy was authorised by hospital management on 17 March.

URL: <https://eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.14.2000433>

DOI: [doi:https://doi.org/10.2807/1560-7917.ES.2020.25.14.2000433](https://doi.org/10.2807/1560-7917.ES.2020.25.14.2000433)

Shared Library – 17 Apr, 2020

1. An P, Song P, Wang Y, et al. Asymptomatic Patients with Novel Coronavirus Disease (COVID-19). Balkan medical journal. 2020. DOI: 10.4274/balkanmedj.galenos.2020.2020.4.20

DOI: 10.4274/balkanmedj.galenos.2020.2020.4.20

2. He G, Sun W, Fang P, et al. The clinical feature of silent infections of novel coronavirus infection (COVID-19) in Wenzhou. J Med Virol. 2020;2020/04/11. DOI: 10.1002/jmv.25861.; ID: 11643

10.1002/jmv.25861

ABSTRACT: Here were reported clinical features of silent infected COVID-19 patients. Our study showed that the prevalence of the silent infection of COVID-19 is 5.8% (95% CI: 3.4-9.9%), which is much higher than 1.2% which from the report in China CDC. The silent infection patients were more likely to be young adults, the patients without chronic disease. All of the cases in the presented study was found because they were traced as close contact of confirmed cases. Our study indicated that traced the close contract of confirmed case, long time self-quarantine, and screening is necessary to prevent the secondary cases in community. This article is protected by copyright. All rights reserved.

DOI: 10.1002/jmv.25861.; ID: 11643

10.1002/jmv.25861

3. Mayor S. Covid-19: Nine in 10 pregnant women with infection when admitted for delivery are asymptomatic, small study finds. BMJ. 2020;369:m1485-m. DOI: 10.1136/bmj.m1485

ABSTRACT: Nearly 90% of pregnant women admitted to hospital for delivery who test positive for SARS-CoV-2 have no symptoms of the infection, a small study has found.1 Researchers led by Dena Goffman at Columbia University Irving Medical Center in New York, USA, screened all 215 pregnant women admitted to two New York City hospitals from 22 March to 4 April 2020 for symptoms of covid-19 and for infection with SARS-CoV-2. The results, reported in a letter to the New England Journal of Medicine ,1 showed that four women (1.9%) had fever or other symptoms of covid-19 on admission ...

URL: <http://www.bmj.com/lookup/doi/10.1136/bmj.m1485>

DOI: 10.1136/bmj.m1485

Original Search

1. **Aguilar JB, Faust JS, Westafer LM, et al. Investigating the Impact of Asymptomatic Carriers on COVID-19 Transmission. medRxiv. 2020:2020.03.18.20037994. DOI: 10.1101/2020.03.18.20037994**

Coronavirus disease 2019 (COVID-19) is a novel human respiratory disease caused by the SARS-CoV-2 virus.

Asymptomatic carriers of the virus display no clinical symptoms but are known to be contagious. Recent evidence reveals that this sub-population, as well as persons with mild, represent a major contributor in the propagation of COVID-19. The asymptomatic sub-population frequently escapes detection by public health surveillance systems. Because of this, the currently accepted estimates of the basic reproduction number (R_0) of the virus are inaccurate. It is unlikely that a pathogen can blanket the planet in three months with an R_0 in the vicinity of 3, as reported in the literature. In this manuscript, we present a mathematical model taking into account asymptomatic carriers. Our results indicate that an initial value

of the effective reproduction number could range from 5.5 to 25.4, with a point estimate of 15.4, assuming mean parameters. The first three weeks of the model exhibit exponential growth, which is in agreement with average case data collected from thirteen countries with universal health care and robust communicable disease surveillance systems; the average rate of growth in the number of reported cases is 23.3% per day during this period. Competing Interest Statement The authors have declared no competing interest. Funding Statement N/A Author Declarations All relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript. Yes All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes All data used in this article is available from public sources. <https://tinyurl.com/USA-COVID-19-Cases> https://drive.google.com/open?id=18qaRKnQG1GoXamnzJwkHu2GG9xCe4w8_

URL: <http://medrxiv.org/content/early/2020/03/31/2020.03.18.20037994.abstract>

DOI: 10.1101/2020.03.18.20037994

2. **Al-Tawfiq JA. Asymptomatic coronavirus infection: MERS-CoV and SARS-CoV-2 (COVID-19). *Travel Med Infect Dis.* 2020:101608-. DOI: 10.1016/j.tmaid.2020.101608**

The occurrence of asymptomatic individuals with coronaviruses or other viruses may pose a significant public health issue. A recent review in this journal showed that an increase in the rate of asymptomatic individuals with the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) increased from 0% to 28.6% [1]. Actually, as the MERS-CoV progressed overtime there was more identification of asymptomatic individuals due to increased surveillance and contacts testing. This increase had proportionally but inversely affected the case fatality rate. It is expected that early on the course of any outbreak that severe cases are recognized first and then less severe (mildly or asymptomatic) cases are detected with increasing frequency. The extent of asymptomatic MERS-CoV cases is about 9.8% from different studies, Table 1

URL: <https://pubmed.ncbi.nlm.nih.gov/32114075>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7102602/>

DOI: 10.1016/j.tmaid.2020.101608

3. **Atkinson P, French J, Lang E, et al. Just the Facts: Protecting frontline clinicians during the COVID-19 pandemic. *CJEM.* 2020:1-13. DOI: 10.1017/cem.2020.359**

Scenario: You are an emergency physician looking for clear advice on protecting frontline emergency department clinical staff during the coronavirus disease (COVID19) pandemic. You turn to trusted sources for advice and set about summarizing the best available evidence into a useful format to help you and your staff minimize and mitigate the risks of contracting coronavirus infection while treating patients in the emergency department (ED) during the pandemic.

URL: <https://www.cambridge.org/core/article/just-the-facts-protecting-frontline-clinicians-during-the-covid19-pandemic/B1C873338C611F69803841737EAEAA0A>

DOI: 10.1017/cem.2020.359

4. **Bai Y, Yao L, Wei T, et al. Presumed Asymptomatic Carrier Transmission of COVID-19. *JAMA*. 2020. DOI: 10.1001/jama.2020.2565**

URL: <https://jamanetwork.com/journals/jama/fullarticle/2762028>

DOI: 10.1001/jama.2020.2565

5. **Blumberg S, Lietman TM, Porco TC. Assessing the plausibility of subcritical transmission of 2019-nCoV in the United States. *medRxiv*. 2020:2020.02.08.20021311. DOI: 10.1101/2020.02.08.20021311**

Abstract: The 2019-nCoV outbreak has raised concern of global spread. While person-to-person transmission within the Wuhan district has led to a large outbreak, the transmission potential outside of the region remains unclear. Here we present a simple approach for determining whether the upper limit of the confidence interval for the reproduction number exceeds one for transmission in the United States, which would allow endemic transmission. As of February 7, 2020, the number of cases in the United States support subcritical transmission, rather than ongoing transmission. However, this conclusion can change if pre-symptomatic cases resulting from human-to-human transmission have not yet been identified. Competing Interest Statement The authors have declared no competing interest. Funding Statement None of the authors received payment or services from a third party for any aspect of the submitted work. The authors are supported by grants by the NIH and Gates Foundation, but no additional funding was received for this work. Author Declarations All relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript. Yes All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes The data for this study is available for the public (see references). The methodology has been previously published (see references).

URL: <http://medrxiv.org/content/early/2020/02/11/2020.02.08.20021311.abstract>

DOI: 10.1101/2020.02.08.20021311

6. **Day M. Covid-19: four fifths of cases are asymptomatic, China figures indicate. *BMJ*. 2020;369:m1375. DOI: 10.1136/bmj.m1375**

New evidence has emerged from China indicating that the large majority of coronavirus infections do not result in symptoms. Chinese authorities began publishing daily figures on 1 April on the number of new coronavirus cases that are asymptomatic, with the first day's figures suggesting that around four in five coronavirus infections caused no illness. Many experts believe that unnoticed, asymptomatic cases of coronavirus infection could be an important source of contagion. A total of 130 of 166 new infections (78%) identified in the 24 hours to the afternoon of Wednesday 1 April were asymptomatic, said China's National Health Commission. And most of the 36 cases in which patients showed symptoms involved arrivals from overseas, down from 48 the previous day, the commission said. China ...

URL: <http://www.bmj.com/content/369/bmj.m1375.abstract>

DOI: 10.1136/bmj.m1375

7. **Fung SY, Yuen KS, Ye ZW, et al. A tug-of-war between severe acute respiratory syndrome coronavirus 2 and host antiviral defence: lessons from other pathogenic viruses. *Emerging Microbes & Infections*. 2020;9(1):558-70.**

World Health Organization has declared the ongoing outbreak of coronavirus disease 2019 (COVID-19) a Public Health Emergency of International Concern. The virus was named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses. Human infection with SARS-CoV-2 leads to a wide range of clinical manifestations ranging from asymptomatic, mild, moderate to severe. The severe cases present with pneumonia, which can progress to acute respiratory distress syndrome. The outbreak provides an opportunity for real-time tracking of an animal coronavirus that has just crossed species barrier to infect humans. The outcome of SARS-CoV-2 infection is largely determined by virus-host interaction. Here, we review the discovery, zoonotic origin, animal hosts, transmissibility and pathogenicity of SARS-CoV-2 in relation to its interplay with host antiviral defense. A comparison with SARS-CoV, Middle East respiratory syndrome coronavirus, community-acquired human coronaviruses and other pathogenic viruses including human immunodeficiency viruses is made. We summarize current understanding of the induction of a proinflammatory cytokine storm by other highly pathogenic human coronaviruses, their adaptation to humans and their usurpation of the cell death programmes. Important questions concerning the interaction between SARS-CoV-2 and host antiviral defence, including asymptomatic and presymptomatic virus shedding, are also discussed.

URL: <https://www.tandfonline.com/doi/full/10.1080/22221751.2020.1736644>

8. **Gao WJ, Li LM. [Advances on presymptomatic or asymptomatic carrier transmission of COVID-19]. *Zhonghua liu xing bing xue za zhi = Zhonghua liuxingbingxue zazhi*. 2020;41(0):485-8. DOI: 10.3760/cma.j.cn112338-20200228-00207**

COVID-19 is rapidly spreading. Patients in incubation period and healthy carriers are possible sources for transmission. However, such sources of infection cannot be effectively identified due to the symptoms absent. The research evidence is very lacking so far, although there are a few studies suggesting that presymptomatic or asymptomatic carrier may cause COVID-19 transmission. Nearly half of the literature is in the state of preprint without peer review. The question of "the degree to which presymptomatic or asymptomatic infections can transmit" is not fully understood. There is an urgent need to screen infected carriers in larger close contacts or in the general population, and assess their risk for transmission.

URL: <http://rs.yiigle.com/yufabiao/1183795.htm> [Chinese]

<https://www.ncbi.nlm.nih.gov/pubmed/32141279> [English, Abstract]

DOI: 10.3760/cma.j.cn112338-20200228-00207

9. **Hiroshi Nishiura TK, Ayako Suzuki, Sung-Mok Jung, Katsuma Hayashi, Ryo Kinoshita, Yichi Yang, Baoyin Yuan, Andrei R. Akhmetzhanov, Natalie M. Linton. Estimation of the asymptomatic ratio of novel coronavirus infections (COVID-19). *Int J Infect Dis*. 2020;preprint.**

The number of novel coronavirus (COVID-19) cases worldwide continues to grow, and the gap between reports from China and statistical estimates of incidence based on cases diagnosed outside China indicates that a substantial number of cases are underdiagnosed (Nishiura et al., 2020a). Estimation of the asymptomatic ratio—the percentage of carriers with no symptoms—will improve understanding of COVID-19 transmission and the spectrum of disease it causes, providing insight into epidemic spread. Although the asymptomatic ratio is conventionally estimated using seroepidemiological data (Carrat et al., 2008; Hsieh et al., 2014), collection of these data requires significant logistical effort, time, and cost.

Instead, we propose to estimate the asymptomatic ratio by using information on Japanese nationals that were evacuated from Wuhan, China on chartered flights.

URL: [https://www.ijidonline.com/article/S1201-9712\(20\)30139-9/pdf](https://www.ijidonline.com/article/S1201-9712(20)30139-9/pdf)

10. **Hu Z, Song C, Xu C, et al. Clinical characteristics of 24 asymptomatic infections with COVID-19 screened among close contacts in Nanjing, China. *Science China Life Sciences*. 2020. DOI: 10.1007/s11427-020-1661-4**

Previous studies have showed clinical characteristics of patients with the 2019 novel coronavirus disease (COVID-19) and the evidence of person-to-person transmission. Limited data are available for asymptomatic infections. This study aims to present the clinical characteristics of 24 cases with asymptomatic infection screened from close contacts and to show the transmission potential of asymptomatic COVID-19 virus carriers. Epidemiological investigations were conducted among all close contacts of COVID-19 patients (or suspected patients) in Nanjing, Jiangsu Province, China, from Jan 28 to Feb 9, 2020, both in clinic and in community. Asymptomatic carriers were laboratory-confirmed positive for the COVID-19 virus by testing the nucleic acid of the pharyngeal swab samples. Their clinical records, laboratory assessments, and chest CT scans were reviewed. As a result, none of the 24 asymptomatic cases presented any obvious symptoms while nucleic acid screening. Five cases (20.8%) developed symptoms (fever, cough, fatigue, etc.) during hospitalization. Twelve (50.0%) cases showed typical CT images of ground-glass chest and 5 (20.8%) presented stripe shadowing in the lungs. The remaining 7 (29.2%) cases showed normal CT image and had no symptoms during hospitalization. These 7 cases were younger (median age: 14.0 years; $P=0.012$) than the rest. None of the 24 cases developed severe COVID-19 pneumonia or died. 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). Through epidemiological investigation, we observed a typical asymptomatic transmission to the cohabiting family members, which even caused severe COVID-19 pneumonia. Overall, the asymptomatic carriers identified from close contacts were prone to be mildly ill during hospitalization. However, the communicable period could be up to three weeks and the communicated patients could develop severe illness. These results highlighted the importance of close contact tracing and longitudinally surveillance via virus nucleic acid tests. Further isolation recommendation and continuous nucleic acid tests may also be recommended to the patients discharged.

URL: <https://doi.org/10.1007/s11427-020-1661-4>

DOI: 10.1007/s11427-020-1661-4

11. **Ki M, Task Force for -nCoV. Epidemiologic characteristics of early cases with 2019 novel coronavirus (2019-nCoV) disease in Korea. *Epidemiology and health*. 2020;42:e2020007.**

In about 20 days since the diagnosis of the first case of the 2019 novel coronavirus (2019-nCoV) in Korea on January 20, 2020, 28 cases have been confirmed. Fifteen patients (53.6%) of them were male and median age of was 42 years (range, 20-73). Of the confirmed cases, 16, 9, and 3 were index (57.2%), first-generation (32.1%), and second-generation (10.7%) cases, respectively. All first-generation and second-generation patients were family members or intimate acquaintances of the index cases with close contacts. Fifteen among 16 index patients had entered Korea from January 19 to 24, 2020 while 1 patient had entered Korea on January 31, 2020. The average incubation period was 3.9 days (median, 3.0), and the reproduction number was estimated as 0.48. Three of the confirmed patients were asymptomatic when they were diagnosed. Epidemiological indicators will be revised with the availability of additional data in the future. Sharing epidemiological information among researchers worldwide is essential for efficient preparation and response in tackling this new infectious disease.

URL: <https://www.e-epih.org/journal/view.php?doi=10.4178/epih.e2020007>

12. **Kimball A, Hatfield KM, Arons M, et al. Asymptomatic and Presymptomatic SARS-CoV-2 Infections in Residents of a Long-Term Care Skilled Nursing Facility - King County, Washington, March 2020. *MMWR - Morbidity & Mortality Weekly Report*. 2020;69(13):377-81.**

Older adults are susceptible to severe coronavirus disease 2019 (COVID-19) outcomes as a consequence of their age and, in some cases, underlying health conditions (1). A COVID-19 outbreak in a long-term care skilled nursing facility (SNF) in King County, Washington that was first identified on February 28, 2020, highlighted the potential for rapid spread among residents of these types of facilities (2). On March 1, a health care provider at a second long-term care skilled nursing facility (facility A) in King County, Washington, had a positive test result for SARS-CoV-2, the novel coronavirus that causes COVID-19, after working while symptomatic on February 26 and 28. By March 6, seven residents of this second facility were symptomatic and had positive test results for SARS-CoV-2. On March 13, CDC performed symptom assessments and SARS-CoV-2 testing for 76 (93%) of the 82 facility A residents to evaluate the utility of symptom screening for identification of COVID-19 in SNF residents. Residents were categorized as asymptomatic or symptomatic at the time of testing, based on the absence or presence of fever, cough, shortness of breath, or other symptoms on the day of testing or during the preceding 14 days. Among 23 (30%) residents with positive test results, 10 (43%) had symptoms on the date of testing, and 13 (57%) were asymptomatic. Seven days after testing, 10 of these 13 previously asymptomatic residents had developed symptoms and were recategorized as presymptomatic at the time of testing. The reverse transcription-polymerase chain reaction (RT-PCR) testing cycle threshold (Ct) values indicated large quantities of viral RNA in asymptomatic, presymptomatic, and symptomatic residents, suggesting the potential for transmission regardless of symptoms. Symptom-based screening in SNFs could fail to identify approximately half of residents with COVID-19. Long-term care facilities should take proactive steps to prevent introduction of SARS-CoV-2 (3). Once a confirmed case is identified in an SNF, all residents should be placed on isolation precautions if possible (3), with considerations for extended use or reuse of personal protective equipment (PPE) as needed (4).

URL: https://www.cdc.gov/mmwr/volumes/69/wr/mm6913e1.htm?s_cid=mm6913e1_w

13. **Lai C-C, Liu YH, Wang C-Y, et al. Asymptomatic carrier state, acute respiratory disease, and pneumonia due to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2): Facts and myths. *Journal of Microbiology, Immunology and Infection*. 2020. DOI: <https://doi.org/10.1016/j.jmii.2020.02.012>**

Since the emergence of coronavirus disease 2019 (COVID-19) (formerly known as the 2019 novel coronavirus [2019-nCoV]) in Wuhan, China in December 2019, which is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), more than 75,000 cases have been reported in 32 countries/regions, resulting in more than 2000 deaths worldwide. Despite the fact that most COVID-19 cases and mortalities were reported in China, the WHO has declared this outbreak as the sixth public health emergency of international concern. The COVID-19 can present as an asymptomatic carrier state, acute respiratory disease, and pneumonia. Adults represent the population with the highest infection rate; however, neonates, children, and elderly patients can also be infected by SARS-CoV-2. In addition, nosocomial infection of hospitalized patients and healthcare workers, and viral transmission from asymptomatic carriers are possible. The most common finding on chest imaging among patients with pneumonia was ground-glass opacity with bilateral involvement. Severe cases are more likely to be older patients with underlying comorbidities compared to mild cases. Indeed, age and disease severity may be correlated with the outcomes of COVID-19. To date, effective treatment is lacking; however, clinical trials investigating the efficacy of several agents, including remdesivir and chloroquine, are

underway in China. Currently, effective infection control intervention is the only way to prevent the spread of SARS-CoV-2.

URL: <http://www.sciencedirect.com/science/article/pii/S1684118220300402>

DOI: <https://doi.org/10.1016/j.jmii.2020.02.012>

14. **Leung C. 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. *Infect Control Hosp Epidemiol.* 2020;1-3. DOI: 10.1017/ice.2020.81**

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.

URL: <https://www.cambridge.org/core/article/difference-in-the-incubation-period-of-2019-novel-coronavirus-sarscov2-infection-between-travelers-to-hubei-and-nontravelers-the-need-for-a-longer-quarantine-period/AB1FB7B5B94F5ED63408D86D43087239>

DOI: 10.1017/ice.2020.81

15. **Li C, Ji F, Wang L, et al. Asymptomatic and Human-to-Human Transmission of SARS-CoV-2 in a 2-Family Cluster, Xuzhou, China. *Emerg Infect Dis.* 2020;26(7). DOI: 10.3201/eid2607.200718**

We report epidemiologic, laboratory, and clinical findings for 7 patients with 2019 novel coronavirus disease in a 2-family cluster. Our study confirms asymptomatic and human-to-human transmission through close contacts in familial and hospital settings. These findings might also serve as a practical reference for clinical diagnosis and medical treatment.

URL: https://wwwnc.cdc.gov/eid/article/26/7/20-0718_article

DOI: 10.3201/eid2607.200718

16. **Li R, Pei S, Chen B, et al. Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV2). *Science.* 2020:eabb3221. DOI: 10.1126/science.abb3221**

Estimation of the prevalence and contagiousness of undocumented novel coronavirus (SARS-CoV2) infections is critical for understanding the overall prevalence and pandemic potential of this disease. Here we use observations of reported infection within China, in conjunction with mobility data, a networked dynamic metapopulation model and Bayesian inference, to infer critical epidemiological characteristics associated with SARS-CoV2, including the fraction of undocumented infections and their contagiousness. We estimate 86% of all infections were undocumented (95% CI: [82%–90%]) prior to 23 January 2020 travel restrictions. 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. These findings explain the rapid geographic spread of SARS-CoV2 and indicate containment of this virus will be particularly challenging.

URL: <https://science.sciencemag.org/content/sci/early/2020/03/24/science.abb3221.full.pdf>

DOI: 10.1126/science.abb3221

17. **Liu Y, Centre for Mathematical Modelling of Infectious Diseases n CoV Working Group, Funk S, et al. The contribution of pre-symptomatic infection to the transmission dynamics of COVID-2019 [version 1; peer review: awaiting peer review]. *Wellcome Open Research.* 2020;5(58). DOI: 10.12688/wellcomeopenres.15788.1**

Background: Pre-symptomatic transmission can be a key determinant of the effectiveness of containment and mitigation strategies for infectious diseases, particularly if interventions rely on syndromic case finding. For COVID-19, infections in the absence of apparent symptoms have been reported frequently alongside circumstantial evidence for asymptomatic or pre-symptomatic transmission. We estimated the potential contribution of pre-symptomatic cases to COVID-19 transmission.

Methods: Using the probability for symptom onset on a given day inferred from the incubation period, we attributed the serial interval reported from Shenzhen, China, into likely pre-symptomatic and symptomatic transmission. We used the serial interval derived for cases isolated more than 6 days after symptom onset as the no active case finding scenario and the unrestricted serial interval as the active case finding scenario. We reported the estimate assuming no correlation between the incubation period and the serial interval alongside a range indicating alternative assumptions of positive and negative correlation.

Results: We estimated that 23% (range accounting for correlation: 12 – 28%) of transmissions in Shenzhen may have originated from pre-symptomatic infections. Through accelerated case isolation following symptom onset, this percentage increased to 46% (21 – 46%), implying that about 35% of secondary infections among symptomatic cases have been prevented. These results were robust to using reported incubation periods and serial intervals from other settings.

Conclusions: Pre-symptomatic transmission may be essential to consider for containment and mitigation strategies for COVID-19.

URL: <https://wellcomeopenresearch.org/articles/5-58/v1>

DOI: 10.12688/wellcomeopenres.15788.1

18. **Luo SH, Liu W, Liu ZJ, et al. A confirmed asymptomatic carrier of 2019 novel coronavirus (SARS-CoV-2). *Chin Med J (Engl)*. 2020. DOI: 10.1097/cm9.0000000000000798**

URL:

https://journals.lww.com/cmj/Citation/publishahead/A_confirmed_asymptomatic_carrier_of_2019_novel.99353.aspx

DOI: 10.1097/cm9.0000000000000798

19. **Mizumoto K, Kagaya K, Zarebski A, et al. Estimating the asymptomatic proportion of coronavirus disease 2019 (COVID-19) cases on board the Diamond Princess cruise ship, Yokohama, Japan, 2020. *Eurosurveillance*. 2020;25(10):2000180. DOI: doi:https://doi.org/10.2807/1560-7917.ES.2020.25.10.2000180**

An outbreak of coronavirus disease 2019 (COVID-19) unfolded on board a Princess Cruises' ship called the Diamond Princess. Shortly after arriving in Yokohama, Japan, this ship had been placed under quarantine orders from 5 February 2020, after a former passenger had tested positive for the virus responsible for the disease (i.e. severe acute respiratory syndrome coronavirus 2; SARS-CoV-2), subsequent to disembarking in Hong Kong. In this study, we conducted a statistical modelling analysis to estimate the proportion of asymptomatic individuals among those who tested positive for SARS-CoV-2 on board the ship until 20 February 2020 included, along with their times of infections. The model accounted for the delay in symptom onset and also for right censoring, which can occur due to the time lag between a patient's examination and sample collection and the development of illness.

URL: <https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.10.2000180>

DOI: doi:https://doi.org/10.2807/1560-7917.ES.2020.25.10.2000180

20. **Nicastrì E, D'Abramo A, Faggioni G, et al. Coronavirus disease (COVID-19) in a paucisymptomatic patient: epidemiological and clinical challenge in settings with limited community transmission, Italy, February 2020. *Euro Surveill.* 2020;25(11). DOI: 10.2807/1560-7917.Es.2020.25.11.2000230**

Data concerning the transmission of the novel severe acute respiratory syndrome coronavirus (SARS-CoV-2) in paucisymptomatic patients are lacking. We report an Italian paucisymptomatic case of coronavirus disease 2019 with multiple biological samples positive for SARS-CoV-2. This case was detected using the World Health Organization protocol on cases and contact investigation. Current discharge criteria and the impact of extra-pulmonary SARS-CoV-2 samples are discussed.

URL: <https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.11.2000230>

DOI: 10.2807/1560-7917.Es.2020.25.11.2000230

21. **Park SW, Cornforth DM, Dushoff J, et al. The time scale of asymptomatic transmission affects estimates of epidemic potential in the COVID-19 outbreak. *medRxiv.* 2020:2020.03.09.20033514. DOI: 10.1101/2020.03.09.20033514**

We assess the impact of asymptomatic transmission on epidemic potential of novel respiratory pathogens (like COVID-19) -- as measured both by the basic reproduction number (i.e., the expected number of secondary cases generated by an average primary case in a fully susceptible population) and the fraction of new secondary cases attributable to asymptomatic individuals. We show that the impact of asymptomatic transmission depends on generation intervals (i.e., time between when an individual is infected and when that individual infects another person). If the generation-interval distribution of asymptomatic transmission differs from that of symptomatic transmission, then estimates of the basic reproduction number which do not explicitly account for asymptomatic cases may be systematically biased. Specifically, if asymptomatic cases have a shorter generation interval than symptomatic cases, R_0 will be over-estimated, and if they have a longer generation interval, R_0 will be under-estimated. We also show that as the length of asymptomatic generation intervals increase, estimates of the realized proportion of asymptomatic transmission during the exponential phase of the epidemic decrease. Our analysis provides a rationale for assessing the duration of asymptomatic cases of COVID-19 in addition to their prevalence in the population. Competing Interest Statement The authors have declared no competing interest. Funding Statement This work was supported, in part, by support from the Army Research Office to JSW (W911NF1910384). Author Declarations All relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript. Yes All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes All code is available at https://github.com/mac-theobio/coronavirus_asymptomatic. https://github.com/mac-theobio/coronavirus_asymptomatic.

URL: <http://medrxiv.org/content/early/2020/03/13/2020.03.09.20033514.abstract>

DOI: 10.1101/2020.03.09.20033514

22. **Peak CM, Kahn R, Grad YH, et al. Modeling the Comparative Impact of Individual Quarantine vs. Active Monitoring of Contacts for the Mitigation of COVID-19. *medRxiv.* 2020:2020.03.05.20031088. DOI: 10.1101/2020.03.05.20031088**

Individual quarantine and active monitoring of contacts are core disease control strategies, particularly for emerging infectious diseases such as Coronavirus Disease 2019 (COVID-19). To estimate the comparative efficacy of these interventions to control COVID-19, we fit a stochastic branching model, comparing two sets of reported parameters for the dynamics of the disease. Our results suggest that individual quarantine may contain an outbreak of COVID-19 with a short serial interval (4.8 days) only in settings with high intervention performance where at least three-quarters of infected contacts are individually quarantined. However, in settings where this performance is unrealistically high and the outbreak of COVID-19 continues to grow, so too will the burden of the number of contacts traced for active monitoring or quarantine. In such circumstances where resources are prioritized for scalable interventions such as social distancing, we show active monitoring or individual quarantine of high-risk contacts can contribute synergistically to social distancing. To the extent that interventions based on contact tracing can be implemented, therefore, they can help mitigate the spread of COVID-19. Our model highlights the urgent need for more data on the serial interval and the extent of presymptomatic transmission in order to make data-driven policy decisions regarding the cost-benefit comparisons of individual quarantine vs. active monitoring of contacts.

Competing Interest Statement ML reports grants from NIH/NIGMS, during the conduct of the study; personal fees from Merck, grants from CDC, grants from Open Philanthropy Project, outside the submitted work.

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Author Declarations All relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.

Yes All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.

Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).

Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.

Yes Code will be available on github. https://github.com/peakcm/General_Quarantine_Paper

URL: <http://medrxiv.org/content/early/2020/03/08/2020.03.05.20031088.abstract>

DOI: 10.1101/2020.03.05.20031088

23. **Qian G, Yang N, Ma AHY, et al. A COVID-19 Transmission within a family cluster by presymptomatic infectors in China. *Clin Infect Dis.* 2020. DOI: 10.1093/cid/ciaa316**

We report a COVID-19 family cluster caused by a presymptomatic case. There were 9 family members, including 8 laboratory-confirmed with COVID-19, and a 6-year-old child had no evidence of infection. Amongst the 8 patients, one adult and one 13-month-old infant were asymptomatic, one adult was diagnosed as having severe pneumonia.

URL: <https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciaa316/5810900>

DOI: 10.1093/cid/ciaa316

24. **Rothe C, Schunk M, Sothmann P, et al. Transmission of 2019-nCoV Infection from an Asymptomatic Contact in Germany. *N Engl J Med.* 2020;382(10):970-1.**

URL: <https://www.nejm.org/doi/full/10.1056/NEJMc2001468>

25. **Song H, Xiao J, Qiu J, et al. A considerable proportion of individuals with asymptomatic SARS-CoV-2 infection in Tibetan population. *medRxiv*. 2020:2020.03.27.20043836. DOI: 10.1101/2020.03.27.20043836**

Severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2) quickly became a major epidemic threat in the whole China. We analysed SARS-Cov-2 infected cases from Tibetan Autonomous Prefecture, and noted divergent characteristics of these Tibetans infected cases compared to Han Chinese, characterizing by a considerable proportion of asymptomatic carriers (21.7%), and few symptomatic patients with initial symptom of fever (7.7%). Here, we did a descriptive study on clinical characteristics of 18 asymptomatic individuals with SARS-CoV-2 infection. The median age of these asymptomatic carriers was 31 years and one third of them were students, aged under 20 years. Notably, some of asymptomatic carriers had recognizable changes in radiological and laboratory indexes. Our finding indicates a potentially big number of SARS-CoV-2 asymptomatic carriers in prevalent area, highlighting a necessity of screening individuals with close contact of infected patients, for a better control on the spread of SARS-CoV-2 infection.

Competing Interest StatementThe authors have declared no competing interest.

Funding StatementNo funding

Author DeclarationsAll relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript.

YesAll necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived.

YesI understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance).

YesI have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable.

YesThe data used in this study are compiled in the COVID-19 database at Sichuan Univeristy and are available for review on site, on request.

URL: <http://medrxiv.org/content/early/2020/03/30/2020.03.27.20043836.abstract>

DOI: 10.1101/2020.03.27.20043836

26. **Tao Y, Cheng P, Chen W, et al. High incidence of asymptomatic SARS-CoV-2 infection, Chongqing, China. *medRxiv*. 2020:2020.03.16.20037259. DOI: 10.1101/2020.03.16.20037259**

Background: SARS-CoV-2 has been a global pandemic, but the emergence of asymptomatic patients has caused difficulties in the prevention of the epidemic. Therefore, it is significant to understand the epidemiological characteristics of asymptomatic patients with SARS-CoV-2 infection. **Methods:** In this single-center, retrospective and observational study, we collected data from 167 patients with SARS-CoV-2 infection treated in Chongqing Public Health Medical Center (Chongqing, China) from January to March 2020. The epidemiological characteristics and variable of these patients were collected and analyzed. **Findings:** 82.04% of the SARS-CoV-2 infected patients had a travel history in Wuhan or a history of contact with returnees from Wuhan, showing typical characteristics of imported cases, and the proportion of severe Covid-19 patients was 13.2%, of which 59% were imported from Wuhan. For the patients who was returnees from Wuhan, 18.1% was asymptomatic patients. In different infection periods, compared with the proportion after 1/31/2020, the proportion of asymptomatic patient among SARS-CoV-2 infected patient was higher(19% VS 1.5%). In different age groups, the proportion of asymptomatic patient was the highest(28.6%) in children group under 14, next in elder group over 70 (27.3%). Compared with mild and common Covid-19 patients, the mean latency of asymptomatic was longer (11.25 days VS 8.86 days), but the hospital length of stay was shorter (14.3 days VS 16.96 days) . **Conclusion:** The SARS-CoV-2 prevention needs to focus on the screening of asymptomatic patients in the

community with a history of contact with the imported population, especially for children and the elderly population. Competing Interest Statement The authors have declared no competing interest. Funding Statement This work was supported by the National Key Research and Development Program (No. 2016YFC1101100) and National Science Fund for Distinguished Young Scholars (No. 31625011). Author Declarations All relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript. Yes All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes After publication, the data will be made available to others on reasonable requests to the corresponding author. A proposal with detailed description of study objectives and statistical analysis plan will be needed for evaluation of the reasonability of requests. Additional materials might also be required during the process of evaluation. Deidentified participant data will be provided after approval from the corresponding author and Chongqing Public Health Medical Center .

URL: <http://medrxiv.org/content/early/2020/03/23/2020.03.16.20037259.abstract>

DOI: 10.1101/2020.03.16.20037259

27. **Tian S, Hu N, Lou J, et al. Characteristics of COVID-19 infection in Beijing. *J Infect.* 2020;80(4):401-6.**

BACKGROUND: Since the first case of a novel coronavirus (COVID-19) infection pneumonia was detected in Wuhan, China, a series of confirmed cases of the COVID-19 were found in Beijing. We analyzed the data of 262 confirmed cases to determine the clinical and epidemiological characteristics of COVID-19 in Beijing.

METHODS: We collected patients who were transferred by Beijing Emergency Medical Service to the designated hospitals. The information on demographic, epidemiological, clinical, laboratory test for the COVID-19 virus, diagnostic classification, cluster case and outcome were obtained. Furthermore we compared the characteristics between severe and common confirmed cases which including mild cases, no-pneumonia cases and asymptomatic cases, and we also compared the features between COVID-19 and 2003 SARS.

FINDINGS: By Feb 10, 2020, 262 patients were transferred from the hospitals across Beijing to the designated hospitals for special treatment of the COVID-19 infected by Beijing emergency medical service. Among of 262 patients, 46 (17.6%) were severe cases, 216 (82.4%) were common cases, which including 192 (73.3%) mild cases, 11(4.2%) non-pneumonia cases and 13 (5.0%) asymptomatic cases respectively. The median age of patients was 47.5 years old and 48.5% were male. 192 (73.3%) patients were residents of Beijing, 50 (26.0%) of which had been to Wuhan, 116 (60.4%) had close contact with confirmed cases, 21 (10.9%) had no contact history. The most common symptoms at the onset of illness were fever (82.1%), cough (45.8%), fatigue (26.3%), dyspnea (6.9%) and headache (6.5%). The median incubation period was 6.7 days, the interval time from between illness onset and seeing a doctor was 4.5 days. As of Feb 10, 17.2% patients have discharged and 81.7% patients remain in hospital in our study, the fatality of COVID-19 infection in Beijing was 0.9%.

INTERPRETATION: On the basis of this study, we provided the ratio of the COVID-19 infection on the severe cases to the mild, asymptomatic and non-pneumonia cases in Beijing. Population was generally susceptible, and with a relatively low fatality rate. The measures to prevent transmission was very successful at early stage, the next steps on the COVID-19 infection should be focused on early isolation of patients and quarantine for close contacts in families and communities in Beijing.

FUNDING: Beijing Municipal Science and Technology Commission and Ministry of Science and Technology.

URL: [https://www.journalofinfection.com/article/S0163-4453\(20\)30101-8/pdf](https://www.journalofinfection.com/article/S0163-4453(20)30101-8/pdf)

28. **Tindale L, Coombe M, Stockdale JE, et al. Transmission interval estimates suggest pre-symptomatic spread of COVID-19. *medRxiv*. 2020:2020.03.03.20029983. DOI: 10.1101/2020.03.03.20029983**

Background: As the COVID-19 epidemic is spreading, incoming data allows us to quantify values of key variables that determine the transmission and the effort required to control the epidemic. We determine the incubation period and serial interval distribution for transmission clusters in Singapore and in Tianjin.

We infer the basic reproduction number and identify the extent of pre-symptomatic transmission.

Methods: We collected outbreak information from Singapore and Tianjin, China, reported from Jan.19-Feb.26 and Jan.21-Feb.27, respectively. We estimated incubation periods and serial intervals in both populations.

Results: The mean incubation period was 7.1 (6.13, 8.25) days for Singapore and 9 (7.92, 10.2) days for Tianjin. Both datasets had shorter incubation periods for earlier-occurring cases. The mean serial interval was 4.56 (2.69, 6.42) days for Singapore and 4.22 (3.43, 5.01) for Tianjin. We inferred that early in the outbreaks, infection was transmitted on average 2.55 and 2.89 days before symptom onset (Singapore, Tianjin). The estimated basic reproduction number for Singapore was 1.97 (1.45, 2.48) secondary cases per infective; for Tianjin it was 1.87 (1.65, 2.09) secondary cases per infective.

Conclusions: Estimated serial intervals are shorter than incubation periods in both Singapore and Tianjin, suggesting that pre-symptomatic transmission is occurring. Shorter serial intervals lead to lower estimates of R₀, which suggest that half of all secondary infections should be prevented to control spread. Competing Interest Statement The authors have declared no competing interest. Funding Statement CC and JS receive funding from the Canada 150 Research Chairs program of the Federal Government of Canada. Author Declarations All relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript. Yes All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes Data are available at the link below. <https://github.com/carolinecolijn/ClustersCOVID19>

URL: <http://medrxiv.org/content/early/2020/03/06/2020.03.03.20029983.abstract>

DOI: 10.1101/2020.03.03.20029983

29. **Tong ZD, Tang A, Li KF, et al. Potential Presymptomatic Transmission of SARS-CoV-2, Zhejiang Province, China, 2020. *Emerg Infect Dis*. 2020;26(5). DOI: 10.3201/eid2605.200198**

We report a 2-family cluster of persons infected with severe acute respiratory syndrome coronavirus 2 in the city of Zhoushan, Zhejiang Province, China, during January 2020. The infections resulted from contact with an infected but potentially presymptomatic traveler from the city of Wuhan in Hubei Province.

URL: https://wwwnc.cdc.gov/eid/article/26/5/20-0198_article

DOI: 10.3201/eid2605.200198

30. **Wang Y, Liu Y, Liu L, et al. Clinical outcome of 55 asymptomatic cases at the time of hospital admission infected with SARS-Coronavirus-2 in Shenzhen, China. *J Infect Dis.* 2020. DOI: 10.1093/infdis/jiaa119**
An epidemic caused by SARS-Coronavirus-2 infection has spread unexpectedly in Wuhan, Hubei Province, China since December 2019. It is rarely reported about asymptomatic cases screened from close contacts. We study epidemiological and clinical outcome of 55 asymptomatic carriers who were laboratory-confirmed positive for the SARS-Coronavirus-2 by testing the nucleic acid of the pharyngeal swab samples. The evidence showed that asymptomatic carriers occurred more often in middle aged people who had close contact with infected family members. The majority of the cases developed to be mild and ordinary COVID-19 during hospital.

URL: <https://www.ncbi.nlm.nih.gov/pubmed/32179910>

DOI: 10.1093/infdis/jiaa119

31. **Ye F, Xu S, Rong Z, et al. Delivery of infection from asymptomatic carriers of COVID-19 in a familial cluster. *Int J Infect Dis.* 2020. DOI: 10.1016/j.ijid.2020.03.042**
OBJECTIVES: With the ongoing outbreak of COVID-19 around the world, it has become a worldwide health concern. One previous study reported a family cluster with asymptomatic transmission of COVID-19. Here, we report another series of cases and further demonstrate the repeatability of the transmission of COVID-19 by pre-symptomatic carriers. METHODS: A familial cluster of five patients associated with COVID-19 was enrolled in the hospital. We collected epidemiological and clinical characteristics, laboratory outcomes from electronic medical records, and also affirmed them with the patients and their families. RESULTS: Among them, three family members (Case 3/4/5) had returned from Wuhan. Additionally, two family members, those who had not travelled to Wuhan, also contracted COVID-19 after contacting with the other three family members. Case 1 developed severe pneumonia and was admitted to the ICU. Case 3 and Case 5 presented fever and cough on days 2 through 3 of hospitalization and had ground-glass opacity changes in their lungs. Case 4 presented with diarrhoea and pharyngalgia after admission without radiographic abnormalities. Case 2 presented no clinical or radiographic abnormalities. All the cases had an increasing level of C-reactive protein. CONCLUSIONS: Our findings indicate that COVID-19 can be transmitted by asymptomatic carriers during the incubation period.

URL: [https://www.ijidonline.com/article/S1201-9712\(20\)30174-0/fulltext](https://www.ijidonline.com/article/S1201-9712(20)30174-0/fulltext)

DOI: 10.1016/j.ijid.2020.03.042

32. **Yu P, Zhu J, Zhang Z, et al. A familial cluster of infection associated with the 2019 novel coronavirus indicating potential person-to-person transmission during the incubation period. *J Infect Dis.* 2020. DOI: 10.1093/infdis/jiaa077**
An ongoing outbreak of pneumonia associated with 2019 novel coronavirus (2019-nCoV) was reported in China. It is unclear if the infectivity exists during the incubation period, although a person-to-person transmission has been reported in previous studies. We report the epidemiological features of a familial cluster of four patients in Shanghai, of which one was 88 years old man with moving difficulties and was only exposed to his asymptomatic family members who developed symptoms later. The epidemiological evidence has shown a potential transmission of the 2019-nCoV during the incubation period.

URL: <https://www.ncbi.nlm.nih.gov/pubmed/32067043>

DOI: 10.1093/infdis/jiaa077

33. **Yu X, Yang R. COVID-19 transmission through asymptomatic carriers is a challenge to containment. *Influenza Other Respi Viruses.* 2020;n/a(n/a). DOI: 10.1111/irv.12743**

Abstract Since the first report on the outbreak of a novel coronavirus disease COVID-19 in Wuhan, Hubei, China, in December, 2019,¹ there have been 78 064 cases have been confirmed and 2715 deaths as of February 25, 2020. For any infectious disease, there are three kinds of way to control the epidemic of infectious disease-that is, to control the source of infection, to cut off transmission routes, and to protect the susceptible population. As a new infectious disease, it is difficult to develop a safe and effective vaccine against COVID-19 in a short period of time. So, it is not possible to protect susceptible population at present. Social distancing is one of the main ways to cut off transmission routes ? people cannot pass on infection if they do not come into contact with other people. Based on the understanding that COVID-19 spreads through respiratory droplets, there has been widespread use of face masks in Wuhan.

URL: <https://doi.org/10.1111/irv.12743>

DOI: 10.1111/irv.12743

34. **Zhang J, Tian S, Lou J, et al. Familial cluster of COVID-19 infection from an asymptomatic. *Crit Care*. 2020;24(1):119. DOI: 10.1186/s13054-020-2817-7**

URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7100442/>

DOI: 10.1186/s13054-020-2817-7

35. **Zhang W. Estimating the presymptomatic transmission of COVID19 using incubation period and serial interval data. *medRxiv*. 2020:2020.04.02.20051318. DOI: 10.1101/2020.04.02.20051318**

We estimated the fraction and timing of presymptomatic transmissions of COVID19 with mathematical models combining the available data of the incubation period and serial interval. We found that up to 79.7% transmissions could be presymptomatic among the imported cases in China outside Wuhan. The average timing of presymptomatic transmissions is 3.8 days (SD = 6.1) before the symptom onset, which is much earlier than previously assumed. Competing Interest Statement The authors have declared no competing interest. Funding Statement N/A Author Declarations All relevant ethical guidelines have been followed; any necessary IRB and/or ethics committee approvals have been obtained and details of the IRB/oversight body are included in the manuscript. Yes All necessary patient/participant consent has been obtained and the appropriate institutional forms have been archived. Yes I understand that all clinical trials and any other prospective interventional studies must be registered with an ICMJE-approved registry, such as ClinicalTrials.gov. I confirm that any such study reported in the manuscript has been registered and the trial registration ID is provided (note: if posting a prospective study registered retrospectively, please provide a statement in the trial ID field explaining why the study was not registered in advance). Yes I have followed all appropriate research reporting guidelines and uploaded the relevant EQUATOR Network research reporting checklist(s) and other pertinent material as supplementary files, if applicable. Yes All data and code to reproduce this paper are available online <https://github.com/witjump/COVID19-presymptomatic-transmission>

URL: <http://medrxiv.org/content/early/2020/04/06/2020.04.02.20051318.abstract>

DOI: 10.1101/2020.04.02.20051318

SEARCH STRATEGIES

Search Alert Strategies

PubMed

((((transmission[Text Word] OR carrier[Text Word] OR carriers[Text Word])) OR (transmission[Title/Abstract] OR carrier[Title/Abstract] OR carriers[Title/Abstract]))) AND (((asymptomatic[Text Word] OR a-symptomatic[Text Word] OR presymptomatic[Text Word] OR pre-symptomatic[Text Word] OR symptomatic[Text Word])) OR (transmission[Title/Abstract] OR asymptomatic[Title/Abstract] OR a-symptomatic[Title/Abstract] OR presymptomatic[Title/Abstract] OR pre-symptomatic[Title/Abstract] OR symptomatic[Title/Abstract]))) AND (((("COVID-19"[Supplementary Concept] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept] OR COVID-19[tiab] OR COVID 19[tiab] OR SARS-CoV-2[tiab] OR 2019-nCoV[tiab] OR 2019 ncov[tiab] OR (Wuhan[tiab] AND coronavirus[tiab]) OR ((2019[dp] OR 2020[dp]) AND (new[tiab] OR novel[tiab] OR pandemic[tiab] OR epidemic[tiab]) AND (coronavirus*[tiab] OR corona virus*[tiab])))))

Medline

- 1 coronavirus/ or exp betacoronavirus/ or coronavirus infections/
(coronavirus* or corona virus* or coronovirus* or coronaviral or (wuhan adj1 virus) or (wuhan adj1 viral) or cov or covid or WN-CoV or ncov or 2019ncov or ncov2019 or ncovid or ncovid2019 or 2019ncovid or covid-19 or covid19 or covid 19 or corvid 19 or HCov-19 or HCov-2019 or hcov19 or hcov2019 or severe acute respiratory syndrome coronavirus 2 or severe acute respiratory syndrome corona virus 2 or SARS
- 2 Coronavirus 2 or SARS Corona virus 2 or SARS-COV-2 or SARSCOV2 or SARSCOV 2 or SARS2 or SARS-2 or coronavirus disease 2019 or corona virus disease 2019 or 2019 novel coronavirus infection* or 2019 novel coronavirus disease or 2019-nCoV infection* or coronavirus disease-19 or new coronavirus or novel corona virus).mp,kf,hw,rn,in.
- 3 1 or 2
- 4 (asymptomatic or a-symptomatic or presymptomatic or pre-symptomatic or symptomatic).tw,kf.
- 5 exp "health care facilities, manpower, and services"/
(health workforce or health care worker? or healthcare worker? or health-care worker? or health care provider? or healthcare provider? or health-care provider? or medical care provider? or healthcare employee? or health personnel or medical personnel or medical staff or hospitalist? or physician? or doctor? or clinician? or pathologist? or primary care phsyician? or primary care provid! er? or GP or PCP or pulmonologist? or general practitioner? or general practice physician? or nursing staff or nurse? or hospital personnel or hospital staff).tw,kf.
- 6
- 7 5 or 6
- 8 3 and 4 and 7
- 9 limit 8 to yr="2020 -Current"
- 10 3 and 4
- 11 limit 10 to yr="2020 -Current"
- 12 11 not 8
- 13 12 or 8

Shared Library

All fields (a-symptomatic OR asymptomatic OR pre-symptomatic OR presymptomatic)

Original Search Strategies

MEDLINE -April 6, 2020, 4:23pm

#	Searches	Results
1	coronavirus/ or exp betacoronavirus/ or coronavirus infections/	10084
2	(coronavirus* or corona virus* or coronovirus* or coronaviral or (wuhan adj1 virus) or (wuhan adj1 viral) or cov or covid or WN-CoV or ncov or 2019ncov or ncov2019 or ncovid or ncovid2019 or 2019ncovid or covid-19 or covid19 or covid 19 or corvid 19 or HCov-19 or HCov-2019 or hcov19 or hcov2019 or severe acute respiratory syndrome coronavirus 2 or severe acute respiratory syndrome corona virus 2 or SARS Coronavirus 2 or SARS Corona virus 2 or SARS-COV-2 or SARSCOV2 or SARSCOV 2 or SARS2 or SARS-2 or coronavirus disease 2019 or corona virus disease 2019 or 2019 novel coronavirus infection* or 2019 novel coronavirus disease or 2019-nCoV infection* or coronavirus disease-19 or new coronavirus or novel corona virus).mp,kf,hw,rn,in.	17250
3	1 or 2	18707
4	(asymptomatic or a-symptomatic or presymptomatic or pre-symptomatic or symptomatic).tw,kf.	302831
5	exp "health care facilities, manpower, and services"/	2868418
6	(health workforce or health care worker? or healthcare worker? or health-care worker? or health care provider? or healthcare provider? or health-care provider? or medical care provider? or healthcare employee? or health personnel or medical personnel or medical staff or hospitalist? or physician? or doctor? or pathologist? or primary care phsycian? or GP or PCP or pulmonologist? or general practitioner? or general practice physician? or nursing staff or nurse? or hospital personnel or hospital staff or respiratory therapist?).tw,kf.	906744
7	5 or 6	3343214
8	3 and 4 and 7	93
9	limit 8 to yr="2019 -Current"	21
10	3 and 4	432
11	limit 10 to yr="2019 -Current"	152
12	11 not 8	131

CINAHL - April 6, 2020, 4:44pm

#	Query	Results
S1	TX coronavirus* or corona virus* or coronovirus* or coronaviral or (wuhan w1 virus)	7,551

or (wuhan w1 viral) or cov or covid or WN-CoV or ncov or 2019ncov or ncov2019 or ncovid or ncovid2019 or 2019ncovid or covid-19 or covid19 or covid 19 or corvid 19 or HCov-19 or HCov-2019 or hcov19 or hcov2019 or severe acute respiratory syndrome coronavirus 2 or severe acute respiratory syndrome corona virus 2 or SARS Coronavirus 2 or SARS Corona virus 2 or SARS-COV-2 or SARSCOV2 or SARSCOV 2 or SARS2 or SARS-2 or coronavirus disease 2019 or corona virus disease 2019 or 2019 novel coronavirus infection* or 2019 novel coronavirus disease or 2019-nCoV infection* or coronavirus disease-19 or new coronavirus or novel corona virus

TI (asymptomatic or a-symptomatic or presymptomatic or pre-symptomatic or symptomatic) OR AB (asymptomatic or a-symptomatic or presymptomatic or pre-symptomatic or symptomatic)

S2 67,356

S3 (MH "Health Manpower+") 606,441

TI (health workforce or health care worker# or healthcare worker# or health-care worker# or health care provider# or healthcare provider# or health-care provider# or medical care provider# or healthcare employee# or health personnel or medical personnel or medical staff or hospitalist# or physician# or doctor# or pathologist# or primary care phsycian# or GP or PCP or pulmonologist# or general practitioner# or general practice physician# or nursing staff or nurse# or hospital personnel or hospital staff or respiratory therapist#) OR AB (health workforce or health care worker# or healthcare worker# or health-care worker# or health care provider# or healthcare provider# or health-care provider# or medical care provider# or healthcare employee# or health personnel or medical personnel or medical staff or hospitalist# or physician# or doctor# or pathologist# or primary care phsycian# or GP or PCP or pulmonologist# or general practitioner# or general practice physician# or nursing staff or nurse# or hospital personnel or hospital staff or respiratory therapist#)

S4 621,258

S5 S3 OR S4 1,034,647

S6 S1 AND S2 AND S5 18

S7 S1 AND S2 110

S8 S1 AND S2 [Limit to 2019-2020] 31

PubMed – April 7, 2020, 9:30am

(((((transmission[Text Word] OR carrier[Text Word] OR carriers[Text Word])) OR (transmission[Title/Abstract] OR carrier[Title/Abstract] OR carriers[Title/Abstract]))) AND (((asymptomatic[Text Word] OR a-symptomatic[Text Word] OR presymptomatic[Text Word] OR pre-symptomatic[Text Word] OR symptomatic[Text Word])) OR (transmission[Title/Abstract] OR asymptomatic[Title/Abstract] OR a-symptomatic[Title/Abstract] OR presymptomatic[Title/Abstract] OR pre-symptomatic[Title/Abstract] OR symptomatic[Title/Abstract]))) AND (((("COVID-19"[Supplementary Concept] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept] OR COVID-19[tiab] OR COVID 19[tiab] OR SARS-CoV-2[tiab] OR 2019-nCoV[tiab] OR 2019 ncov[tiab] OR (Wuhan[tiab] AND coronavirus[tiab]) OR ((2019[dp] OR 2020[dp]) AND (new[tiab] OR novel[tiab] OR pandemic[tiab] OR epidemic[tiab]) AND (coronavirus*[tiab] OR corona virus*[tiab])))))

Results - 448

Embase – April 7, 2020, 2:59pm

#	Searches	Results
1	(coronavirus* or corona virus* or coronovirus* or coronaviral or (wuhan adj1 virus) or (wuhan adj1 viral) or cov or covid or WN-CoV or ncov or 2019ncov or ncov2019 or nccovid or nccovid2019 or 2019nccovid or covid-19 or covid19 or covid 19 or corvid 19 or HCov-19 or HCov-2019 or hcov19 or hcov2019 or severe acute respiratory syndrome coronavirus 2 or severe acute respiratory syndrome corona virus 2 or SARS Coronavirus 2 or SARS Corona virus 2 or SARS-COV-2 or SARSCOV2 or SARSCOV 2 or SARS2 or SARS-2 or coronavirus disease 2019 or corona virus disease 2019 or 2019 novel coronavirus infection* or 2019 novel coronavirus disease or 2019-nCoV infection* or coronavirus disease-19 or new coronavirus or novel corona virus).mp,hw,rn,in.	22004
2	(health workforce or health care worker? or healthcare worker? or health-care worker? or health care provider? or healthcare provider? or health-care provider? or medical care provider? or healthcare employee? or health personnel or medical personnel or medical staff or hospitalist? or physician? or doctor? or pathologist? or primary care phsycian? or GP or PCP or pulmonologist? or general practitioner? or general practice physician? or nursing staff or nurse? or hospital personnel or hospital staff).tw,hw,mp.	1586277
3	exp "health care facilities, manpower, and services"/	6053263
4	2 or 3	6737484
5	(asymptomatic or a-symptomatic or presymptomatic or pre-symptomatic or symptomatic).tw,hw,mp.	454397
6	1 and 4 and 5	187
7	limit 6 to (human and yr="2019 -Current")	43

Search terms for other resources used in various combinations:

COVID-19 asymptomatic