# Evidence Search Service Results of your search request

## How long does a COVID patient remains contagious after being tested positive please?

**ID of request:** 22770  
**Date of request:** 17th April, 2020  
**Date of completion:** 20th April, 2020

If you would like to request any articles or any further help, please contact:  Pam Collins at [Pamela.collins@nhs.net](mailto:Pamela.collins@nhs.net)

Please acknowledge this work in any resulting paper or presentation as: Evidence search: How long does a COVID patient remains contagious after being tested positive please?. Pam Collins. (20th April, 2020). WOLVERHAMPTON, UK: The Royal Wolverhampton NHS Trust Library and Knowledge Service.

**Sources searched**  
CINAHL (1)  
Coronavirus Research Database -Proquest (1)  
EMBASE (8)  
Lis-Medical (7)  
MEDLINE (14)  
PubMed (2)  
The Conversation (1)

**Date range used** (5 years, 10 years): 2019 onwards   
**Limits used** (gender, article/study type, etc.): English Language, Human   
**Search terms and notes** (full search strategy for database searches below):

The following relevant controlled vocabulary (MeSH Headings) and natural language terms where selected and combined to conduct the search:

Covid-19

* Coronavirus disease
* SARS-CoV-2 infection
* infectivity period
* infectious period
* transmissibility
* viral shedding
* virus shedding
* viral loading

Data sources searched include Medline, Cinahl, Embase, Emcare and PubMed on the HDAS platform. The results were then limited to English Language, Adult and Human. The Coronavirus Research Database and the Public Health Database on the ProQuest platform where also searched. Further searches were then completed on Cochrane, BMJ Best Practice, UpToDate, DynaMed, NHS Evidence, Google and Google Scholar.

For more information about the resources please go to: <https://base-library.nhs.uk/rwtlks/>.

## Summary of Results

An initial search for the terms were conducted in Medline, Cinhal, Embase, Emcare and PubMed. This resulted in a nil return, but identified articles relating to incubation period and seroconversion. The Coronavirus Research Database and the Public Health Database on the ProQuest platform where also searched, again this gave nil results.

A further search was conducted on Google and Google Scholar, with one item identified in The Conversation.  However the reliability of this article needs to be considered as it makes no reference to its's reference sources, it is also aimed at the general public.

Assistance with the search was placed on LIS-Medical, a JISC mailing list of medical librarians across the world.  A number of responses received, suggesting the terms viral shedding or Viral shedding, along with pdf's of articles.

The search strategy was amend to include viral shedding, virus shedding, viral loads and transmissibility. Further, searches were conducted on DynaMed, Up-To-Date and BMJ Best practice, high quality point-of-care tools.

There seems to be very little evidence based research relating to the infectiousness of COVID-19 at the current time.  The following articles may be of interest.

Beeching NJ et al reported in the BMJ Best Practice (Page 8 of the full report)  that Pharyngeal viral shedding is high during the first week of symptoms when symptoms are mild or prodromal, peaking on day 4. This suggests active virus replication in upper respiratory tract tissues. The duration of viral shedding has been estimated to be between 8 and 20 days after symptoms resolve. Also, the virus has been detected in sputum and faeces for up to 39 days after pharyngeal swabs became negative. However, it is unclear whether the virus is capable of transmission later in the course of the disease or after negative pharyngeal swabs.

McIntosh K reported in uptodate that  Whether a test-based strategy reliably identifies patients who are no longer infectious is unknown. Positive RT-PCR tests for SARS-CoV-2 RNA were reported in laboratory-confirmed COVID-19 patients after they had clinically improved and tested negative on two consecutive tests. Another report described 22 patients with COVID-19 who had detectable viral RNA in fecal and/or sputum specimens for up to 13 and 39 days, respectively, even though the viral RNA was no longer detectable in pharyngeal specimens. The clinical significance of these findings is uncertain; it is unknown whether these individuals continued to shed infectious virus.

Lei Z et al notes that there were persistent positive RNA in feces after negative nasopharyngeal swabs suggests a possible prolonged transmission period that changes current quarantine practices.

Liao C et al looks at a case study of a husband and wife who tested positive for COVID-19 in Taiwan. The wifes tested negative on days 17 and 19, but tested positive again on day with negative results on days 28, 30 and 32 from the onset of the disease. Her stool sample tested negative after day 9. Isolation was discontinued on day 33.  However, the husband tested positive on day 15, but negative on 17th, 19th and 21st from the onset. His stool sample showed positive on 17th day, but then negative on 21st day. Isolation was discontinued on the 22nd day.

Siordia JA suggests that Symptoms tend to resolve after 10 days. However, viral shedding continues despite symptoms disappearing. COVID-19 RNA viral shedding persists for about 18 days (by nasopharyngeal swab) or 19 days (via feces). Mild and asymptomatic cases tend to shed 10 days (between 8-15 days) after symptom resolution, with 90 % resolving after 10 days and nearly all cases resolving after 15 days. Severe cases continue shedding up until 25 days after initial symptoms arise. Severe cases also have 60 times more viral load than mild cases. However, the infectious potential based on severity has not been discovered. Due to these findings, the Chinese Municipal Health Commission has recommended against discharging patients until the patient has remained afebrile for three days and RT-PCR becomes negative.

Liu, WA et al reported that positive tests continued until day 63, after the systematic period had completed and seroconversion.

Wickramaratchi MM et al suggests an incubation period of 18-21 days rather than 14 days, with a full recovery at 37 days.

In relation to children:

Lin J et al, suggests that children present with milder mainifestations than adults, However, the continous positive real-time reverse transcription-polymerase chain reaction assay for SARS-CoV-2 in the child's throat swab sample indicated the isolation period for suspected child cases should be longer than 14 days.

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The Conversation

[How long are you infectious when you have coronavirus?](#Research626333)

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28. [The Presence of SARS-CoV-2 RNA in Feces of COVID-19 Patients.](#Research626800)
29. [The transmission and diagnosis of 2019 novel coronavirus infection disease (COVID-19): A Chinese perspective.](#Research626808)
30. [Translating transmissibility measures into recommendations for coronavirus prevention.](#Research626809)
31. [Virological assessment of hospitalized patients with COVID-2019.](#Research626801)
32. [Virus shedding patterns in nasopharyngeal and fecal specimans of COVID-19 patients.](#Research626492)

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

## A. Synopses or Summaries

#### BMJ Best Practice

**Coronavirus disease 2019 (COVID-19) - symptoms, diagnosis and treatment** (2020)

Beeching, NJ et al

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=6e8ca8256142e22e6c23f1c19da35ef7)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=907b97d74bac55a294ae334364e78183)

Pharyngeal viral shedding is high during the first week of symptoms when symptoms are mild or prodromal, peaking on day 4. This suggests active virus replication in upper respiratory tract tissues. The duration of viral shedding has been estimated to be between 8 and 20 days after symptoms resolve. Also, the virus has been detected in sputum and faeces for up to 39 days after pharyngeal swabs became negative. However, it is unclear whether the virus is capable of transmission later in the course of the disease or after negative pharyngeal swabs.

#### The Conversation

**How long are you infectious when you have coronavirus?** (2020)

Khan, S

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=cf1e2b52a05da1d9bb674053dabb2d41)

For COVID-19, there is emerging evidence to suggest the infectious period may start 1 to 3 days before you develop symptoms. The most infectious period is thought to be 1 to 3 days before symptoms start, and in the first 7 days after symptoms begin. But some people may remain infectious for longer. Commonly reported symptoms for COVID-19 – such as fever, cough and fatigue – usually last around 9 to 10 days but this can be longer. If someone has been symptom-free for 3 days and they developed their first symptoms more than 10 days prior, they are no longer considered to be infectious. However, one study from Hong Kong found the virus could be detected for 20 days or longer after the initial onset of symptoms in one-third of patients tested. Another study from China found found the virus in a patients’ faecal samples five weeks after the first onset of symptoms.

## B. Original Research

1. **A cross-sectional comparison of epidemiological and clinical features of patients with coronavirus disease (COVID-19) in Wuhan and outside Wuhan, China.**  
   Lei Travel Medicine and Infectious Disease 2020;(9th April 2020.):[Epub ahead of print].

This study indicates possible diminishing virulence of the virus in the process of transmission. Yet persistent positive RNA in feces after negative nasopharyngeal swabs suggests a possible prolonged transmission period that challenges current quarantine practices.

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[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=68bc3214d050526de37381a88ee0d3b7)

1. **A systematic review of covid-19 epidemiology based on current evidence**  
   Park M. Journal of Clinical Medicine 2020;9(4):No page numbers.

As the novel coronavirus (SARS-CoV-2) continues to spread rapidly across the globe, we aimed to identify and summarize the existing evidence on epidemiological characteristics of SARS-CoV-2 and the effectiveness of control measures to inform policymakers and leaders in formulating management guidelines, and to provide directions for future research. We conducted a systematic review of the published literature and preprints on the coronavirus disease (COVID-19) outbreak following predefined eligibility criteria. Of 317 research articles generated from our initial search on PubMed and preprint archives on 21 February 2020, 41 met our inclusion criteria and were included in the review. Current evidence suggests that it takes about 3-7 days for the epidemic to double in size. Of 21 estimates for the basic reproduction number ranging from 1.9 to 6.5, 13 were between 2.0 and 3.0. The incubation period was estimated to be 4-6 days, whereas the serial interval was estimated to be 4-8 days. Though the true case fatality risk is yet unknown, current model-based estimates ranged from 0.3% to 1.4% for outside China. There is an urgent need for rigorous research focusing on the mitigation efforts to minimize the impact on society.<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=7eb00ed2921c91007755bc10ebf73b48)

1. **Assessing Viral Shedding and Infectivity of Tears in Coronavirus Disease 2019 (COVID-19) Patients.**  
   Seah Ivan Yu Jun Ophthalmology 2020;:No page numbers.

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[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=b1a5f9456c01a856003aa9eea6721846)

1. **Characteristics of pediatric SARS-CoV-2 infection and potential evidence for persistent fecal viral shedding**  
   Xu Y. Nature Medicine 2020;:No page numbers.

We report epidemiological and clinical investigations on ten pediatric SARS-CoV-2 infection cases confirmed by real-time reverse transcription PCR assay of SARS-CoV-2 RNA. Symptoms in these cases were nonspecific and no children required respiratory support or intensive care. Chest X-rays lacked definite signs of pneumonia, a defining feature of the infection in adult cases. Notably, eight children persistently tested positive on rectal swabs even after nasopharyngeal testing was negative, raising the possibility of fecal-oral transmission.<br/>Copyright &#xa9; 2020, The Author(s), under exclusive licence to Springer Nature America, Inc.

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1. **Clinical and epidemiological features of 36 children with coronavirus disease 2019 (COVID-19) in Zhejiang, China: an observational cohort study**  
   Qiu H. The Lancet Infectious Diseases 2020;:No page numbers.

Background: Since December, 2019, an outbreak of coronavirus disease 2019 (COVID-19) has spread globally. Little is known about the epidemiological and clinical features of paediatric patients with COVID-19. <br/>Method(s): We retrospectively retrieved data for paediatric patients (aged 0-16 years) with confirmed COVID-19 from electronic medical records in three hospitals in Zhejiang, China. We recorded patients' epidemiological and clinical features. <br/>Finding(s): From Jan 17 to March 1, 2020, 36 children (mean age 8.3 [SD 3.5] years) were identified to be infected with severe acute respiratory syndrome coronavirus 2. The route of transmission was by close contact with family members (32 [89%]) or a history of exposure to the epidemic area (12 [33%]); eight (22%) patients had both exposures. 19 (53%) patients had moderate clinical type with pneumonia; 17 (47%) had mild clinical type and either were asymptomatic (ten [28%]) or had acute upper respiratory symptoms (seven [19%]). Common symptoms on admission were fever (13 [36%]) and dry cough (seven [19%]). Of those with fever, four (11%) had a body temperature of 38.5degreeC or higher, and nine (25%) had a body temperature of 37.5-38.5degreeC. Typical abnormal laboratory findings were elevated creatine kinase MB (11 [31%]), decreased lymphocytes (11 [31%]), leucopenia (seven [19%]), and elevated procalcitonin (six [17%]). Besides radiographic presentations, variables that were associated significantly with severity of COVID-19 were decreased lymphocytes, elevated body temperature, and high levels of procalcitonin, D-dimer, and creatine kinase MB. All children received interferon alfa by aerosolisation twice a day, 14 (39%) received lopinavir-ritonavir syrup twice a day, and six (17%) needed oxygen inhalation. Mean time in hospital was 14 (SD 3) days. By Feb 28, 2020, all patients were cured. <br/>Interpretation(s): Although all paediatric patients in our cohort had mild or moderate type of COVID-19, the large proportion of asymptomatic children indicates the difficulty in identifying paediatric patients who do not have clear epidemiological information, leading to a dangerous situation in community-acquired infections. <br/>Funding(s): Ningbo Clinical Research Center for Children's Health and Diseases, Ningbo Reproductive Medicine Centre, and Key Scientific and Technological Innovation Projects of Wenzhou.<br/>Copyright &#xa9; 2020 Elsevier Ltd

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=5bab13e93242f1603c99c93b014b723c)

1. **Clinical Course and Outcomes of Patients with Severe Acute Respiratory Syndrome Coronavirus 2 Infection: a Preliminary Report of the First 28 Patients from the Korean Cohort Study on COVID-19.**  
   Kim Eu Suk Journal of Korean medical science 2020;35(13):e142.

BACKGROUNDSevere acute respiratory syndrome coronavirus 2 (SARS-CoV-2)-infected pneumonia emerged in Wuhan, China in December 2019. In this retrospective multicenter study, we investigated the clinical course and outcomes of novel coronavirus disease 2019 (COVID-19) from early cases in Republic of Korea.METHODSAll of the cases confirmed by real time polymerase chain reaction were enrolled from the 1st to the 28th patient nationwide. Clinical data were collected and analyzed for changes in clinical severity including laboratory, radiological, and virologic dynamics during the progression of illness.RESULTSThe median age was 40 years (range, 20-73 years) and 15 (53.6%) patients were male. The most common symptoms were cough (28.6%) and sore throat (28.6%), followed by fever (25.0%). Diarrhea was not common (10.7%). Two patients had no symptoms. Initial chest X-ray (CXR) showed infiltration in 46.4% of the patients, but computed tomography scan confirmed pneumonia in 88.9% (16/18) of the patients. Six patients (21.4%) required supplemental oxygen therapy, but no one needed mechanical ventilation. Lymphopenia was more common in severe cases. Higher level of C-reactive protein and worsening of chest radiographic score was observed during the 5-7 day period after symptom onset. Viral shedding was high from day 1 of illness, especially from the upper respiratory tract (URT).CONCLUSIONThe prodromal symptoms of COVID-19 were mild and most patients did not have limitations of daily activity. Viral shedding from URT was high from the prodromal phase. Radiological pneumonia was common from the early days of illness, but it was frequently not evident in simple CXR. These findings could be plausible explanations for the easy and rapid spread of SARS-CoV-2 in the community.

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1. **COVID-19: Knowns, Unknowns, and Questions.**  
   Weston Stuart mSphere 2020;5(2):No page numbers.

The recent emergence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from the Hubei province in China in late 2019 demonstrates the epidemic potential of coronaviruses. The rapid spread of this virus across the world in only 2 months highlights the transmissibility of this family of viruses and the significant morbidity and mortality that they can cause. We highlight the current state of knowledge of coronavirus biology while answering questions concerning the current outbreak of SARS-CoV-2.

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[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=a5d3d00566d8b9adc8cc9ac21be1ba85)

1. **Duration of SARS-CoV-2 viral shedding during COVID-19 infection.**  
   Qian Guo-Qing Infectious diseases (London, England) 2020;:1-2.

1. **Early in the epidemic: impact of preprints on global discourse about COVID-19 transmissibility.**  
   Majumder Maimuna S. The Lancet. Global health 2020;:No page numbers.

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1. **Epidemiology and clinical features of COVID-19: A review of current literature**  
   Siordia J.A. Journal of Clinical Virology 2020;127:No page numbers.

Coronavirus disease 2019 is a pandemic influencing the first half of the year 2020. The virus has rapidly spread to many countries. Studies are rapidly published to share information regarding epidemiology, clinical and diagnostic patterns, and prognosis. The following review condenses the surge of information into an organized format.<br/>Copyright &#xa9; 2020 Elsevier B.V.

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1. **Evaluation of SARS-CoV-2 RNA shedding in clinical specimens and clinical characteristics of 10 patients with COVID-19 in Macau.**  
   Lo Iek Long International journal of biological sciences 2020;16(10):1698-1707.

As a city famous for tourism, the public healthcare system of Macau SAR has been under great pressure during the outbreak of the Coronavirus Disease 2019 (COVID-19). In this study, we report clinical and microbiological features of ten COVID-19 patients enrolled in the Centro Hospitalar Conde de São Januário (CHCSJ) between January 21 to February 16, 2020. Clinical samples from all patients including nasopharyngeal swab (NPS)/sputum, urine, and feces were collected for serial virus RNA testing by standard qRT-PCR assay. In total, seven were imported cases and three were local cases. The median duration from Macau arrival to admission in imported cases was 3 days. Four patients required oxygen therapy but none of them needed machinal ventilation. No fatal cases were noted. The most common symptoms were fever (80%) and diarrhea (80%). In the "Severe" group, there was significantly more elderly patients (p=0.045), higher lactate dehydrogenase levels (p=0.002), and elevated C-Reactive protein levels compared to the "Mild to Moderate" group (p<0.001). There were positive SARS-CoV-2 RNA signals in all patients' NPS and stool specimens but negative in all urine specimens. Based on our data on SARS-CoV-2 RNA shedding in stool and the possibility of a lag in viral detection in NPS specimens, the assessment of both fecal and respiratory specimen is recommended to enhance diagnostic sensitivity, and also to aid discharge decision before the role of viral RNA shedding in stool is clarified.

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[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=662b2ea32ea074563520e816b3020330)

1. **Evolving epidemiology and transmission dynamics of coronavirus disease 2019 outside Hubei province, China: a descriptive and modelling study**  
   Zhang J. The Lancet Infectious Diseases 2020;:No page numbers.

Background: The coronavirus disease 2019 (COVID-19) epidemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), began in Wuhan city, Hubei province, in December, 2019, and has spread throughout China. Understanding the evolving epidemiology and transmission dynamics of the outbreak beyond Hubei would provide timely information to guide intervention policy. <br/>Method(s): We collected individual information from official public sources on laboratory-confirmed cases reported outside Hubei in mainland China for the period of Jan 19 to Feb 17, 2020. We used the date of the fourth revision of the case definition (Jan 27) to divide the epidemic into two time periods (Dec 24 to Jan 27, and Jan 28 to Feb 17) as the date of symptom onset. We estimated trends in the demographic characteristics of cases and key time-to-event intervals. We used a Bayesian approach to estimate the dynamics of the net reproduction number (R<sub>t</sub>) at the provincial level. <br/>Finding(s): We collected data on 8579 cases from 30 provinces. The median age of cases was 44 years (33-56), with an increasing proportion of cases in younger age groups and in elderly people (ie, aged &gt;64 years) as the epidemic progressed. The mean time from symptom onset to hospital admission decreased from 4.4 days (95% CI 0.0-14.0) for the period of Dec 24 to Jan 27, to 2.6 days (0.0-9.0) for the period of Jan 28 to Feb 17. The mean incubation period for the entire period was estimated at 5.2 days (1.8-12.4) and the mean serial interval at 5.1 days (1.3-11.6). The epidemic dynamics in provinces outside Hubei were highly variable but consistently included a mixture of case importations and local transmission. We estimated that the epidemic was self-sustained for less than 3 weeks, with mean Rt reaching peaks between 1.08 (95% CI 0.74-1.54) in Shenzhen city of Guangdong province and 1.71 (1.32-2.17) in Shandong province. In all the locations for which we had sufficient data coverage of Rt, Rt was estimated to be below the epidemic threshold (ie, &lt;1) after Jan 30. <br/>Interpretation(s): Our estimates of the incubation period and serial interval were similar, suggesting an early peak of infectiousness, with possible transmission before the onset of symptoms. Our results also indicate that, as the epidemic progressed, infectious individuals were isolated more quickly, thus shortening the window of transmission in the community. Overall, our findings indicate that strict containment measures, movement restrictions, and increased awareness of the population might have contributed to interrupt local transmission of SARS-CoV-2 outside Hubei province. <br/>Funding(s): National Science Fund for Distinguished Young Scholars, National Institute of General Medical Sciences, and European Commission Horizon 2020.<br/>Copyright &#xa9; 2020 Elsevier Ltd

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1. **Factors associated with prolonged viral RNA shedding in patients with COVID-19.**  
   Xu Kaijin Clinical infectious diseases : an official publication of the Infectious Diseases Society of America 2020;:No page numbers.

BACKGROUNDAn outbreak of coronavirus disease 2019 (COVID-19) is becoming a public health emergency. Data are limited on the duration and host factors related to viral shedding.METHODSIn this retrospective study, risk factors associated with severe acute respiratory coronavirus 2 (SARS-CoV-2) RNA shedding were evaluated in a cohort of 113 symptomatic patients from two hospitals outside Wuhan.RESULTSThe median duration of SARS-CoV-2 RNA detection was 17 days (Interquartile Range [IQR], 13-22 days) as measured from illness onset. When comparing patients with early (<15 days) and late viral RNA clearance (≥15 days after illness onset), prolonged SARS-CoV-2 RNA shedding was associated with male sex (p=0.009), old age (p=0.033), concomitated with hypertension (p=0.009), delayed admission to hospital after illness onset (p=0.001), severe illness at admission (p=0.049), invasive mechanical ventilation (p=0.006), and corticosteroid treatment (p=0.025). Patients with longer SARS-CoV-2 RNA shedding duration had slower recovery of body temperature (p<0.001) and focal absorption on radiograph images (p<0.001) than patients with early SARS-CoV-2 RNA clearance. Male sex (odds ratio [OR], 3.24 [95% CI, 1.31-8.02]), delayed hospital admission (OR, 1.30 [95% CI, 1.10-1.54]), and invasive mechanical ventilation (OR, 9.88 [95% CI, 1.11-88.02]) were independent risk factors for prolonged SARS-CoV-2 RNA shedding.CONCLUSIONSMale sex, delayed admission to hospital after illness onset, and invasive mechanical ventilation were associated with prolonged SARS-CoV-2 RNA shedding. Hospital admission and general treatments should be started as soon as possible in symptomatic COVID-19 patients, especially male patients.

1. **How do we decide to de-isolate COVID-19?**  
   Liao CH et al Journal of Microbiology, Immunology and Infection 2020;(22nd March 2020):[Online]..

Since the outbreak of coronavirus disease 2019 (COVID-19) in December 2019, the number of individuals affected by the disease has rapidly risen. It has been suggested that the disease is contagious during the incubation period in infected patients. However, the duration for which the disease remains contagious in the patients is not known. It is not known as to how and when can a decision be made to de-isolate these patients to avoid the transmission of the causative virus i.e. severe acute respiratory syndrome corona virus 2 (SARS-CoV-2). Serial collections of oropharyngeal swab and sputum specimens are recommended by the Taiwan Centers for Disease Control and Prevention (Taiwan CDC) to detect SARS-CoV-2 from the upper airways in COVID-19 patients. Based on this, we hypothesized that virus detection from the upper airways may have a direct correlation with the possibility of transmission. In this study, we observed the clinical course and presence of SARS-CoV-2 RNA in serial collections of specimens from the upper airways of two patients with COVID-19.

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[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=cfbb5518a69b581d16861a9e47df0ea8)

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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1. **Interrupting COVID-19 transmission by implementing enhanced traffic control bundling: Implications for global prevention and control efforts.**  
   Yen Muh-Yong Journal of microbiology, immunology, and infection = Wei mian yu gan ran za zhi 2020;:No page numbers.

We argue that enhanced Traffic Control Bundling (eTCB) can interrupt the community-hospital-community transmission cycle, thereby limiting COVID-19's impact. Enhanced TCB is an expansion of the traditional TCB that proved highly effective during Taiwan's 2003 SARS outbreak. TCB's success derived from ensuring that Health Care Workers (HCWs) and patients were protected from fomite, contact and droplet transmission within hospitals. Although TCB proved successful during SARS, achieving a similar level of success with the COVID-19 outbreak requires adapting TCB to the unique manifestations of this new disease. These manifestations include asymptomatic infection, a hyper-affinity to ACE2 receptors resulting in high transmissibility, false negatives, and an incubation period of up to 22 days. Enhanced TCB incorporates the necessary adaptations. In particular, eTCB includes expanding the TCB transition zone to incorporate a new sector - the quarantine ward. This ward houses patients exhibiting atypical manifestations or awaiting definitive diagnosis. A second adaptation involves enhancing the checkpoint hand disinfection and gowning up with Personal Protective Equipment deployed in traditional TCB. Under eTCB, checkpoint hand disinfection and donning of face masks are now required of all visitors who seek to enter hospitals. These enhancements ensure that transmissions by droplets, fomites and contact are disrupted both within hospitals and between hospitals and the broader community. Evidencing eTCB effectiveness is Taiwan's success to date in containing and controlling the community-hospital-community transmission cycle.

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1. **Monitoring Transmissibility and Mortality of COVID-19 in Europe.**  
   Yuan Jing International journal of infectious diseases : IJID : official publication of the International Society for Infectious Diseases 2020;:No page numbers.

OBJECTIVESAs a global pandemic is inevitable, real-time monitoring of transmission is vital for containing the spread of COVID-19. The main objective was to report real-time effective reproduction numbers (R(t)) case fatality rate (CFR).METHODSData were mainly obtained from WHO website, up to 9 March 2020. R(t) was estimated by exponential growth rate (EG) and time dependent (TD) methods. "R0" package in R was employed to estimate R(t) by fitting the existing epidemic curve. Both naïve CFR (nCFR) and adjust CFR (aCFR) were estimated.RESULTSIn EG method, R(t) was 3.27 [3.17-3.38] for Italy, 6.32 [5.72-6.99] for France, 6.07 [5.51-6.69] for Germany, 5.08 [4.51-5.74] for Spain. With TD method, the R value for March 9 was 3.10 [2.21-4.11] for Italy, 6.56 [2.04-12.26] for France, 4.43 [1.83-7.92] for Germany, and 3.95 [0-10.19] for Spain.CONCLUSIONSThis study provides important findings on an early outbreak of COVID-19 in Europe. Due to the recent rapid increase in new cases of COVID-19, real-time monitoring of the transmissibility and mortality in Spain and France is a priority.

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1. **Novel coronavirus outbreak in Wuhan, China, 2020: Intense surveillance is vital for preventing sustained transmission in new locations**  
   Thompson R.N. Journal of Clinical Medicine 2020;9(2):No page numbers.

The outbreak of pneumonia originating in Wuhan, China, has generated 24,500 confirmed cases, including 492 deaths, as of 5 February 2020. The virus (2019-nCoV) has spread elsewhere in China and to 24 countries, including South Korea, Thailand, Japan and USA. Fortunately, there has only been limited human-to-human transmission outside of China. Here, we assess the risk of sustained transmission whenever the coronavirus arrives in other countries. Data describing the times from symptom onset to hospitalisation for 47 patients infected early in the current outbreak are used to generate an estimate for the probability that an imported case is followed by sustained human-to-human transmission. Under the assumptions that the imported case is representative of the patients in China, and that the 2019-nCoV is similarly transmissible to the SARS coronavirus, the probability that an imported case is followed by sustained human-to-human transmission is 0.41 (credible interval [0.27, 0.55]). However, if the mean time from symptom onset to hospitalisation can be halved by intense surveillance, then the probability that an imported case leads to sustained transmission is only 0.012 (credible interval [0, 0.099]). This emphasises the importance of current surveillance efforts in countries around the world, to ensure that the ongoing outbreak will not become a global pandemic.<br/>Copyright &#xa9; 2020 by the authors; licensee MDPI, Basel, Switzerland.

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1. **Prolonged viral shedding in feces of pediatric patients with coronavirus disease 2019.**  
   Xing Yu-Han Journal of microbiology, immunology, and infection = Wei mian yu gan ran za zhi 2020;:No page numbers.

OBJECTIVETo determine the dynamic changes of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) RNA in respiratory and fecal specimens in children with coronavirus disease 2019 (COVID-19).METHODSFrom January 17, 2020 to February 23, 2020, three paediatric cases of COVID-19 were reported in Qingdao, Shandong Province, China. Epidemiological, clinical, laboratory, and radiological characteristics and treatment data were collected. Patients were followed up to March 10, 2020, and dynamic profiles of nucleic acid testing results in throat swabs and fecal specimens were closely monitored.RESULTSClearance of SARS-CoV-2 in respiratory tract occurred within two weeks after abatement of fever, whereas viral RNA remained detectable in stools of pediatric patients for longer than 4 weeks. Two children had fecal SARS-CoV-2 undetectable 20 days after throat swabs showing negative, while that of another child lagged behind for 8 days.CONCLUSIONSSARS-CoV-2 may exist in children's gastrointestinal tract for a longer time than respiratory system. Persistent shedding of SARS-CoV-2 in stools of infected children raises the possibility that the virus might be transmitted through contaminated fomites. Massive efforts should be made at all levels to prevent spreading of the infection among children after reopening of kindergartens and schools.

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1. **Prolonged virus shedding even after seroconversion in a patient with COVID-19**  
   Liu WD et al Journal of Infection 2020;(31st March 2020):[Online]..

Previous reports revealed that the emergence of the novel coronavirus (SARS-CoV-2) infection (COVID-19) had raised global concern. Several studies discussing the clinical pictures of COVID-19 and specific antibody responding to SARS-CoV-2 have been published. However, the time sequences of clinical manifestations, virus shedding kinetics, contagiousness, and specific antibody reaction, which are essential for understanding pathophysiology and infection control strategy, have less been discussed. Here we present a COVID-19 patient with prolonged viral shedding and detailed time sequence of these parameters mentioned above.

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1. **Public health might be endangered by possible prolonged discharge of SARS-CoV-2 in stool.**  
   He Yu Journal of Infection 2020;80(5):No page numbers.

• The published data, which showed the COVID-19 patients with low digestive. • manifestation, might be misleading. Case with negative URT test showed positive in. • rectal scarab which challenge the isolation protocol. • As fomite transmission caused clusters of infection of SARS, adequate disinfection. • operations should be adopted in SARS-CoV-2 outbreak.

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1. **Review on Identification of Major Infection Site and Disease Progression Pathway for Early Detection of Novel Corona Virus (Covid-19)**  
   Wickramaratchi MetaArXiv 2020;(12th April 2020):[Online]..

Early identification of Covid-19 asymptomatic individuals is the biggest challenge faced globally. This study recommends a longer quarantine period of 18 – 21 days instead of 14 days. Furthermore due to further viral shedding of survived individuals, actual full recovery period should extend up to 37 days. Shedding can be further monitored by testing stools, sweat and hair follicles. Another major way of disease spread is via excretion of urine and faeces. Proper hygiene practice and sanitary issues in poor countries need attention as Covid-19 virus indicates prolong survival period in the human excretory system.

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1. **Risk of nosocomial transmission of coronavirus disease 2019: an experience in a general ward setting in Hong Kong**  
   Wong S.C.-Y. The Journal of hospital infection 2020;:No page numbers.

BACKGROUND: Coronavirus disease 2019 (COVID-19) was first reported in Wuhan in December 2019 and has rapidly spread across different cities within and outside China. Hong Kong started to prepare for COVID-19 on 31st December 2019 and infection control measures in public hospitals were tightened to limit nosocomial transmission within healthcare facilities. However, the recommendations on the transmission-based precautions required for COVID-19 in hospital settings vary from droplet and contact precautions, to contact and airborne precautions with placement of patients in airborne infection isolation rooms. AIM: To describe an outbreak investigation of a patient with COVID-19 who was nursed in an open cubicle of a general ward before the diagnosis was made. <br/>METHOD(S): Contacts were identified and risk categorized as 'close' or 'casual' for decisions on quarantine and/or medical surveillance. Respiratory specimens were collected from contacts who developed fever, and/or respiratory symptoms during the surveillance period and were tested for SARS-CoV-2. FINDINGS: A total of 71 staff and 49 patients were identified from contact tracing, seven staff and 10 patients fulfilled the criteria of 'close contact'. At the end of 28-day surveillance, 76 tests were performed on 52 contacts and all were negative, including all patient close contacts and six of the seven staff close contacts. The remaining contacts were asymptomatic throughout the surveillance period. <br/>CONCLUSION(S): Our findings suggest that SARS-CoV-2 is not spread by an airborne route, and nosocomial transmissions can be prevented through vigilant basic infection control measures, including wearing of surgical masks, hand and environmental hygiene.<br/>Copyright &#xa9; 2020. Published by Elsevier Ltd.

1. **SARS-CoV-2 shedding and infectivity.**  
   Atkinson B. Lancet (London, England) 2020;:No page numbers.

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1. **Temporal dynamics in viral shedding and transmissibility of COVID-19**  
   He X. et al Nature Medicine 2020;(15th April 2020):[Online]..

We report temporal patterns of viral shedding in 94 patients with laboratory-confirmed COVID-19 and modeled COVID-19 infectiousness profiles from a separate sample of 77 infector-infectee transmission pairs. We observed the highest viral load in throat swabs at the time of symptom onset, and inferred that infectiousness peaked on or before symptom onset. We estimated that 44% (95% confidence interval, 25-69%) of secondary cases were infected during the index cases' presymptomatic stage, in settings with substantial household clustering, active case finding and quarantine outside the home. Disease control measures should be adjusted to account for probable substantial presymptomatic transmission.

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1. **The duration of viral shedding of discharged patients with sever COVID-19.**  
   Zhou B. et al Clinical Infectious Diseases 2020;ciaa451(17th April 2020):Epub ahead of print.

The 2019 coronavirus disease (COVID-19) has drawn global intensive attention. Most of studies paid attention to epidemiological, clinical, and radiological features of inpatients with COVID-19. However, little studies have focused on clinical characteristics of discharged patients with severe COVID-19, especially the duration of viral shedding. The study reports that median duration of viral shedding was 31 days from illness onset, the shortest observed was 18 days and longest 48 days. The median total time from illness onset to discharge was 40 days. A further study suggests a positive tests results 5 to 13 days after discharge, suggesting the recovered patients might still be virus carriers.

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1. **The isolation period should be longer: Lesson from a child infected with SARS-CoV-2 in Chongqing, China.**  
   Lin J. et al Pediatric Pulmonology 2020;(3rd April.):[Online]..

In December 2019, COVID-19 caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbroke in Wuhan, the capital city of Hubei province, China. The disease rapidly spread to other areas in China due to a huge population movement during the New Year Festival. Here, a 7-year-old child with SARS-CoV-2 infection in Chongqing, outside of Wuhan, Hubei province, was reported. This case suggested that children infected with SARS-CoV-2 are more likely to present milder manifestations than adults. The continuous positive real-time reverse transcription-polymerase chain reaction assay for SARS-CoV-2 in the child's throat swab sample indicated the isolation period for suspected child cases should be longer than 14 days.

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1. **The Presence of SARS-CoV-2 RNA in Feces of COVID-19 Patients.**  
   Chen Yifei Journal of medical virology 2020;:No page numbers.

BACKGROUNDIn December 2019, Coronavirus Disease 2019 (COVID-19), caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), emerged in Wuhan, China, and has spread globally. However, the transmission route of SARS-CoV-2 has not been fully understood. In this study, we aimed to investigate the SARS-CoV-2 shedding in excreta of COVID-19 patients.METHODSElectronical medical records, including demographics, clinical characteristics, laboratory and radiological findings, of enrolled patients were extracted and analyzed. Pharyngeal swab, stool and urine specimens were collected and tested for SARS-CoV-2 RNA by RT-PCR. Viral shedding at multiple time points in specimens was recorded, and analyzed its correlation with clinical manifestations and the severity of illness.RESULTSA total of 42 laboratory-confirmed patients were enrolled, 8 (19.05%) of whom had gastrointestinal symptoms. 28 (66.67%) patients tested positive for SARS-CoV-2 RNA in stool specimens, which was not associated with the presence of gastrointestinal symptoms and the severity of illness. Among them, 18 (64.29%) patients remained positive for viral RNA in feces after pharyngeal swabs turned negative. The duration of viral shedding from feces after negative conversion in pharyngeal swabs was 7 (6-10) days, regardless of COVID-19 severity. The demographics, clinical characteristics, laboratory and radiologic findings did no differ between patients tested positive and negative for SARS-CoV-2 RNA in feces. Viral RNA was not detectable in urine specimens from 10 patients.CONCLUSIONSOur results demonstrated the presence of SARS-CoV-2 RNA in feces of COVID-19 patients, and suggested the possibility of SARS-CoV-2 transmission via the fecal-oral route. This article is protected by copyright. All rights reserved.

1. **The transmission and diagnosis of 2019 novel coronavirus infection disease (COVID-19): A Chinese perspective.**  
   Han Yu Journal of medical virology 2020;:No page numbers.

2019 novel coronavirus (SARS-CoV-2), which originated in Wuhan, China, has attracted the world's attention over the last month. The Chinese government has taken emergency measures to control the outbreak and has undertaken initial steps in the diagnosis and treatment of 2019 novel coronavirus infection disease (COVID-19). However, SARS-CoV-2 possesses powerful pathogenicity as well as transmissibility and still holds many mysteries that are yet to be solved, such as whether the virus can be transmitted by asymptomatic patients or by mothers to their infants. Our research presents selected available cases of COVID-19 in China to better understand the transmission and diagnosis regarding this infectious disease.

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1. **Translating transmissibility measures into recommendations for coronavirus prevention.**  
   Diaz-Quijano Fredi Alexander Revista de saude publica 2020;54:43.

The rapid increase in clinical cases of the new coronavirus disease, COVID-19, suggests high transmissibility. However, the estimates of the basic reproductive number reported in the literature vary widely. Considering this, we drew the function of contact-rate reduction required to control the transmission from both detectable and undetectable sources. Based on this, we offer a set of recommendations for symptomatic and asymptomatic populations during the current pandemic. Understanding the dynamics of transmission is essential to support government decisions and improve the community's adherence to preventive measures.

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1. **Virological assessment of hospitalized patients with COVID-2019.**  
   Wölfel Roman Nature 2020;:No page numbers.

Coronavirus disease 2019 (COVID-19) is an acute respiratory tract infection that emerged in late 20191,2. Initial outbreaks in China involved 13.8% cases with severe, and 6.1% with critical courses3. This severe presentation corresponds to the usage of a virus receptor that is expressed predominantly in the lung2,4. By causing an early onset of severe symptoms, this same receptor tropism is thought to have determined pathogenicity, but also aided the control, of severe acute respiratory syndrome (SARS) in 20035. However, there are reports of COVID-19 cases with mild upper respiratory tract symptoms, suggesting the potential for pre- or oligosymptomatic transmission6-8. There is an urgent need for information on body site-specific virus replication, immunity, and infectivity. Here we provide a detailed virological analysis of nine cases, providing proof of active virus replication in upper respiratory tract tissues. Pharyngeal virus shedding was very high during the first week of symptoms (peak at 7.11 × 108 RNA copies per throat swab, day 4). Infectious virus was readily isolated from throat- and lung-derived samples, but not from stool samples, in spite of high virus RNA concentration. Blood and urine never yielded virus. Active replication in the throat was confirmed by viral replicative RNA intermediates in throat samples. Sequence-distinct virus populations were consistently detected in throat and lung samples from the same patient, proving independent replication. Shedding of viral RNA from sputum outlasted the end of symptoms. Seroconversion occurred after 7 days in 50% of patients (14 days in all), but was not followed by a rapid decline in viral load. COVID-19 can present as a mild upper respiratory tract illness. Active virus replication in the upper respiratory tract puts the prospects of COVID-19 containment in perspective.

1. **Virus shedding patterns in nasopharyngeal and fecal specimans of COVID-19 patients.**  
   Zhang 2020;(30th March 2020):[Online]..

Diagnosis is the key point for confirmation and treatment of COVID-19. we focused on comparative analysis of virus dynamics between the upper respiratory and feces specimens in the COVID-19 patients. A total of 66 upper respiratory swabs, 51 feces, 56 urine and 56 plasma samples were sequentially collected from 23 patients in a designated hospital.

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| 4. | Medline | "DISEASE TRANSMISSION, INFECTIOUS"/ | 9006 |
| 5. | Medline | (spread).ti,ab | 156067 |
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| 7. | Medline | (3 OR 4 OR 5) | 494665 |
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| 9. | Medline | 8 [DT 2019-2020] [Languages English] [Humans] | 253 |
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| 11. | Medline | (viral shedding).ti,ab | 3463 |
| 12. | Medline | (10 OR 11) | 6787 |
| 13. | Medline | (6 AND 12) | 202 |
| 14. | Medline | 13 [DT 2019-2020] [Languages English] [Humans] | 15 |
| 15. | Medline | (infectivity).ti,ab | 25939 |
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| 17. | Medline | (SARS-CoV-2 infection).ti,ab | 429 |
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| 51. | EMCARE | (transmission).ti,ab | 64188 |
| 52. | EMCARE | (spread).ti,ab | 32963 |
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| 63. | PubMed | (SARS-CoV-2 infection).ti,ab | 233 |
| 64. | PubMed | (transmission).ti,ab | 513939 |
| 65. | PubMed | (spread).ti,ab | 159051 |
| 66. | PubMed | (transmissibility).ti,ab | 3424 |
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| 71. | PubMed | (64 OR 65 OR 66 OR 67 OR 68 OR 69) | 1267341 |
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