



Review paper

Investigating methods for Coronavirus Disease 2019 control: A systematic review

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ARTICLE INFO

Article history

Received 14 May 2020

Accepted 24 May 2020

Available online 6 August 2020

Keywords

China

Infection control

Coronavirus

Bibliometrics

COVID-19

Doi

<https://doi.org/10.29089/2020.20.00115>

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ABSTRACT

Introduction: The Coronavirus Disease 2019 (COVID 19) epidemic began in December 2019 in China and caused major concern. But no systematic review of COVID-19 infection control has been published.

Aim: The aim of this study is to determine the COVID-19 disease control methods.

Material and methods: We performed a systematic review of the literature using the keywords: 'coronavirus' and '2020,' 'COVID-19' in databases including ScienceDirect, PubMed, Springer and Scopus from January 1, 2020 to February 23, 2020. All observational studies, as well as case reports and editorials that were published in English were included. Data on the disease control methods of COVID-19 were extracted by two researchers.

Results and discussion: The preliminary search result was about 131 articles; 38 articles were retrieved for full-text screening, after screening articles by title and abstract. Finally, 17 papers having the study inclusion criteria were selected. Disease control is possible at three levels of prevention, diagnosis and treatment.

Conclusions: COVID-19 is a new clinical infectious disease that can be controlled by adopting measures to prevent, diagnose and treat the disease. Further studies are needed to elucidate factors that may be effective in controlling the spread of the disease during recovery.

1. INTRODUCTION

It was first announced on December 31, 2019 that an pneumonia of unknown etiology illness was caused by coronavirus.^{1,2} On January 12, 2020 it was introduced by the World Health Organization (WHO) as the coronavirus novel 2019 or '2019 nCoV'³⁻⁵ because Wuhan viral pneumonia cases were discovered at the end of 2019. COVID-19 was first identified in Wuhan, China, among a cluster of patients that presented with an unidentified form of viral pneumonia with shared history of visiting the Huanan Seafood Market.⁶ COVID-19 is a new type of virus that has not been identified before in humans.⁷ Coronaviruses are zoonotic and are a large family of viruses that cause illness ranging from the common cold to more severe diseases, such as Middle East respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS).⁸ 2019-nCoV is considered to be one of the close relatives of SARS-CoV, because it is very homologous to it. 2019-nCoV was classified by the International Commission on Virus Classification (ICTV) on February 11, 2020 as severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2).⁹ The rapid spread of the virus is fueling fears of a global pandemic¹⁰, and over 150 countries have confirmed cases to date, all continents reported confirmed cases of COVID-19. As of May 23, 2020, more than 5 386 218 confirmed cases have been reported worldwide, with a rapid rise in the number of deaths (343 368 deaths and 2 234 752 recovered).² The virus spread internationally within 1 month of the first identification, and can be transmitted via close human-to-

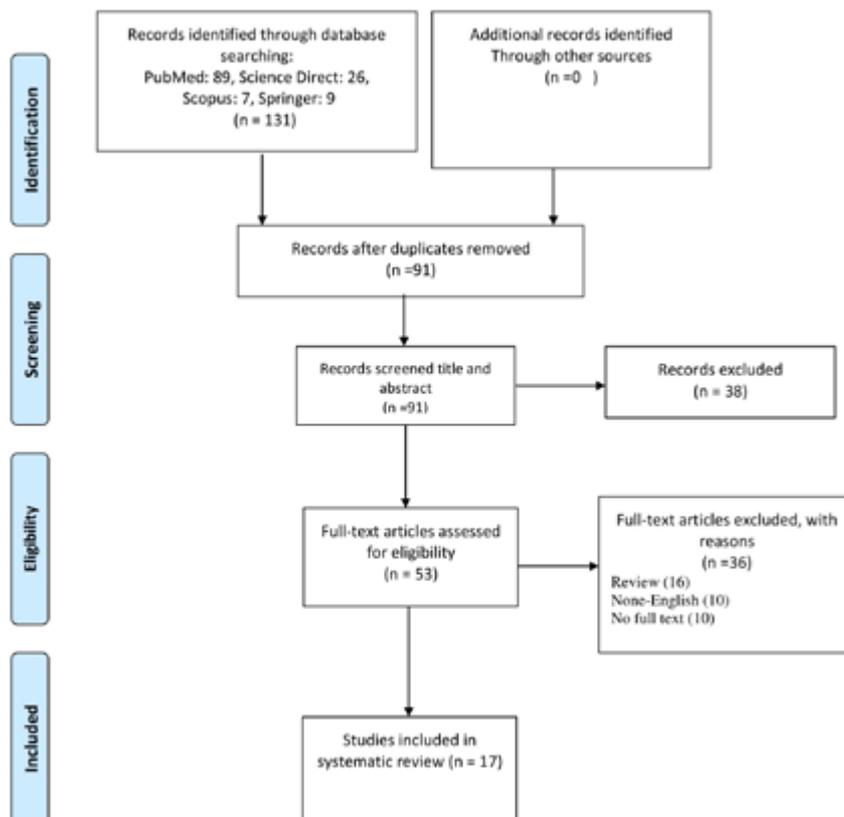
human contact,⁶ face-to-face contact by a sneeze or cough, or from contact with secretions of people who are infected.¹¹ Transmission of COVID-19 from an asymptomatic carrier with normal chest computed tomography (CT) findings has not been reported.¹² Transmission of the virus can occur during the incubation period in asymptomatic patients. In addition, high sputum viral loads were observed in a patient with Novel COVID-19-infected pneumonia during the recovery phase.¹³ Non-pharmaceutical interventions remain central for management of COVID-19 because there are no licensed vaccines or coronavirus antivirals.¹¹

Now, several measures have been taken to prevent and control possible imports from China. However, the ability to restrict and control local transmission after import depends on the application and implementation of precise control measures.^{14,15} Considering the emerging nature of COVID-2019, lack of prevention and treatment protocols, and rapid and extensive spread of disease in the whole world, there is still ambiguity regarding methods for COVID-2019 control. Despite extensive studies of clinical and paraclinical symptoms and treatment of COVID-2019, there has been no study on the disease control, therefore, we performed present study to systematically investigate methods for COVID-19 control.

2. AIM

The aim of this study was to determine the COVID-19 disease control methods.

Figure 1. PRISMA flow diagram.



3. MATERIAL AND METHODS

This systematic review study was conducted using the Cochrane book and reported using PRISMA checklist.

3.1. Data sources

This protocol follows the recommendations established by the PRISMA statement.¹⁶ Search was done in order to obtain data using the keywords: ‘coronavirus’ and ‘2020,’ ‘COVID-19’ in databases: ScienceDirect, PubMed, Springer and Scopus during the period January 1, 2020 to February 23, 2020. Control was not a keyword for search because most of the papers were not written specifically for control. Five different researchers independently evaluated search results.

3.2. Study selection

All the observational studies, case reports, and editorials that were published in English were included. The preliminary search result was about 131 articles with the term ‘COVID-19’ or ‘coronavirus’ in the title, abstract or text published in English. After reviewing the articles and deleting repetitive articles, to determine whether the article was relevant to the main purpose of the review or not, two authors reviewed the titles and abstracts separately. In the case of ambiguity, the authors referred to the full text for the final decision. Figure 1 displays the process of selecting articles.

3.3. Data Extraction

Information on the type of publication, the publishing institution, country, year and date of publication and strategies for infection control were extracted independently by

five investigators. A sixth researcher checked the article list and data extractions to ensure there were no duplicate articles. The excreted items were include: author, journal, date (MM/DD), country, and study type. To assess the quality of included studies we used STROBE checklist (Table 1).

4. RESULTS

According to the results of a systematic review of studies, disease control can be categorized into three levels: (1) prevention, (2) diagnosis, (3) treatment.

4.1. Control at prevention level

At the prevention level, disease control is carried out through early-stage screening¹⁷ using non-contact infrared thermometers¹⁸ and controlling travelers’ temperatures at land, air and sea borders.¹⁹ We can also prevent the disease spread in dental procedures by using personal protective equipment, hand washing and precautions on respiratory droplets.²⁰

The results of the previous studies show that the spread of the disease can be controlled by applying restrictions such as travel restrictions,^{21,22} cancellation of all flights to and from China,^{19,22} compulsory leave for travelers who have returned from China within the past 14 days, and the quarantine of all travelers to China.^{19,22} Other measures also include delays in customs clearance,²¹ cancellation of social meetings,²³ closing of schools, remote work, and home quarantine of suspected cases²⁴ and quarantining of people who appear to be in the incubation period for 14 days.^{19,23}

Table 1. Characteristics of the included studies on COVID-19, 2020.

ID	Author	Journal	Date (MM/DD)	Country	Study type
1	Zhang	Academic Radiology	02/13	China	Case report
2	Binnicker	Clinical Chemistry	02/20	—	Editorial
3	Tong	Emerging Infectious Disease	03/17	China	Case report
4	Junjie Aw	Journal of Hospital Infection	02/21	Singapore	Letter to the Editor
5	Sabino-Silva	Clinical Oral Investigations	02/20	Canada	Letter to the Editor
6	Habibi	The Lancet	02/13	Canada	Comment
7	Van Cuong	The Lancet Infectious Disease	02/18	Vietnam	Case report
8	Jeannette Guarner	American Journal of Clinical Pathology	02/13	USA	Letter to the Editor
9	Wong	JAMA	02/20	Singapore	Letter to the Editor
10	Haibo Qiu	Intensive Care Med	02/20	China	Letter to the Editor
11	Yang	Journal of Medical Virology	02/24	China	Cohort
12	Jalavaa	International Journal of Hygiene and Environmental Health	02/10	China	Case report
13	COVID-19 National Incident Room Surveillance Team	Communicable Diseases Intelligence	03/11	Australia	Case report
14	Chen	The Lancet	02/18	China	Comment
15	Yuncheng Zhu	Neuroscience Bulletin	02/25	China	Letter to the Editor
16	Lum	Singapore Medical Journal	02/13	Singapore	Editorial
17	Gostic	The Lancet	02/10	China	Case report

Education

The effect of public education to increase public awareness and to avoid any rumors plays an important role in disease control.¹⁷ Education on personal hygiene and proper handwashing, face-to-face contact, proper use of gloves and masks through social media can also be effective.^{19,24}

Environmental hygiene

One of the factors which plays an important role in controlling and preventing the spread of disease is environmental washing and disinfection of airports, train stations, and roads.²⁵

4.2. Disease control at the diagnosis level

Immediate and timely diagnosis of the disease can be very effective in controlling COVID-2019 from spreading. Monitoring the health status of symptomatic people by means of telephone and online counseling is effective in quickly diagnosing the disease and preventing it from spreading to other people.²³

Pre-epidemic planning and preparation, such as the construction of specialized infectious and laboratory centers¹⁷ will enable faster diagnosis. Moreover, collection and rapid reporting of epidemic information,²⁴ use of an effective and rapid diagnostic system to control the spread of the disease,^{17,24} rapid transfer of samples to the laboratory and rapid response to test results²⁶ and use of personal protective equipment by laboratory and sampling personnel²⁶ can be effective in controlling the spread of the disease.

4.3. Disease control at the treatment level

Quick and accurate planning to treat patients at treatment centers can be effective in controlling and preventing the spread of the disease. To this end, these patients are rapidly and individually triaged^{17,27,28} and immediately admitted after diagnosing the related symptoms,²² and all febrile patients are isolated in one room²⁷ away from other patients.^{3,24,27,29} It is also necessary to build temporary and separate hospitals^{25,24} and to increase isolated beds^{17,30} and to store personal protective equipment in hospitals.¹⁷ Other measures include recruitment of trained infection control supervisors, monitoring the implementation of health care, using personal protective equipment, monitoring the health status of the treatment team,³¹ and quarantining personnel who have had direct contact with patients.^{31,32}

5. DISCUSSION

In the last two months, more than 5 386 218 cases of COVID-2019 have been recorded in China and other countries across five continents. The novel COVID-2019 (nCoV-2019) is an emerging disease that primarily threatens the preparedness and biosecurity of countries around the world.¹⁶ Being prepared at various levels to confront a new disease requires efforts in the field of epidemiology, diagnosis, treatment and prevention during a pandemic,³³ and such preparedness will

be reduced as a new disease spreads to new territories and areas at risk of epidemics.

Identifying methods for controlling the spread of such viral diseases, which are highly contagious and spread rapidly is just as important as the identification of the nature of the disease, such as methods of transmission, disease symptoms, laboratory results, and radiological findings, and treatment modalities for coping and dealing with treatment of emerging diseases.

Reviewing previous studies shows that COVID-19 spread can be controlled at three levels of prevention, diagnosis and treatment. Accordingly, the results of the present study showed that we can apply restrictions such as closing of schools, cancellation of public meetings and restriction of travels and cancellation of all flights to infected areas (China), quarantining travelers and compulsory leave of all travelers who travelled to infected areas within past 14 days to control the spread of the disease. In this regard, Wells et al. study showed that delaying travels 3.5 weeks could reduce the incidence of the disease.³⁴ Results of a study on SARS referred to cancellation of international travels, cancellation of public meetings, and closing of schools and home quarantine as effective methods to control the spread of the disease.²⁴

The results of a systematic review of studies showed that training the treatment personnel in the use of personal protective equipment, informing, training, and persuading people to protect themselves and to wash their hands, as well as protecting the environmental hygiene by washing and disinfecting airports, train stations, and roads help to significantly reduce the spread of the disease by reducing infectious agents and reducing the likelihood of infection. Results of a study by Lipsitch et al. based on the experience of the MERS, influenza pandemic, and other epidemic diseases, showed that the immediate expansion of public health activities is significantly effective in controlling infection and spread of the disease.³⁵ Singapore's experience of SARS epidemic has also shown that training the treatment personnel in the use of personal protective equipment can help reduce the likelihood of infection and reduce the transmission and spread of infection.²⁴

Results of the present study revealed that the use of infection control supervisors to monitor the implementation of care and proper use of personal protective equipment by treatment personnel and the prompt and rapid follow-up of exposures and quarantine of nurses who have been in direct contact with COVID-19 patients as well as rapid triage and isolation of patients and home quarantine of suspected cases at the treatment level can prevent further spread of disease by quickly identifying and following-up exposure cases. Accordingly, considering SARS and MERS epidemic experience showing that most patients are infected in care settings,³⁶ results of a study of SARS outbreak showed that rapid exposure tracking, rapid isolation, and quarantine were effective in controlling SARS spread.³⁷

Considering the dramatic increase in the number of patients and people in need of hospitalization, the incidence of epidemic, high prevalence of disease, and low number

of hospital beds, treatment personnel, and equipment, it is recommended to quarantine suspected or infected patients who do not have any indication for hospitalization in accordance with national guidelines, or those who have passed the acute course of the disease and do not need hospital care, if they meet the requirements of home isolation based on medical prescription, training and advice on isolation. It is recommended that these patients be monitored by health care providers online or through telephone and if a patient does not have conditions for home quarantine, city-wide cottage hospitals where patients can be maintained until the end of the disease are recommended.

This review has several limitations. First, few studies are available for inclusion. It would be better to include as many studies as possible, not only those from China. Once these studies have been published, a more comprehensive understanding of COVID-19 will be possible. Second, a few studies are not available in English or full text.

6. CONCLUSIONS

COVID-19 is an emerging viral disease that is highly contagious and has spread rapidly across five continents. The spread of the disease can be controlled only through adoption of educational, hygienic, limitation measures at the prevention level, use of an effective and rapid diagnostic system at the diagnosis level, and rapid and separate patient identification and triage, isolation and monitoring of the proper use of personal protective equipment and follow-up of exposures among treatment personnel by infection control supervisors at the treatment level, which requires national and even global coordination and participation in the field of disease control.

Conflict of interest

None declared.

Funding

None declared.

References

- 1 Donovan D. *Map tracks coronavirus outbreak in near real time*. Published: 23.01.2020. <https://hub.jhu.edu/2020/01/23/coronavirus-outbreak-mapping-tool-649-em1-art1-dtd-health>. Accessed: 20.03.2020.
- 2 World Health Organization (WHO). *Coronavirus disease 2019 (COVID-19). Situation Report – 66*. Published: 2020. <https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200326-sitrep-66-covid-19.pdf>. Accessed: 26.03.2020.
- 3 Zhu Y, Chen L, Ji H, Xi M, Fang Y, Li Y. The Risk and Prevention of Novel Coronavirus Pneumonia Infections Among Inpatients in Psychiatric Hospitals. *Neurosci Bull.* 2020;36(3): 299–302. <https://doi.org/10.1007/s12264-020-00476-9>.
- 4 Chen Y, Liu Q, Guo D. Emerging coronaviruses: Genome structure, replication, and pathogenesis. *J Med Virol.* 2020;92(4):418–423. <https://doi.org/10.1002/jmv.25681>.
- 5 Cioni G. The role of angiotensin-converting-enzyme 2 in the age- and sex related poor prognosis of COVID-19. A comment on recent findings on novel coronavirus infection by SARS-CoV-2. *Pol Ann Med.* 2020;27(1):85–87. <https://doi.org/10.29089/2020.20.00100>.
- 6 Peeri NC, Shrestha N, Rahman MS, et al. The SARS, MERS and novel coronavirus (COVID-19) epidemics, the newest and biggest global health threats: what lessons have we learned? *Int J Epidemiol.* 2020. <https://doi.org/10.1093/ije/dyaa033>.
- 7 Hernández JC, Ramzy A. *China Confirms New Coronavirus Spreads from Humans to Humans*. Published: 20.01.2020. <https://www.nytimes.com/2020/01/20/world/asia/coronavirus-china-symptoms.html>. Accessed: 24.01.2020.
- 8 de Wit E, van Doremalen N, Falzarano D, Munster VJ. SARS and MERS: Recent insights into emerging coronaviruses. *Nat Rev Microbiol.* 2016;14(8):523–534. <https://doi.org/10.1038/nrmicro.2016.81>.
- 9 Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet.* 2020;395(10223):P497–506. [https://doi.org/10.1016/s0140-6736\(20\)30183-5](https://doi.org/10.1016/s0140-6736(20)30183-5).
- 10 Cohen E. *CDC to Screen at three US Airports for Signs of New Virus from China*. Published: 2020. <https://edition.cnn.com/2020/01/17/health/wuhan-virus-us-airport-screenings-china-bn/index.html>. Accessed: 30.01.2020.
- 11 Heymann DL, Shindo N. COVID-19: What is next for public health? *Lancet.* 2020;395(10224):P542–545. [https://doi.org/10.1016/s0140-6736\(20\)30374-3](https://doi.org/10.1016/s0140-6736(20)30374-3).
- 12 Bai Y, Yao L, Wei T, et al. Presumed asymptomatic carrier transmission of COVID-19. *JAMA.* 2020;323(14): 1406–1407. <https://doi.org/10.1001/jama.2020.2565>.
- 13 Rothe C, Schunk M, Sothmann P, et al. Transmission of 2019-nCoV infection from an asymptomatic contact in Germany. *N Engl J Med.* 2020;382:970–971. <https://doi.org/10.1056/nejmc2001468>.
- 14 Gilbert M, Pullano G, Pinotti F, et al. Preparedness and vulnerability of African countries against importations of COVID-19: a modelling study. *Lancet.* 2020;395(10227):871–877. [https://doi.org/10.1016/s0140-6736\(20\)30411-6](https://doi.org/10.1016/s0140-6736(20)30411-6).
- 15 WHO Regional Office for Africa. *WHO ramps up preparedness for novel coronavirus in the African region*. Published: 31.01.2020. <https://www.afro.who.int/news/who-ramps-preparedness-novel-coronavirus-african-region>. Accessed: 01.02.2020.
- 16 Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med.* 2009;6(7): e1000097. <https://doi.org/10.1371/journal.pmed.1000097>.
- 17 Guarner J. Three Emerging Coronaviruses in Two Decades: The Story of SARS, MERS, and Now COVID-19. *Am J Clin Pathol.* 2020;153(4):420–421. <https://doi.org/10.1093/ajcp/aqaa029>.
- 18 Tong Z, Tang A, Li K, et al. Potential Presymptomatic Transmission of SARS-CoV-2, Zhejiang Province, China, 2020. *Emerg Infect Dis.* 2020;26(5):1052–1054. <https://doi.org/10.3201/eid2605.200198>.
- 19 Qiao J. What are the risks of COVID-19 infection in pregnant women? *Lancet.* 2020;395(10226):P760–762. [https://doi.org/10.1016/s0140-6736\(20\)30365-2](https://doi.org/10.1016/s0140-6736(20)30365-2).

- ²⁰ Aw D. The non-contact handheld cutaneous infra-red thermometer for fever screening during the COVID-19 global emergency. *J Hosp Infect.* 2020;104(4):451. <https://doi.org/10.1016/j.jhin.2020.02.010>.
- ²¹ Sabino-Silva R, Gomez Jardim AC, Siqueira WL. Coronavirus COVID-19 impacts to dentistry and potential salivary diagnosis. *Clin Oral Investig.* 2020;24(4):1619–1621. <https://doi.org/10.1007/s00784-020-03248-x>.
- ²² Yang Y, Shang W, Rao X. Facing the COVID-19 outbreak: What should we know and what could we do? *J Med Virol.* 2020. <https://doi.org/10.1002/jmv.25720>.
- ²³ Lum LHW, Tambyah PA. Outbreak of COVID-19 – an urgent need for good science to silence our fears? *Singapore Med J.* 2020;61(2):55–57. <https://doi.org/10.11622/smedj.2020018>.
- ²⁴ Wong JE, Leo YS, Tan CC. COVID-19 in Singapore – Current experience: Critical global issues that require attention and action. *JAMA.* 2020;323(13):1243–1244. <https://doi.org/10.1001/jama.2020.2467>.
- ²⁵ Van Cuong L, Giang H, Linh L, et al. The first Vietnamese case of COVID-19 acquired from China. *Lancet Infect Dis.* 2020;20(4):P408–409. [https://doi.org/10.1016/s1473-3099\(20\)30111-0](https://doi.org/10.1016/s1473-3099(20)30111-0).
- ²⁶ Chen X, Tian J, Li G, Li G. Initiation of a new infection control system for the COVID-19 outbreak. *Lancet Infect Dis.* 2020;20(4):397–398. [https://doi.org/10.1016/s1473-3099\(20\)30110-9](https://doi.org/10.1016/s1473-3099(20)30110-9).
- ²⁷ Zhang H-W, Yu J, Xu H-J, et al. Corona Virus International Public Health Emergencies: Implications for Radiology Management. *Acad Radiol.* 2020;27(4):463–467. <https://doi.org/10.1016/j.acra.2020.02.003>.
- ²⁸ Qiu H, Tong Z, Ma P, et al. Intensive care during the coronavirus epidemic. *Intensive Care Med.* 2020;46:576–578. <https://doi.org/10.1007/s00134-020-05966-y>.
- ²⁹ Team C-NIRS. COVID-19, Australia: Epidemiology Report 6. Reporting week ending 1900 AEDT 7 March 2020. *Commun Dis Intell.* 2020;44:1–15. <https://doi.org/10.33321/cdi.2020.44.21>.
- ³⁰ Binnicker MJ. Emergence of a Novel Coronavirus Disease (COVID-19) and the Importance of Diagnostic Testing: Why Partnership between Clinical Laboratories, Public Health Agencies, and Industry Is Essential to Control the Outbreak. *Clin Chem.* 2020;66(5):664–666. <https://doi.org/10.1093/clinchem/hvaa071>.
- ³¹ Jalava K. First respiratory transmitted food borne outbreak? *Int J Hyg Environ Health.* 2020;226:113490. <https://doi.org/10.1016/j.ijheh.2020.113490>.
- ³² Habibi R, Burci GL, de Campos TC, et al. Do not violate the International Health Regulations during the COVID-19 outbreak. *Lancet.* 2020;395(10225):P664–666. [https://doi.org/10.1016/s0140-6736\(20\)30373-1](https://doi.org/10.1016/s0140-6736(20)30373-1).
- ³³ Paules CI, Marston HD, Fauci AS. Coronavirus Infections – More Than Just the Common Cold. *JAMA* 2020;323(8):707–708. <https://doi.org/10.1001/jama.2020.0757>.
- ³⁴ Wells CR, Sah P, Moghadas SM, et al. Impact of international travel and border control measures on the global spread of the novel 2019 coronavirus outbreak. *Proc Natl Acad Sci U S A.* 2020;117(13):7504–7509. <https://doi.org/10.1073/pnas.2002616117>.
- ³⁵ Lipsitch M, Swerdlow DL, Finelli L. Defining the epidemiology of Covid-19 – studies needed. *N Engl J Med.* 2020;382:1194–1196. <https://doi.org/10.1056/nejmp2002125>.
- ³⁶ Habibzadeh P, Stoneman EK. The Novel Coronavirus: A Bird's Eye View. *Int J Occup Environ Med Health.* 2020;11(2):65–71. <https://doi.org/10.15171/ijoem.2020.1921>.
- ³⁷ Lum LHW, Tambyah PA. Outbreak of COVID-19 – an urgent need for good science to silence our fears? *Singapore Med J.* 2020;61(2):55–57. <https://doi.org/10.11622/smedj.2020018>.