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Epidemiologic Parameters for COVID-19: A Systematic Review and Meta-Analysis

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Abstract

Background: The World Health Organization (WHO) declared the coronavirus disease 2019 (COVID-19) outbreak to be a public health emergency and international concern and recognized it as a pandemic. This study aimed to estimate the epidemiologic parameters of the COVID-19 pandemic for clinical and epidemiological help.

Methods: In this systematic review and meta-analysis study, 4 electronic databases, including Web of Science, PubMed, Scopus, and Google Scholar were searched for the literature published from early December 2019 up to 23 March 2020. After screening, we selected 76 articles based on epidemiological parameters, including basic reproduction number, serial interval, incubation period, doubling time, growth rate, case-fatality rate, and the onset of symptom to hospitalization as eligibility criteria. For the estimation of overall pooled epidemiologic parameters, fixed and random effect models with 95% CI were used based on the value of between-study heterogeneity (I2).

Results: A total of 76 observational studies were included in the analysis. The pooled estimate for R0 was 2.99 (95% CI, 2.71-3.27) for COVID-19. The overall R0 was 3.23, 1.19, 3.6, and 2.35 for China, Singapore, Iran, and Japan, respectively. The overall serial interval, doubling time, and incubation period were 4.45 (95% CI, 4.03-4.87), 4.14 (95% CI, 2.67-5.62), and 4.24 (95% CI, 3.03-5.44) days for COVID-19. In addition, the overall estimation for the growth rate and the case fatality rate for COVID-19 was 0.38% and 3.29%, respectively.

Conclusion: The epidemiological characteristics of COVID-19 as an emerging disease may be revealed by computing the pooled estimate of the epidemiological parameters, opening the door for health policymakers to consider additional control measures.

Keywords: epidemiologic parameters, R0; serial interval, doubling time, case fatality rate

Conflicts of Interest: *None declared*
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Introduction

Coronaviruses are a group of RNA viruses that cause diseases among humans and animals (1). The latest of coronavirus types as a novel coronavirus that was named severe acute respiratory syndrome coronavirus 2 (SARS-

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↑What is "already known" in this topic:
COVID-19 is a highly contagious disease that has spread significantly worldwide. Numerous strategies and parameter values have been documented in the reports from various countries on the epidemiological characteristics of the COVID-19 pandemic.

→What this article adds:
The results of this study showed that the pooled estimate for R0 was 2.99 for COVID-19. The overall R0 was 3.23, 1.19, 3.6, and 2.35 for China, Singapore, Iran, and Japan, respectively. The overall serial interval, doubling time, incubation period, growth rate, and case fatality rate (CFR) were 2.99, 4.45, 4.14, 4.24 days, 0.38%, and 3.29%, for COVID-19, respectively.

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Cov2) or COVID-19 occurred in Wuhan, China, in December 2019 with a human outbreak (2).

The World Health Organization (WHO) declared the outbreak to be a public health emergency and international concern and recognized it as a pandemic on March 11, 2020 (3). COVID-19 has spread widely in the world and is prevalent in different countries such as China, Italy, United States, France, Spain, Iran, and Germany, with 2,833,697 cases and 197,354 deaths and 807,469 recovered until April 24 2020 worldwide (4). The main rout of transmission of COVID-19 is based on human-to-human transmission via either respiratory droplets, saliva, or close contacts with infected people or aerosol generation procedures during the clinical care of COVID-19 patients (5).

Most COVID-19 infected people (80.9%) are with mild to moderate respiratory syndromes, old people or patients with underlying diseases such as diabetes, cardiovascular disease, cancer, immune deficiency, and respiratory diseases are more at risk to develop the severe (13.8%) and critical (4.7%) form of the disease (6, 7).

Knowledge regarding epidemiological characteristics and parameters of the infectious diseases such as incubation period (time from exposure to the agent until the first symptoms develop), serial interval (duration between symptom onset of a primary case and symptom onset of its secondary cases), basic reproduction number (R_0) (the transmission potential of a disease), and other epidemiologic parameters is important for modelling and estimating epidemic trends and also implementing and evaluating preventive procedures (8-11).

With regard to COVID-19 pandemic parameters, there are many reports from different countries in the world. For example, about 25.6% to 51.7% of patients have been reported to be asymptomatic or with mild symptoms (12) and 25% to 30% of them have been admitted to the intensive care unit for medical care (13). The case-fatality rate was reported in China and other countries among old patients to be 6% (range: 4%-11%) and 2.3% in all ages (13, 14). Furthermore, the median incubation period was reported as 5 to 6 days (2-14 ranges) from the WHO, while in China the incubation period was reported up to 24 days (15, 16). Also, according to different mathematical models, R_0 was reported about 6.47 (range, 1.66-10) in China, 2.6 in South Korea, and 4.7 in Iran (17-19).

Thus, according to the reports from different countries about epidemiological characteristics of the COVID-19 pandemic, different methods and values of parameters have been observed. Thus, to estimate and forecast the spread of the disease efficiently, we need acceptable and real values for each parameter. The present study was conducted to provide a systematic assessment and estimation of parameters related to COVID-19. This evaluation will help researchers with better prediction and estimation of current epidemic trends.

Methods

This is a systematic review and meta-analysis to determine the epidemiologic parameters for COVID-19.

Search Strategy

To find relevant studies, a comprehensive literature search of the Web of Science, Medline (PubMed), Scopus, and Google Scholar was performed for observational studies published electronically from early December 2019 up to 23 March 2020.

Two researchers independently searched studies. In the search strategy, English keywords (MeSH termas) and probable combination of them were used. Epidemiologic parameters in infectious diseases are combination of some specific keywords and definitions such as basic reproduction number (R_0), serial interval, incubation period, doubling time, growth rate, case-fatality rate, mortality rate, and onset of symptom to hospitalization. These keywords with the Boolean operators (‘OR ‘and ‘AND’) were combined in search process.

The terms of search strategies were according to the following keywords: ("novel coronavirus" OR ″2019-nCov″ OR ″COVID-19″ OR ″SARS-CoV-2″) AND ("basic reproduction number" OR "basic reproductive rate" OR "case fatality rate" OR "case fatality ratio" OR "mortality rate" OR "doubling time" OR "growth rate" OR "incubation period" OR "onset of symptom to hospitalization"). Moreover, for comprehensive assessment of available evidences, grey literatures such as web-based nonpeer review studies were searched in this topic as well.

Study Selection

We included studies in accordance with the PRISMA guidelines and standard meta-analysis methods. All of the extracted articles were screened independently by 2 researchers. The abstracts and full texts of the articles were reviewed, duplicate studies were excluded, and relevant articles were selected for data extraction.

Inclusion and Exclusion Criteria

The COVID-19 epidemiologic parameters of interest were provided by all epidemiological study designs (observational studies), including peer-reviewed and nonpeer-reviewed articles. In addition, irrelevant studies, letters, news, and studies that did not report epidemiologic parameters were excluded.

Screening and Data Extraction

All articles were reviewed independently by 4 researchers and information was extracted using a designed checklist (Appendix 1). Extracted items were the first author, year and month of publication, duration of the study, location of the study, type of parameters, point estimate, or mean/median and its confidence interval for epidemiological parameters, and the review status of articles (peer-reviewed or not).

Quality Assessment of Studies

To assess the quality of the included peer-reviewed and nonpeer-reviewed articles, 2 authors separately assessed the quality of the studies using the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist as a scale for assessing the quality of observational studies. The STROBE includes 22 questions

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about methodology, aim of study, study design, and frame of original article. Finally, we scored the quality of the study as high if its rating was at least 70% (score of 16 out of 22), medium if its rating was at least 55% (12 out of 22), and poor if its rating was less than 55% (lower 12 out of 22). After that, studies with high and medium quality were included in the analysis. Given that there is a possibility of error in nonpeer review studies, we have analyzed this group of studies separately, regardless of the quality score of these studies.

Statistical Analysis

The "Metan" command was used to apply a fixed or random effects model based on Cochran's Q-test results or a large Higgins and Thompson's I^2 value. Forest plots were used for graphical description of the results. Cumulative meta-analysis was used to examine the R0 trend during different months. However, due to the small number of months in this study, this part was removed from the analysis and results.

In studies that mortality rate was reported, because the denominator was confirmed cases, it was considered a CFR. In addition, for studies that reported the median and interquartile range (IQR), the median was considered equivalent to the mean and the IQR was converted to standard deviation using the "IQR/1.35" formula. Finally, publication bias was examined using the Begg and Egger test. Stata 14 was used for all statistical analyses. Satistical significance was set at $P < 0.05$.

Results

Having assessed the quality of relevant studies, 76 observational studies up to March 23, 2020, were included in this study (Fig. 1). The majority of studies were done in Wuhan, China. Detailed information of the eligible studies and their characteristics are presented in Appendix 1 (12, 17, 18, 20-92).

- The Overall Basic Reproductive Number (R_0) by Country and Peer Review Status

Total: The overall R_0 was 2.99 (95% CI, 2.71-3.27) for COVID-19 (Table 1).

Country: The overall R_0 was 3.23, 1.19, 3.6, and 2.35 for China, Singapore, Iran, and Japan, respectively (Table 1).

Peer Review Status: The overall R_0 was 2.75 and 3.08 for peer-reviewed and nonpeer-reviewed articles, respectively (Table 1).

- Overall Serial Interval (SI) by Country and Peer Review Status

Total: The overall SI was 4.45 days (95% CI, 4.03-4.87) for COVID-19.

Country: Using the random effect model, the overall SI was 4.46 and 4.64 days for China and Singapore, respectively (Fig. 2).

Peer Review Status: The overall SI was 5.3 and 4.39 days for peer-reviewed and nonpeer-reviewed articles, respectively (Fig. 3).

- Overall Doubling Time by Peer-review Status

Total: The overall doubling time was 4.14 days (95% CI, 2.67-5.62) for COVID-19.

Peer-review Status: The overall doubling time was 3.33 and 4.64 days for peer-reviewed and non-peer reviewed articles, respectively (Fig. 4).

- Overall Incubation Period by Peer-review Status

Total: The overall incubation period was 4.24 days (95% CI, 3.03-5.44) for COVID-19.

Peer-review Status: The overall incubation period was 4.03 and 5.82 days for peer-reviewed and nonpeer-reviewed articles, respectively (Table 1).

- Overall Estimation for Other Epidemiologic Parameters

The overall estimation for the growth rate and the case fatality rate for COVID-19 was 0.38% and 3.29%, respec-

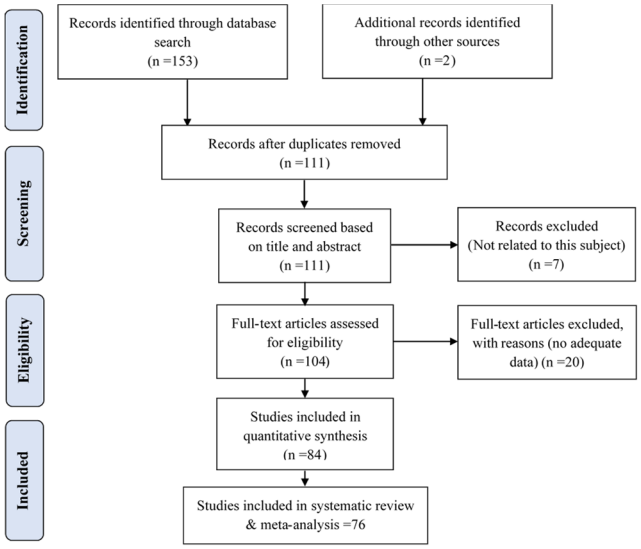

Fig. 1. Flow diagram of the study selection process including publications for the epidemiologic parameters for COVID-19

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Table 1. Overall Estimation of Epidemiologic Parameters for COVID-19

Parameters		No. of studies	Estimate	95% CI	P for Heterogeneity	I^2 (%)
Basic Reproductive Number (R_0)	Overall	69	2.99	2.71-3.27	<0.001	99.3
	Korea	1	2.6	2.5-2.7	-	-
	China	57	3.23	2.92-3.55	<0.001	99.1
	Singapore	6	1.19	1.07-1.3	<0.001	82.2
	Iran	2	3.6 [a]	3.1-4.09	0.99	-
	Japan	3	2.35	2.1-2.6	0.007	80.1
	Peer Review	13	2.75	2.25-3.24	<0.001	99.4
	Not Peer Review	56	3.08	2.73-3.43	<0.001	99.3
Growth Rate (%)	Overall	5	0.38	0.2-0.55	<0.001	97.7
Symptom onset to Hospitalization (day)	Overall	6	5.09	2.15-8.02	0.03	53
Incubation Period (day)	Overall	22	4.24	3.03-5.44	0.02	35
	Peer Review	18	4.03	2.72-5.33	0.01	41
	Non Peer Review	4	5.82 [a]	2.91-8.74	0.76	16

[a] Fixed effect model

tively (Table 1 & Fig. 5). In addition, the overall time from symptom onset to hospitalization was 5.09 days for COVID-19 (Table 1).

- Trend of R0 for COVID-19

Based on the cumulative meta-analysis, the trend of R_0 had been increasing at first and, then, decreasing in March.

- Assessment of Publication Bias

The Begg and/or Egger tests indicated no publication bias in the parameters of R_0, serial interval, doubling time, and incubation period ($P > 0.05$).

Discussion

In this secondary analysis, we aimed to calculate the pooled estimate of some epidemiological parameters of COVID-19; namely, basic reproductive number (R_0), serial interval, doubling time, incubation period, growth rate, CFR, and time from symptom onset to hospitalization. Overall, the estimates were 2.99, 4.45 days, 4.14 days, 4.24 days, 0.38%, 3.29%, and 5.09 days in the same order. The pooled estimated values may differ from the pooled reported values from other studies. This variation is ex-

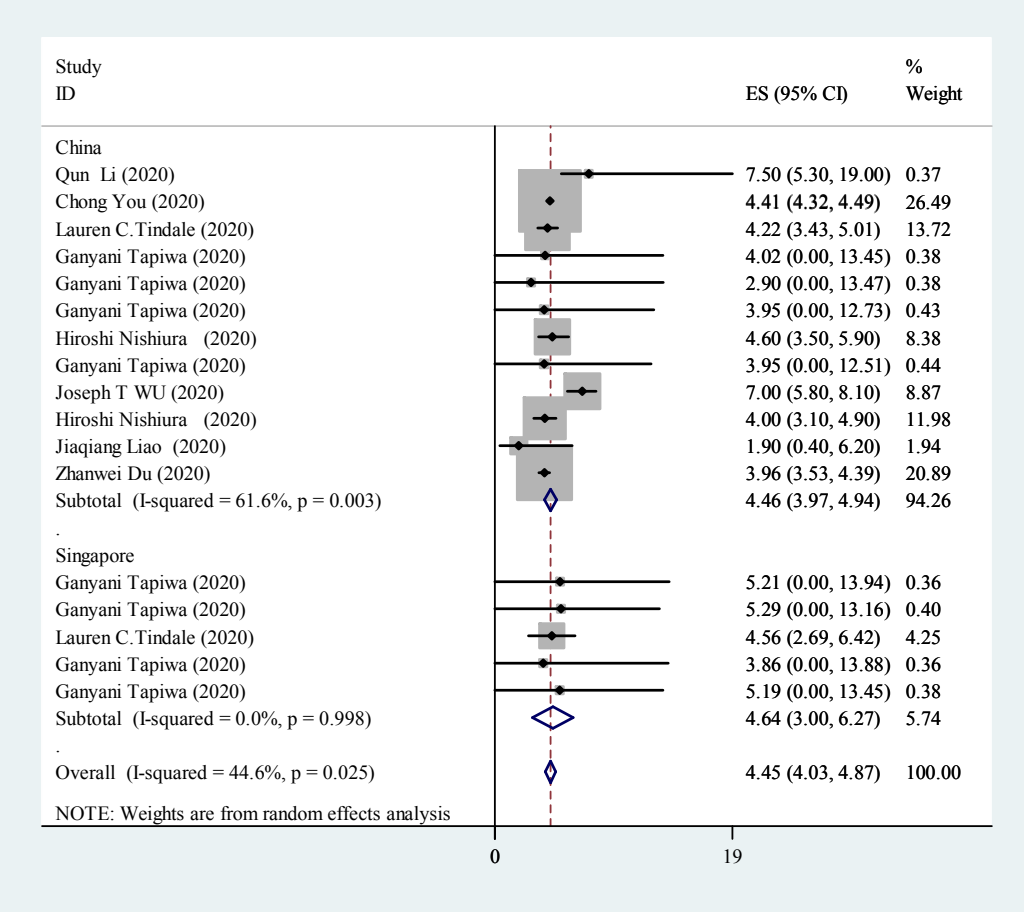

Fig. 2. Overall serial interval (SI) for COVID-19 by country

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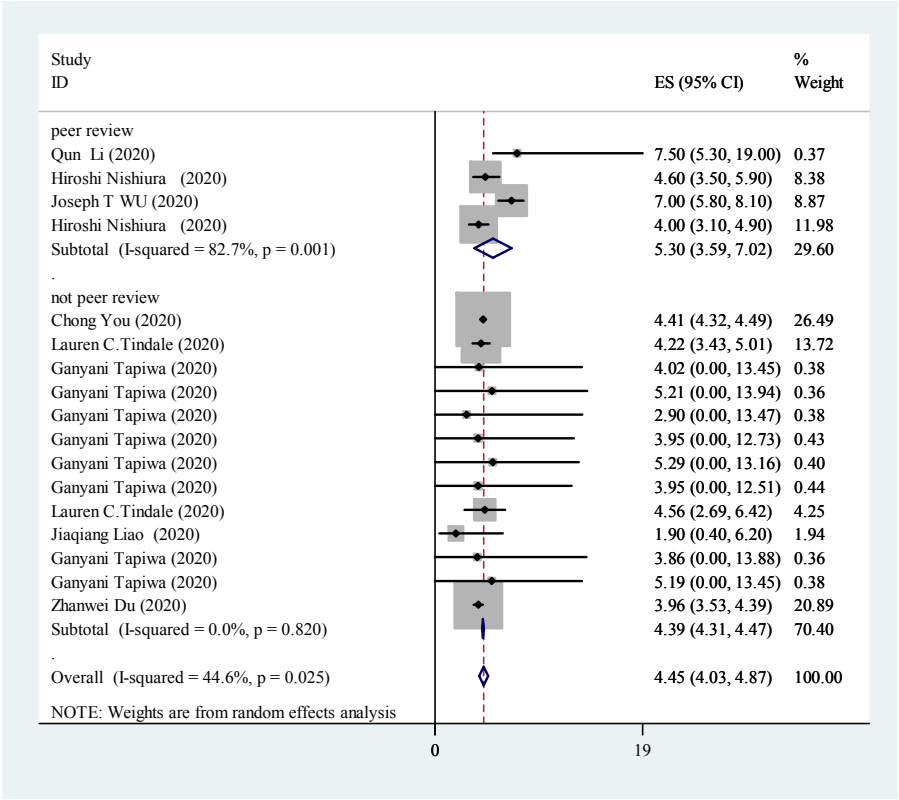

Fig. 3. Overall serial interval (SI) for COVID-19 by peer review status

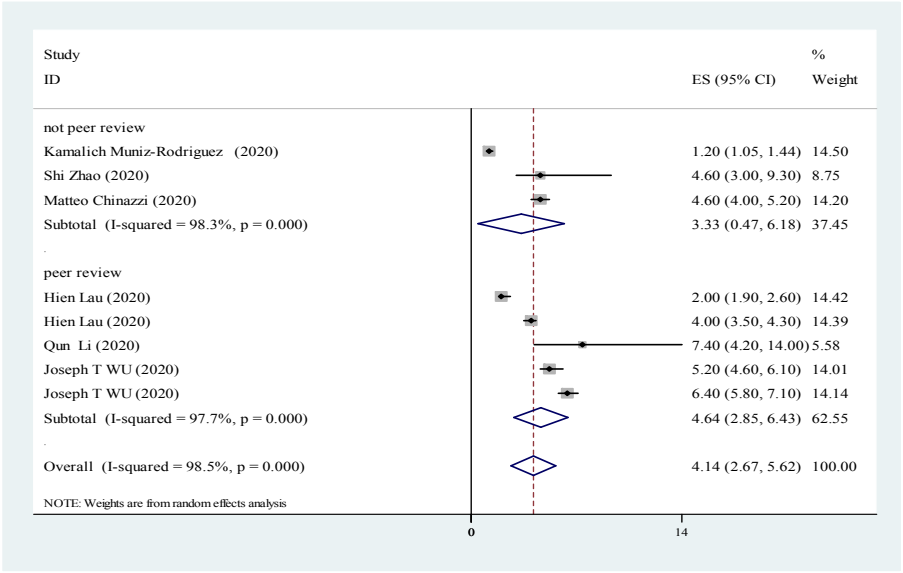

Fig. 4. Overall doubling time for COVID-19 by peer review status

pected because factors such as place of sampling, the sample size, surveillance system, and quality of reported data from countries in emergency condition, and type of data analysis may affect these values. For example, R_0 variations to some extent might be due to different methods calculations, including exponential growth method, maximum likelihood, and Bayesian time-dependent method (93-95). The pooled estimated R_0 in this study was nearly accordant with the pooled estimation found by Alimohamadi et al in 2020. (R_0 = 3.32 (95% CI, 2.81 to 3.82) (96).

According to our results, the pooled estimate of CFR 3.29% (95% CI, 2.78-3.81) is lower than SARS-CoV (97) and MERS-CoV (98). Health control policies, medical standard, and detection rate could affect CFR (35). Moreover, the CFR estimate in the early phase of the epidemic might be biased (overestimated). Usually in the early phase, some subclinical cases and patients with mild symptoms may not be detected (detection bias) (99, 100).

The pooled estimate of incubation period in 22 studies was 4.24 days (95% CI, 3.03, 5.44), while in a study of Jie Li et al the pooled mean incubation period in 7 studies

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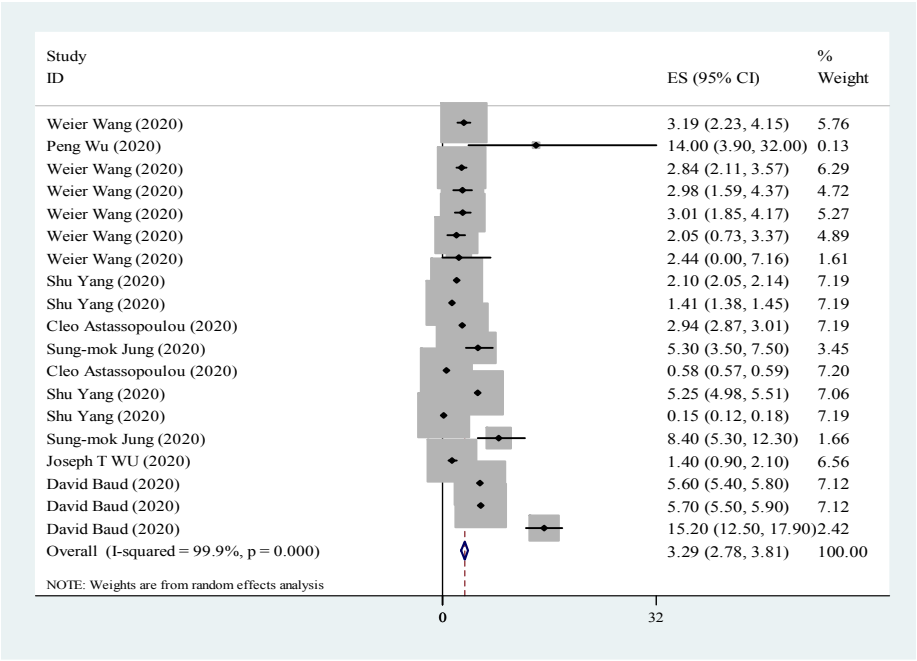

Fig. 5. Overall case fatality rate (CRF) for COVID-19

was 5.3 days (95% CI, 4.5-6.0) (101). A valid and precise estimate of incubation period has a pivotal role for duration of quarantine (50). Indeed, understanding the incubation period is beneficial for surveillance and control methods, as well as modeling and monitoring operations (102).

Our estimate for overall doubling time—time for a given quantity to double in size or number at a constant growth rate—was 4.14 days (95% CI, 2.67, 5.62). This estimation was in accordance with the study of Zhang et al in 2020 (103). The doubling time has an important implication for predicting epidemic. Generally, social distancing, quarantine, and active surveillance are needed to reduce transmission and extend the doubling time (104). Moreover, the authors tried to estimate pooled measures for the growth rate and the serial interval. These 2 epidemiological parameters are used to estimate the reproduction number (105). In this study, the serial interval was calculated as 4.45 (95% CI, 4.03-4.87). In addition, the pooled serial interval of COVID-19 obtained in this study was shorter than the pooled serial interval in study of Rai et al (5.19 (95% CI, 4.37, 6.02) (106).

As a limitation, all 76 studies (except for 1, Mirjam E Kretzschmar et al) (107) have been conducted in Asia, particularly in Wuhan, China. Some epidemiological parameters in Europe, Africa, and the United States could be different based on control strategies. Hence, distribution of these epidemiological parameters could be more global. Future studies to calculate more generalized pooled estimates, using studies all over the world is recommended.

Conclusion

The epidemiological characteristics of COVID-19 as an emerging disease may be revealed by calculating the pooled estimate of the disease's epidemiological parameters, paving the way for health policymakers to consider additional control measures.

Acknowledgment

The authors would like to appreciate all those researchers who helped in conducting this study.

Ethical Approval

The ethical approval is granted by the ethics committee of the school of Public Health and Neuroscience Research Center (PHNS), Shahid-Beheshti University of Medical Sciences (SBMU), Tehran, Iran (IR.SBMU.PHNS.REC.1399.009).

Authors' Contributions

N.I. was involved in design, data analysis, and participated as a reviewer on the topic. Also, she designed tools for the data extraction. N.T. performed an independent systematic literature search, wrote the first manuscript version, and participated as a reviewer on the topic. Y.M. wrote the first manuscript version and participated as a reviewer on the topic. S.S.GH. performed an independent systematic literature search and participated as a reviewer on the topic. KH.R. participated in project administration. S.S.H.N. as a supervisor, directed every step of the review, revised the results, and versions of the manuscript. All authors read and approved the final version of manuscript.

Conflict of Interests

The authors declare that they have no competing interests.

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Appendix 1. Description of eligible studies reporting the epidemiologic parameters for COVID-19

ID	Author	YOP	Mon	Start Date	End Date	Country/ City	N	Explanation	Parameter	Point Est	LCI	UCI	Unit	Mean	SD	Median	IQR	Q1-Q3
1	Kaiyuan Sun(20)	2020	Feb	13-Jan	31-Jan	China	507		Onset of symptom to hospitalization				day			2		0-5
									Incubation period				day			4.5		3-5.5
									R_0	2.5-2.8								
2	Biao Tang(17)	2020	Feb	31-Dec	15-Jan	China-Wuhan	11081		Incubation period				day	7	1.7			
									R_0	6.47	5.71	7.23						
									Generation time				day	6				
3	Biao Tang(18)	2020	Mar	10-Jan	23-Jan	Mainland-China			Serial interval				day	5	3			
								reported	Cumulative confirmed cases	80651			count					
								predicted	Cumulative confirmed cases	600000			count					
								Initial R_0 (main-land-china)	R_0	3.8	3.5	4.2						
								Initial R_0 (Guangdong)	R_0	3	2.6	3.3						
								Initial R_0 (south Korea)	R_0	2.6	2.5	2.7						
4	Sany Tang(21)	2020	Feb	10-Jan	15-Feb	Shaanxi-China			Illness onset to medical visit				day			3.43		
									Importation to illness onset of disease				day			2.38		
									Medical visit to confirma-tion				day			3.05		
								longest	Incubation period	19			day					
									Serial interval				day	7.4	3.4			
									R_0					1.48	0.98			
5	Amna Tariq(22)	2020	Mar	23-Jan	05-Mar	Singapore			Generation time				day	4.41	3.17			
								per day	Number of new cases	2.5			count					
									Reporting delay	7.6	6.6	8.5	day					
									Cumulative case	294.4	101.1	1239.7	count					
									Effective R	0.9	0.7	1						
									R_0	0.7	0.5	1						
									Dispersion parameter	0.4	0.1	inf	count					
6	Sijia Tian(23)	2020	Feb	20-Jan	10-Feb	Beijing-China	262		Incubation period				day			6.7		
									Contact to illness onset				day	6.7	5.2			
									Illness onset to medical visit				day	4.5	3.7			
									Days from visit hospital to define				day	2.1	1.9			
									Percentage of hospitaliza-tion	81.7			%					
									Percentage of discharge	17.2			%					
										0.9			%					

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Appendix 1. Continued

ID	Author	YOP	Mon	Start Date	End Date	Country/ City	N	Explanation	Parameter	Point Est	LCI	UCI	Unit	Mean	SD	Median	IQR	Q1-Q3
7	Lauren C.Tindale(24)	2020	Mar	19-Jan	26-Feb	Singapore	93		Incubation period	7.1	6.1	8.3	day					
									Serial interval	4.56	2.69	6.42	day					
									R_0	1.97	1.45	2.48						
									percentage of discharge	66.7			%					
									Exposure to onset of symptoms				day	6.6	4.8			
									Hospitalization after symptom onset				day	5.9	5.1			
									Length of hospitalization				day	13.3	6			
									Pre-symptomatic trans-mission				day	2.55				
									Growth rate	0.15			count					
									Doubling time	6.6			day					
				21-Jan	26-Feb	Tianjin-China	135		Incubation period	9	7.92	10.2	day					
									Serial interval	4.22	3.43	5.01	day					
									R_0	1.87	1.65	2.09						
									Exposure to onset of symptoms				day	5.4	4.5			
									Percentage of discharge	48.1			%					
									Confirmed after symptom onset				day	5.2	4.2			
									Pre-symptomatic trans-mission				day	2.89				
									Percentage of deaths	2.2			%					
8	Ashleigh R. Tuite(25)	2020	Feb	18-Nov	24-Feb	China/ Wuhan			R_0	2.3								
									Serial interval	7			day					
9	Dawei Wang(26)	2020	Feb	01-Jan	28-Jan	China/ Wuhan	138		Onset of symptoms to hospitalization				day			7		4-8
									Onset of dyspnea				day			5		1-10
									Onset of ARDS				day			8		6-12
									Onset of symptom to ICU admission				day			10		6-12
									Percentage of hospitaliza-tion	12.3			%					
									Admitted to the ICU	26			%					
									Hospital admission to ICU admission				day			1		0-3
10	Wang Meng(27)	2020	Mar	19-Mar	21-Mar	China (ex-cluding Hubei)			R_0					2.82	0.11			
								predicted	Cumulative case				count	14408	429			

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Appendix 1. Continued

ID	Author	YOP	Mon	Start Date	End Date	Country/ City	N	Explanation	Parameter	Point Est	LCI	UCI	Unit	Mean	SD	Median	IQR	Q1-Q3
11	Wang Wenbao(28)	2020	Mar	14-Jan	23-Jan	China (8 provinces)		per 10000	Incidence rate	34	25.3	42.9	count					
									Cumulative case	5586	4156	7048	count					
									R_0	3.38	3.25	3.48						
									Incubation period				day					
									Case fatality rate[$]	3.06			%					
12	Wang Ying(29)	2020	Mar	15-Dec	29-Feb	China/ Wuhan			R_0	3.49	3.42	3.58						
									R_0	2.95	2.86	3.03						
13	Joseph T Wu(30)	2020	Mar	15-Dec	29-Feb	Mainland-China			Case fatality rate	1.4	0.9[*]	2.1[*]	%					
									Fatality rate	11			%					
									Cumulative cases	79394			count					
									R_0	1.94	1.83[*]	2.06[*]						
									Serial interval	7	5.8[*]	8.1[*]	day					
									Illness onset to death				day	20	10			
									Doubling time	5.2	4.6[*]	6.1[*]	day					
14	Joseph T Wu(31)	2020	Jan	31-Dec	28-Jan	China/ Wuhan			Doubling time	6.4	5.8[*]	7.1[*]	day					
									Cumulative cases	75815	37304[*]	130330[*]	count					
									R_0	2.68	2.47[*]	2.86[*]						
15	Peng Wu(32)	2020	Jan	10-Jan	21-Jan	China/ Wuhan	136		Fatality rate	14	3.9	32	%					
							700		R_0	0.3	0.17	0.44						
16	Tianmin Xu(33)	2020	Mar	23-Jan	18-Feb	Changzou-China	15		Incubation period				day			8		4-10
							17		Incubation period				day			8		4-11
							19		Incubation period				day			12		9-14
17	Xiao-Wei Xu(34)	2020	Feb	10-Jan	26-Jan	Zhejiang-China	62		Incubation period				day			4		3-5
									Onset of symptoms to hospitalization				day			2		1-4
									Percentage of discharge	2			%					
									Admitted to ICU	2			%					
									Death	0			%					
									Onset of ARDS	2			%					
18	Shu Yang(35)	2020	Feb	10-Jan	03-Feb	whole main-land China	32020		Case fatality rate	2.1	2.05	2.14	%					
						mainland China ex-cluding Hubei			Case fatality rate	0.15	0.12	0.18	%					
						Hubei ex-cluding Wuhan			Case fatality rate	1.41	1.38	1.45	%					
						Wuhan			Case fatality rate	5.25	4.98	5.51	%					

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ID	Author	YOP	Mon	Start Date	End Date	Country/ City	N	Explanation	Parameter	Point Est	LCI	UCI	Unit	Mean	SD	Median	IQR	Q1-Q3
19	Chong You(36)	2020	Feb	19-Jan	05-Feb	China	5405		Serial interval				day	4.41	3.17	4		2-6
									Infectious period				day	10.91	3.95	11		8-13
				21-Jan	28-Jan	China		SIR method	R_0	5.4	4.5	6.2						
				29-Jan	05-Feb				R_0	2.3	2.1	2.5						
				21-Jan	28-Jan	Hubei			R_0	5.5	4.2	6.8						
				29-Jan	05-Feb				R_0	2.8	2.5	3.1						
				21-Jan	28-Jan	Other			R_0	5.1	3.9	6.3						
				29-Jan	05-Feb				R_0	1.2	1.1	1.4						
				21-Jan	28-Jan	Beijing			R_0	2.3	1.1	3.8						
				29-Jan	05-Feb				R_0	2.1	1	3.3						
				21-Jan	28-Jan	Shanghai			R_0	2.4	1	3.8						
				29-Jan	05-Feb				R_0	1.2	0.7	2						
				21-Jan	28-Jan	Guangdong			R_0	3.7	2.7	4.9						
				29-Jan	05-Feb				R_0	1.2	0.8	1.8						
				21-Jan	28-Jan	Zhejiang			R_0	5	3.3	7						
				29-Jan	05-Feb				R_0	1	0.4	1.7						
				21-Jan	28-Jan	Hun			R_0	5.3	4.3	7						
				29-Jan	05-Feb				R_0	1.3	1	1.8						
				21-Jan	28-Jan	Hen			R_0	6.4	3.5	10.2						
				29-Jan	05-Feb				R_0	1.5	1.1	2						
20	Jasper Fuk-Woo Chan(37)	2020	Jan	10-Jan	15-Jan	China/ Wuhan	6		Onset of symptom to sample collection	7			day					
									Onset of symptom to sample collection	6			day					
									Onset of symptom to sample collection	9			day					
									Onset of symptom to sample collection	10			day					
									Onset of symptom to sample collection	7			day					
									Onset of symptom to hospitalization	7			day					
									Onset of symptom to hospitalization	6			day					
									Onset of symptom to hospitalization	9			day					
									Onset of symptom to hospitalization	10			day					
									Onset of symptom to hospitalization	7			day					

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ID	Author	YOP	Mon	Start Date	End Date	Country/ City	N	Explanation	Parameter	Point Est	LCI	UCI	Unit	Mean	SD	Median	IQR	Q1-Q3
21	Choujun Zhan(38)	2020	Mar	19-Feb	06-Mar	South Korea			Confirmed cases	7313			count					
						Italy			Confirmed cases	5883			count					
						Iran			Confirmed cases	5823			count					
						Iran			Infected cases				count	14450	6244			
						Tehran			Infected cases				count	2498	566			
						Zanjan			Infected cases				count	1695	92			
						Lombardi-Italy			Infected cases				count	4784	788			
						Emelia Romagna-Italy			Infected cases				count	1555	360			
						Daegu-South Korea			Infected cases				count	7619	2096			
						Seoul-South Korea			Infected cases				count	1287	197			
						Italy			Fatality rate	4			%					
22	Bo Zhang(39)	2020	Feb	08-Dec	22-Jan	China/ Wuhan	1568		Infected cases	4508			count					
									R_0	3.6								
				13-Feb	early April	China/ Wuhan			Infected cases	42073	41673	42475	count					
									Number of deaths	2179	2088	2270	count					
				10-Jan	22-Jan	China/ Hubei			R_0	0.67								
									Infected cases	7138			count					
				13-Feb	early April	China/ Hubei			R_0	3.4								
									Infected cases	21342	21057	21629	count					
									Number of deaths	633	585	683	count					
				13-Feb	early April	China excluding Hubei			R_0	0.59								
									Infected cases	13384	13158	13612	count					
									Death	107	87	128	count					
									R_0	0.63								
23	Lianglu Zhang (40)	2020	Feb	22-Jan	12-Feb	China/ Wuhan		after interven-tion	R_0					1.44				1.4-1.47
									Incubation period				day	3				3-7.2
24	Sheng Zhang(41)	2020	Feb	17-Feb	26-Feb	Japan (Princess ship)		maximum likelihood	R_0	2.28	2.06	2.52						
									Cumulative case	1514	1384	1656	count					
25	Zhanwei Du(42)	2020		21-Jan	08-Feb	China	468		Serial interval	3.96	3.53	4.39	count		4.75			
									Asymptomatic patients	12.6			%					
26	Hongxin Zhao(43)	2020	Feb	29-Jan	02-Feb	5 countries (korea, Germa-ny,France,singapore,Japan	1916		Infection rate	1.1	0.4	3.1	%					
									Infected cases	110000	40000	310000	count					
27	Shi Zhao(12)	2020	Feb	20-Jan	20-Feb	Japan (Princess ship)	634		Cumulative cases	3066	2046	3441	count					
									R_0	2.2	2.1	2.4						
									Dispersion parameter	44	6	88	count					
									Doubling time	4.6	3	9.3	day					
									Asymptomatic patients	25.6-51.7			%					

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ID	Author	YOP	Mon	Start Date	End Date	Country/ City	N	Explanation	Parameter	Point Est	LCI	UCI	Unit	Mean	SD	Median	IQR	Q1-Q3
28	Shi Zhao(44)	2020	Jan	10-Jan	24-Jan	China/ Wuhan		(8-fold) exp growth	R_0	2.24	1.96	2.55						
								(0-fold) exp growth	R_0	3.58	2.89	4.39						
29	Shi Zhao(45)	2020	Feb	01-Dec	24-Jan	Mainland China	41		Under reported cases	469	403	540	count					
									R_0	2.56	2.49	2.63						
30	Fei Zhou(46)	2020	Mar	29-Dec	31-Jan	China/ Wuhan (2 hospitals)	191		ICU admission	26			%					
									ICU length of stay				day			8		4-12
									Hospital length of stay				day			11		7-14
									Illness onset to hospitali-zation				day			11		8-14
									Illness onset to dyspnea				day			7		4-9
									Illness onset to ARDS				day			12		8-15
									Illness onset to ICU				day			12		8-15
									Illness onset to Death-discharge				day			21		17-25
31	Guopeng Zhou(47)	2020	Feb	first day	50th day	China/ Wuhan	141427709		Cumulative cases				count	2868.7	1739			
				51th day	70th day				Cumulative cases				count	52185.4	31621.4			
				71 th day	90 th day				Cumulative cases				count	913396.5	559099.9			
				first day	90thday				R_0	2.2	1.4	3.9						
									Incubation period	7.5	5.3	19	day		3.4			
				31-Dec	18-Feb				ICU admission	5			%					
32	Tao Zhou(48)	2020	Feb		25-Jan	China/ Wuhan	3440	Northeastern University Reports	R_0	2.8-3.3								
								People's Daily Reports	R_0	3.2-3.9								
									Asymptomatic patients	5.1			%					

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ID	Author	YOP	Mon	Start Date	End Date	Country/ City	N	Explanation	Parameter	Point Est	LCI	UCI	Unit	Mean	SD	Median	IQR	Q1-Q3
33	Cleo Astassopou-lou(49)	2020	12-Feb	11th of Jan	10th of Feb	Hubei/China		11-16 Jan	R_0	4.8	3.35	6.27						
								11-17 Jan	R_0	4.6	3.56	5.65						
								11-18 Jan	R_0	5.14	4.25	6.04						
								11-19 Jan	R_0	6.09	5.02	7.16						
								11-20 Jan	R_0	7.09	5.84	8.35						
								Nov 16-Feb 10 (Based on the SIRD simulator)	R_0	2.5								
									Case fatality rate[$]	2.94	2.89	3	%					
									Recovery rate	0.05	0.045	0.055						
									Recovery time	20	18	22	day					
									Infection rate	0.199	0.197	0.2						
								Forecast to Feb 29	Expected number of Infected cases	140000	70000	290000						
								Forecast to Feb 29	Expected number of recovered population	60000	33000	95000						
								Forecast to Feb 29	Expected number of Death cases	16000	9000	29000						
								11-16 Jan	R_0	4.15	2.92	5.38						
								11-17 Jan	R_0	3.98	3.11	4.85						
								11-18 Jan	R_0	4.39	3.67	5.11						
								11-19 Jan	R_0	5.15	4.3	6.01						
								11-20 Jan	R_0	6.01	4.93	7.08						
								Nov 16-Feb 10 (Based on the SIRD simulator)	R_0	2.64								
									Case fatality rate[$]	0.58	0.57	0.59	%					
									Recovery rate	0.08	0.073	0.088						
									Recovery time	12	11	13	day					
									Infection rate	0.227	0.224	0.229						
								Forecast to Feb 29	Expected number of Infected cases	1000000	330000	2200000						
								Forecast to Feb 29	Expected number of recovered population	580000	230000	960000						
								Forecast to Feb 29	Expected number of Death cases	19000	7000	35000						
34	Jantien A Backer(50	2020	06-Feb	20-Jan	28-Jan	Wuhan, China	88	Weibull	Incubation period				day	6.4	2.3	6.4		
								Gamma	Incubation period				day	6.5	2.6	6.1		
								Lognormal	Incubation period				day	6.8	3.4	6.1		
35	David Baud(51)	2020	12-Mar		01-Mar	China	79968	China	Case fatality rate[$]	5.6	5.4	5.8	%					
						Outside of China	7169	Outside of China	Case fatality rate[$]	15.2	12.5	17.9	%					
						Global	87137	Global mortality rates	Case fatality rate[$]	5.7	5.5	5.9	%					
36	Zhidong Cao(52)	2020				China			Effective reproduction number		3.37	4.77		4.08	0.36			
									Fatality rate	6.5			%					
									Average infectious period	<2.3			day					

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37	Tian-Mu Chen(53)	2020	28-Feb	7 Dec, 2019	1 Jan, 2020	China			R_0	3.58								
38	Matteo Chinazzi(54)	2020	07-Feb			China			R_0	2.4	2.2	2.6						
									Doubling time measured	4.6	4.2	5.1						
								On Jan 22, 2020, the projected, no travel restrictions for Mainland China excluding Wuhan	Median number of cases	3491	1924	7360						
								On Jan 22, 2020, the projected, in Wuhan	Median number of cases	58956	40760	87471						
									Median ascertainment rate of detecting an infected				%			19.59		14.36-35.58
39	Yi Chen Chong(55	2020	15-Feb			China			R_0	4.29								

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ID	Author	YOP	Mon	Start Date	End Date	Country/ City	N	Explanation	Parameter	Point Est	LCI	UCI	Unit	Mean	SD	Median	IQR	Q1-Q3
40	Ilaria Dorigatti(56)	2020	10-Feb			China	26	China: Parametric model fitted to publicly reported number of cases and Deaths in Hubei as of 5th Feb, assuming exponential growth at rate 0.14/day	Case fatality ratio	18	11*	81*	%					
								Outside mainland China:Parametric model fitted to reported traveller cases up to 8th Feb using both Death and recovery outcomes and inferring latest possible dates of onset in traveller cases	Case fatality ratio	5.1	1.1*	38*	%					
								Outside mainland China:Parametric model fitted to reported traveller cases up to 8th Feb using only Death outcome and inferring latest possible unreported dates of onset in traveller cases	Case fatality ratio	5.6	2*	85*	%					
								Outside mainland China:Kaplan-Meier-like non-parametric model fitted to reported traveller cases up to 8th Feb using both Death and recovery outcomes	Case fatality ratio	1.2	0.9	26	%					
								all infections (asymptomatic or symptomatic): Scaling CASE FATALITY RATE estimate for Hubei for the level of infection under-ascertainment estimated from infection prevalence detected in repatriation flights, assuming infected individuals test positive for 14 days	Case fatality ratio	0.9	0.5	4	%					
								all infections (asymptomatic or symptomatic): As previous row, but assuming infected individuals test positive for 7 days	Case fatality ratio	0.8	0.4	3	%					
									Onset-to-recovery		18*	83*	day	22.2	0.45			
									Onset-to-Death		18*	82*	day	22.3	0.42			

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41	Mirjam E Kretzschmar(57)	2020	Mar			Netherlands		optimistic base-line scenario	R_0	2.5								
								realistic scenario	Effective reproduction number	1.4								
								realistic scenario	Exponential growth rate	0.05			%					
								optimistic base-line scenario	Exponential growth rate	0.127			%					
								optimistic base-line scenario	Doubling time	5.5			day					
								realistic scenario	Doubling time	14.4			day					
									Infectious period	10			day					
									Latent period		4	6	day					
									Incubation period		3	7.2	day	6.54	2.3			
42	Toshikazu kuniya(58)	2020	Mar	Feb	Mar	Japan		(range 2.1-5.1)	R_0	2.6	2.4	2.8						
43	Alessia Lai(59)	2020	Feb	Feb	Feb	China			R_0	2.6								
44	Hien Lau(60)	2020	Mar	Jan	Feb	China			Doubling time	2	1.9	2.6	day					
									Doubling time	4	3.5	4.3	day					
45	Stephen A Lauer(61)	2020	Mar	Jan	Feb	China	181		Incubation period		4.5	5.8	day			5.1		
46	Char Leung(62)	2020	Mar	Jan	Feb	China			Incubation period				day	1.7				
									Incubation period				day	7.5				
									Incubation period				day	1.8				
									Incubation period				day	7.2				
									Incubation period				day	1.7				
									Incubation period				day	7.2				
47	Qun Li(63)	2020	Jan	Dec	Jan	China	425		Incubation period		4.1	7	day	5.2				
									Doubling time	7.4	4.2	14	day					
									Serial interval		5.3	19	day	7.5				
									R_0	2.2	1.4	3.9						
									Growth rate	0.1	0.05	0.16	%					
									Time from symptom onset to hospitalization	12.5	10.3	14.8	day	9.1				
48	Tao Liu(64)	2020	Jan	Dec	Jan	China	830		Time from symptom onset to isolation	2.9			day					
									Proportion of symptomat-ic that die	0.03			%					
									Incubation period				day	4.8				
									R_0	2.9	2.32	3.63						
49	Jiaqiang Liao(65)	2020	Mar	Jan	Feb	China	46		Incubation period		4.4	9.6	day	6.6				
									Serial interval	1.9	0.4	6.2	day					

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50	Qiushi Lin(66)	2020	Feb	Dec	Jan	China			Cumulative case count	4090	3975	4206	count					
									Cumulative case count	56833	55242	58449	count					
									Latent period				day	3				
									Infectious period				day	5				
51	Natalie Linton(67	2020	Feb	Jan	Feb	China			Time from hospitalization to Death	8.3	6.4	10.5	day					
									Time from symptom onset to Death	13.8	11.8	16	day					
									Incubation period	4.6	3.3	5.7	day					
									Incubation period	5	4.1	5.8	day					
									Time from symptom onset to hospitalization	2.7	1.6	4.1	day					
52	Tao Liu(68)	2020	Feb	Jan	Feb	China		nationwide	Doubling time	2.4			day					
								Wuhan	Doubling time	2.8			day					
								Guangdong	Doubling time	3.6			day					
								nationwide	R_0	4.5	4.4	4.6						
								Wuhan	R_0	4.4	4.3	4.6						
53	Kenji Mizumoto(69)	2020	Feb	Jan	Feb	China			Effective reproduction number	3.24	3.16	3.32	num					
									Proportion of symptomatic that die	0.0406			%					
									R_0	7.05	6.11	8.18						
									Cumulative case count	983006	759175	1296258	count					
54	Kamalich Muniz-Rodriguez(70)	2020	Mar	Feb	Feb	Iran			R_0	3.6	3.2	4.2						
								SI: mean=4.41; sd=3.17	R_0	3.58	1.29	8.46						
									Doubling time	1.2	1.05	1.44	day					
									Doubling time	2.4			day					
									Growth rate	0.85	0.69	1	%					
55	Hiroshi Nishiura(71)	2020	Feb	Jan	Feb	Japan	565		Ascertainment rate	9.2	5	20	%					
									Serial interval				day	7.5				
56	Hiroshi Nishiura(72)	2020	Mar	Feb	Feb	China			Serial interval	4	3.1*	4.9*	day					
									Serial interval	4.6	3.5*	5.9*	day					
57	Ryosuke Omori(73	2020	Mar		Feb	Japan			Ascertainment rate	0.44	0.37	0.5	%					
58	Sang Woo Park(74)	2020	Feb		Feb	China			R_0	2.9	2.1	4.5						
59	Liangrong Peng(75)	2020	Feb		Feb	China			Latent period	2			day					
						Mainland			Quarantine time	6.6			day					
						Hubei			Quarantine time	7.2			day					
						Wuhan			Quarantine time	7.4			day					
						Beijing			Quarantine time	5.7			day					
						Shanghai			Quarantine time	5.6			day					

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60	Rachael Pung(76)	2020	Mar	Feb	Feb	China	36		Incubation period				day			4		3-6
									Serial interval		3	8	day					
									Time from symptom onset to hospitalization				day			4		3-6
61	Guo-Qing Qian(77)	2020	Mar	Feb	Feb	China	91		Incubation period				day			6		3-8
62	Jomar F Rabajante(78)	2020	Feb		Feb	Philippine			R_0	2								
									Infectious period	14			day					
63	Jonathan M Read(79)	2020	Feb		Jan	China			Infectious period	3.6	3.6	3.6	day					
									R_0	3.8	3.6	4						
									Ascertainment rate	5.1	4.8	5.5	%					
64	Julien Riou(80)	2020	Jan	Dec	Jan	Wuhan			Dispersion rate	0.54			%					
									R_0	2.2								
65	Steven Sanche(81)	2020	Feb	Dec	Feb	China			Time from hospitalization to Death	11.2	8.7	14.9	day					
									Time from hospitalization to discharge	11.5	8	17.3	%					
									Growth rate	0.29	0.21	0.37	%					
									Growth rate	0.14	0.12	0.15	day					
									Incubation period	4.2	3.5	5.1	day					
66	Mingwang Shen(82)	2020	Jan		Jan	China			R_0	4.71	4.5	4.92						
67	Eunha Shim(83)	2020	Mar	Jan	Feb	South Korea			Effective reproduction number	1.5	1.4	1.6	num					
									Growth rate	0.6	0.5	0.7	%					

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68	Yaqing Fang(84)	2020	Mar	20-Jan	29-Feb	China - Wuhan	291	20-Jan	R_0	2.47								
							437	21-Jan	R_0	2.56								
							560	22-Jan	R_0	2.67								
							805	23-Jan	R_0	2.81								
							1230	24-Jan	R_0	2.92								
							1892	25-Jan	R_0	2.98								
							2635	26-Jan	R_0	3.1								
							4371	27-Jan	R_0	3.14								
							5761	28-Jan	R_0	3.17								
							7439	29-Jan	R_0	3.19								
							9331	30-Jan	R_0	3.2								
							11315	31-Jan	R_0	3.2								
							13775	01-Feb	R_0	3.19								
							16400	02-Feb	R_0	3.17								
							19414	03-Feb	R_0	3.15								
							22974	04-Feb	R_0	3.13								
							26334	05-Feb	R_0	3.11								
							29017	06-Feb	R_0	3.09								
							31774	07-Feb	R_0	3.06								
							33738	08-Feb	R_0	3.03								
							35982	09-Feb	R_0	2.98								
							37626	10-Feb	R_0	2.94								
							38800	11-Feb	R_0	2.89								
							52526	12-Feb	R_0	2.9								
							55748	13-Feb	R_0	2.87								
							56873	14-Feb	R_0	2.84								
							57416	15-Feb	R_0	2.8								
							57934	16-Feb	R_0	2.77								
							58016	17-Feb	R_0	2.74								
							57805	18-Feb	R_0	2.7								
							56303	19-Feb	R_0	2.67								
							54965	20-Feb	R_0	2.64								
							53284	21-Feb	R_0	2.61								
							51606	22-Feb	R_0	2.57								
							49824	23-Feb	R_0	2.54								
							47672	24-Feb	R_0	2.51								
							45604	25-Feb	R_0	2.47								
							43258	26-Feb	R_0	2.44								
							39919	27-Feb	R_0	2.41								
							37414	28-Feb	R_0	2.37								
							35329	29-Feb	R_0	2.34								

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69	Ganyani Tapiwa(85)	2020	Mar		27-Feb	Singapore		Incubation period mean:5.2 - SD:2.8	Generation interval	5.2	3.78	6.78	day		1.72			
								Incubation period mean:5.2 - SD:2.8	Serial interval	5.21	-3.35	13.94	day		4.32			
						Tianjin/ China		Incubation period mean:5.2 - SD:2.8	Generation interval	3.95	3.01	4.91	day		1.51			
								Incubation period mean:5.2 - SD:2.8	Serial interval	3.95	-4.47	12.51	day		4.24			
						Singapore		Incubation period mean:6.4 - SD:2.3	Generation interval	5.29	3.89	6.77	day		2.08			
								Incubation period mean:6.4 - SD:2.3	Serial interval	5.29	-2.13	13.16	day		3.86			
								Incubation period mean:4.8 - SD:2.6	Generation interval	5.19	3.82	6.74	day		1.77			
								Incubation period mean:4.8 - SD:2.6	Serial interval	5.19	-2.86	13.45	day		4.08			
						Tianjin/ China		Incubation period mean:6.4 - SD:2.3	Generation interval	4.02	3.11	5	day		2.29			
								Incubation period mean:6.4 - SD:2.3	Serial interval	4.02	-4.83	13.45	day		3.98			
								Incubation period mean:4.8 - SD:2.6	Generation interval	3.95	3.05	4.93	day		1.75			
								Incubation period mean:4.8 - SD:2.6	Serial interval	3.95	-4.6	12.73	day		4.07			
						Singapore		mean:5.2 - SD:2.8- allowing SI negative	Generation interval	3.86	2.22	5.6	day		2.65			
								mean:5.2 - SD:2.8- allowing SI negative	Serial interval	3.86	-5.15	13.88	day		4.76			
						Tianjin/ China		mean:5.2 - SD:2.8- allowing SI negative	Generation interval	2.9	1.85	4.12	day		2.86			
								mean:5.2 - SD:2.8- allowing SI negative	Serial interval	2.9	-6.12	13.47	day		4.88			
						Singapore		mean:5.2 - SD:2.8- using GI- baseline	R_0	1.27	1.19	1.36						
								mean:5.2 - SD:2.8- using SI- baseline	R_0	1.25	1.17	1.34						
								mean:5.2 - SD:2.8- using GI- all negative SI	R_0	1.19	1.1	1.28						
								mean:5.2 - SD:2.8- using SI- all negative SI	R_0	1.17	1.08	1.26						
						Tianjin/ China		mean:5.2 - SD:2.8- using GI- baseline	R_0	1.59	1.42	1.78						
								mean:5.2 - SD:2.8- using SI- baseline	R_0	1.41	1.26	1.58						
								mean:5.2 - SD:2.8- using GI- all negative SI	R_0	1.32	1.18	1.51						
								mean:5.2 - SD:2.8- using SI- all negative SI	R_0	1.17	1.05	1.34						
						Singapore		mean:5.2 - SD:2.8-baseline	Proportion of pre-symptomatic transmission	48	32	67	%					
						Tianjin/ China		mean:5.2 - SD:2.8-baseline	Proportion of pre-symptomatic transmission	62	50	76	%					
						Singapore		mean:5.2 - SD:2.8-all negative SI	Proportion of pre-symptomatic transmission	66	45	84	%					
						Tianjin/ China		mean:5.2 - SD:2.8-all negative SI	Proportion of pre-symptomatic transmission	77	65	87	%					

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Appendix 1. Continued

ID	Author	YOP	Mon	Start Date	End Date	Country/ City	N	Explanation	Parameter	Point Est	LCI	UCI	Unit	Mean	SD	Median	IQR	Q1-Q3
70	Guan Wei-Jie(86)	2020	Mar		29-Jan	China	1099		Incubation period	4			day			4	5	2
									Duration of hospitalization				day	12.8		12		
71	Slav W. Hermanowicz(87)	2020	Feb	16-Jan	08-Feb	China	62	17-Jan	R_0	1.38								
							121	18-Jan	R_0	1.95								
							198	19-Jan	R_0	1.64								
							291	20-Jan	R_0	1.47								
							440	21-Jan	R_0	1.51								
							571	22-Jan	R_0	1.3								
							830	23-Jan	R_0	1.45								
							1287	24-Jan	R_0	1.55								
							1975	25-Jan	R_0	1.53								
							2744	26-Jan	R_0	1.39								
							4515	27-Jan	R_0	1.65								
							5974	28-Jan	R_0	1.32								
							7711	29-Jan	R_0	1.29								
							9692	30-Jan	R_0	1.26								
							11860	31-Jan	R_0	1.22								
							14380	01-Feb	R_0	1.21								
							17307	02-Feb	R_0	1.2								
							20467	03-Feb	R_0	1.18								
							24324	04-Feb	R_0	1.19								
							28018	05-Feb	R_0	1.15								
							31161	06-Feb	R_0	1.11								
							31774	07-Feb	R_0	1.02								
							33738	08-Feb	R_0	1.06								
72	Zhiliang Hu(88)	2020		28-Jan	09-Feb	Jiangsu Province, China	24		Median communicable period		21	24	day					
73	Xuan Jiang(89)	2020	Feb						Incubation period	4.9	4.4	5.5	day					

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Appendix 1. Continued

ID	Author	YOP	Mon	Start Date	End Date	Country/ City	N	Explanation	Parameter	Point Est	LCI	UCI	Unit	Mean	SD	Median	IQR	Q1-Q3
74	Sung-mok Jung(90)	2020	Feb	08-Dec	24-Jan	China		scenario 1: exponential growth started from the assumed illness onset date of index case,(8 Dec)	Case fatality rate	5.3	3.5	7.5	%					
								scerio2: all parameters are variable, and calculation begins on the date the first exported case was observed (i.e., 13 Jan 2020)	Case fatality rate	8.4	5.3	12.3	%					
								scenario 1: exponential growth started from the assumed illness onset date of index case,(8 Dec)	R_0	2.1	2	2.2						
								scerio2: all parameters are variable, and calculation begins on the date the first exported case was observed (i.e., 13 Jan 2020)	R_0	3.2	2.7	3.7						
								scenario 1: exponential growth started from the assumed illness onset date of index case,(8 Dec)	Cumulative incidence	6924	4885	9211	count					
								scerio2: all parameters are variable, and calculation begins on the date the first exported case was observed (i.e., 13 Jan 2020)	Cumulative incidence	19289	10901	30158	count					

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Appendix 1. Continued

ID	Author	YOP	Mon	Start Date	End Date	Country/ City	N	Explanation	Parameter	Point Est	LCI	UCI	Unit	Mean	SD	Median	IQR	Q1-Q3
75	Moran Ki(91)	2020	Feb	20-Jan		Korea	28		Incubation period	3.9			day	3.9		3		
									Serial interval	6.6			day	6.6		4		
									Symptoms onset to diagnosis	5.2			day	5.2		4		
									Symptoms onset to quarantine or isolation	4.3			day	4.3		3		
									Diagnosis to discharge	13			day	13		12.5		
								total Poisson	R_0	0.48	0.25	0.84						
								total binomial	R_0	0.48	0.28	0.69						
								first generation (n=9) Poisson	R_0	0.56	0.26	1.07						
								first generation (n=9) binomial	R_0	0.56	0.3	0.8						
								second generation (n=3) Poisson	R_0	0.33	0.07	0.97						
								second generation (n=3) binomial	R_0	0.33	0.07	0.7						
76	Weier Wang(92)	2020	Jan	1-Dec	26-Jan	China	41	10-Jan	Case fatality rate[$]	2.44			%					
							440	21-Jan	Case fatality rate[$]	2.05			%					
							571	22-Jan	Case fatality rate[$]	2.98			%					
							830	23-Jan	Case fatality rate[$]	3.01			%					
							1287	24-Jan	Case fatality rate[$]	3.19			%					
							1975	25-Jan	Case fatality rate[$]	2.84			%					

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