



Correspondence

Genomic analysis of SARS-CoV-2 strains among Indians returning from Italy, Iran & China, & Italian tourists in India

Sir,

The single-stranded RNA genome of the 2019 novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) about 29.9 kb in length and encoding about 9860 amino acids, was annotated to possess 14 open reading frames (ORFs) and 27 proteins^{1,2}. The *orf1ab* and *orf1a* genes at the 5'-terminus of the genome encode the pp1ab and pp1a proteins, respectively, together form 15 non-structural proteins (nsps), nsp1-nsp10 and nsp12-nsp16. The 3'-terminus of the genome encodes four structural proteins, the spike surface glycoprotein (*S*), the small envelope protein (*E*), membrane protein (*M*) and nucleocapsid protein (*N*). There are eight accessory proteins denoted as 3a, 3b, p6, 7a, 7b, 8b, 9b and ORF14².

The epidemiology of the SARS-CoV-2 since its emergence in December 2019 has been ever expanding, with increase in the number of cases and its spread globally^{3,4}. The number of SARS-CoV-2 cases in India as on March 31, 2020 was 1,071, with mortality crossing 29⁴. In this context, it is vital to understand the genetic nature of circulating SARS-CoV-2. In India, as per the guideline of the Ministry of Health and Family Welfare, suspected samples of SARS-CoV-2 were collected and tested at the designated Viral Research and Diagnostic Laboratories (VRDL)⁵. As a part of this activity, a total of 15 SARS-CoV-2 positive specimens were obtained during the first week of March 2020, from Italian tourists and travellers from Italy and their contact cases in India. Further, in an effort to screen Indian nationals in Iran to enable their evacuation, during March 5 to 17, 2020, throat swabs were collected from 1,920 individuals; of whom 281 were positive. In addition, a team of Indian doctors visited Italy and collected a total of 380 swabs of

Indian citizens; of whom four positive specimens were identified. In an earlier study, the authors identified the first three cases of SARS-CoV-2 in Kerala, India, as imported cases from Wuhan, China, and presented the first two full-genome sequences along with the potential B-cell and T-cell epitopes on the spike protein⁶. Further, in another study, the SARS-CoV-2 viruses were isolated in Vero CCL-81 cells⁷. The present study was undertaken to understand and compare the genetic makeup of representative samples of the imported cases of SARS-CoV-2 to India from Wuhan, China, those of Italian tourists in India and the Indians evacuated from Iran and Italy.

Throat swab/nasal swab specimens collected from the 1,920 individuals in Iran were tested at the Indian Council of Medical Research-National Institute of Virology (ICMR-NIV) Pune, using real-time reverse transcription-polymerase chain reaction (RT-PCR) protocols to detect *RdRp* (1), *RdRp* (2), *E* and *N* genes as described elsewhere⁸. Next-generation sequencing (NGS) was performed on a total of 41 SARS-CoV-2 positive clinical samples from Italy and Iran. Table I presents the details of the full genomes obtained (n=19) as a part of this study as well as the two earlier genomes retrieved from the Kerala samples (n=2) from those who had the travel history from China^{6,7}.

Multiple sequence alignment of 21 full genomes obtained and 1563 full-genome sequences (Supplementary Table (available from http://www.ijmr.org.in/articles/2020/151/2/images/IndianJMedRes_2020_151_2_255_283159_sm5.pdf) available at the Global Initiative on Sharing All Influenza Data (GISAID) database (as of March 26, 2020) was carried out in MAFFT v.7.450⁹. The phylogenetic

Supplementary material available from <http://www.ijmr.org.in/article.asp?issn=0971-5916;year=2020;volume=151;issue=2;page=255;epage=260;aulast=Potdar>

Table I. Cycle threshold (Ct) values of real-time reverse transcription-polymerase chain reaction (RT-PCR) for the *E* gene of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) along with the per cent of the reads mapped and the genome size recovered for the clinical samples

Sample ID	Travel history/details	Ct value of <i>E</i> gene for clinical samples	Per cent of relevant reads	Genome length (bp)	GISAID ID
hCoV-19/India/1-27/2020*	Wuhan, China travel	34.5	0.36	29,854	EPI_ISL_413522
hCoV-19/India/1-31/2020*	history of Indian citizens (Group A)	28.98	0.80	29,851	EPI_ISL_413523
hCoV-19/India/1073/2020	Specimens collected at Iran from Indian citizens (Group B)	25	1.53	29,855	EPI_ISL_421662
hCoV-19/India/1093/2020		23	0.10	29,847	EPI_ISL_421663
hCoV-19/India/1100/2020		23	0.79	29,862	EPI_ISL_421664
hCoV-19/India/1104/2020		22	34.88	29,890	EPI_ISL_421665
hCoV-19/India/1111/2020		22	3.36	29,861	EPI_ISL_421666
hCoV-19/India/1115/2020		22	3.04	29,864	EPI_ISL_421667
hCoV-19/India/1125/2020		25	0.18	29,873	EPI_ISL_421668
hCoV-19/India/1616/2020		23	0.60	29,857	EPI_ISL_421669
hCoV-19/India/1621/2020		18	5.28	29,860	EPI_ISL_421671
hCoV-19/India/1644/2020		22	1.23	29,855	EPI_ISL_421672
hCoV-19/India/1652/2020	24	0.17	29,847	EPI_ISL_424363	
hCoV-19/India/3118/2020	Indian contacts of an Indian citizen having travel history to Italy (Group C)	24	3.30	29,857	EPI_ISL_424364
hCoV-19/India/3239/2020		20	22.58	29,862	EPI_ISL_424365
hCoV-19/India/770/2020‡	Italian tourists who arrived in Delhi, India and an Indian contact of the cohort (Group D)	18	93.08	29,862	EPI_ISL_420545
hCoV-19/India/773/2020‡		25.1	19.98	29,858	EPI_ISL_420549
hCoV-19/India/777/2020‡		22.1	26.93	29,856	EPI_ISL_420551
hCoV-19/India/781/2020‡		22.1	35.47	29,871	EPI_ISL_420553
hCoV-19/India/31/2020		25	2.13	29,860	EPI_ISL_426179
hCoV-19/India/32/2020‡	Close contacts in Agra, of an infected Delhi-based person who returned from Italy (Group E)	16	88.50	29,903	EPI_ISL_420555

GISAID, Global Initiative on Sharing All Influenza Data
Source: *Ref. 6, ‡Ref. 7

tree was constructed using MEGA v.6¹⁰, employing the neighbour-joining method with the composite likelihood method and 1000 bootstrap replications. An initial tree was constructed based on a total of 1586 sequences. This tree was used to reduce the dataset to 121 sequences, on the basis of country and the genetic variant identified based on the GISAID classification. Comparison of the sequences of this study with respect to the Wuhan Hu-1 reference strain was done to identify unique mutations, if any.

Phylogenetic trees based on full-genome sequences deposited and available at GISAID revealed the diversification and the clustering of sequences into groups, based on the genetic variants. Specific amino

acid substitutions in the nsp3 region, spike protein and ORF8, in general, lead to the formation of V, G and S genetic variants/clades, respectively. The S clade corresponds to the C28144T nucleotide polymorphism that results in a non-synonymous substitution Leu84Ser in ORF8. Clades V, G and a group of unclassified strains possess mainly C28144 and are referred to as the L type¹¹. The phylogenetic analyses of the study strains and the other global sequences revealed that the SARS-CoV-2 sequences derived from Italy (n=8) in this study, clustered in clade G, while the SARS-CoV-2 sequences (n=11) of Indians evacuated from Iran belonged to the unclassified group which also included one of the SARS-CoV-2 sequences

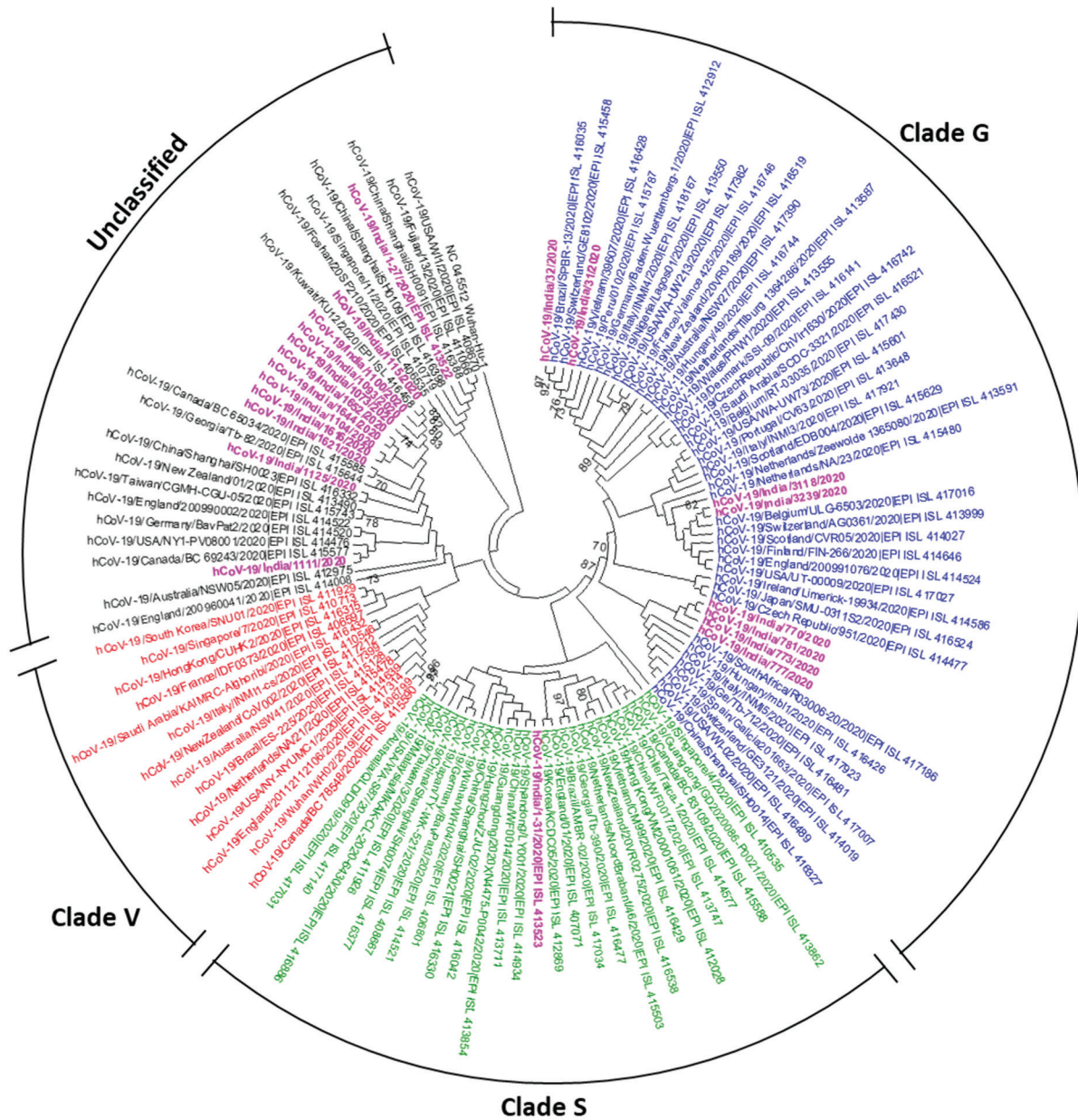


Figure. Phylogenetic tree of selected representative full-genome sequences of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)-derived from coronavirus disease 2019 positive patients’ clinical samples who had travel history of Wuhan, China, Italy and Iran by neighbour-joining method. Strains sequenced at ICMR-NIV are shown in magenta colour. The clades as per Global Initiative on Sharing All Influenza Data (GISAID) nomenclature are indicated in blue (clade G), red (clade V), green (clade S) and black (unclassified).

imported from Wuhan (hCoV-19/India/1-27/2020) (Figure). The other sequences imported from Wuhan (hCoV-19/India/1-31/2020) possessed Leu84Ser in ORF8b, classifying it in clade S.

The sequences of Italy origin were noted to segregate into at least two subgroups. The

percentage nucleotide divergence (PND) within these sequences was found to be 0.01 per cent. The SARS-CoV-2 sequences from the Italian tourists (n=6) showed relatedness to other European SARS-CoV-2 sequences from Scotland, Finland, England, Spain, Ireland and the Czech Republic along with

a Shanghai, China, strain as the outgroup (Figure). Two other sequences (hCoV-19/India/3118/2020 and hCoV-19/India/3239/2020) clustered more closely with sequences from Belgium and Switzerland. The two sequences (hCoV-19/India/31/2020 and hCoV-19/India/32/2020) from the Agra contacts of the Italy-returned Delhi based individuals were more distinct and showed clustering in a strongly supported subgroup consisting of strains from Brazil and the European countries including Switzerland, Germany, France, Hungary and The Netherlands.

The variable amino acid sites based on the alignment of the 21 sequences of this study with respect to Wuhan Hu-1 strain are shown in Table II. All the Italy-origin sequences possessed the substitution D7711G/D614G in the S protein, characteristic of the G clade, along with another mutation P4715L (nsp12-323) that is also shared with many other countries. Mutation S1515F (nsp3-697) was specific to the Italian cohort strain; D8726G (M-3) was specific to hCoV-19/India/3118/2020 and hCoV-19/India/3239/2020 (Indian contacts of an Indian citizen having travel history to Italy), similar to sequences from Scotland, Belgium, Finland, Switzerland and England. The mutations, R9455K and G9456R (N-203 and 204), were found to be specific to the two strains, hCoV-19/India/31/2020 and hCoV-19/India/32/2020 but shared with a few more countries. A recent study has identified the earliest Italian importation of SARS-CoV-2 to a case from Shanghai, China, and has also identified at least two circulating variants in Italy¹². Thus, it is likely that the former strain (Italian cohort) has its origin from China, whereas the latter strain (contacts in Agra, n=2) appears to have been from a European cluster involving an entry into Germany that preceded the first cases in Italy by almost a month^{12,13}.

Analysis of the strains from the SARS-CoV-2 positives in Iran (Figure) showed that these sequences (n=11) clustered with other strains having a global spread inclusive of Canada, USA, several European countries, New Zealand, Australia and Southeast Asian countries noted in this group (moderate support of 64%). The PND among these study sequences was found to be 0.24 per cent. Common mutations shared among SARS-CoV-2 sequences in the group included R207C (nsp2-27), V378I (nsp2-198), M2796I (nsp4-33) and L3606F (nsp6-37). A mutation V9082F (ORF7a-74) was unique to four of the study

sequences (hCoV-19/India/1073/2020, hCoV-19/India/1093/2020, hCoV-19/India/1115/2020 and hCoV-19/India/1100/2020) that clustered with a strain from Kuwait, KU12. The KU12 strain was also noted to possess this mutation. To date, there are no other sequences from Iran in the GISAID database. However, a phylogenetic study¹⁴ of full-genome sequences has identified distinct SARS-CoV-2 link to travellers returning from Iran to Australia and New Zealand. Some of these representative sequences were included in this study as well.

In terms of the overall divergence of SARS-CoV-2, the strains in this study were 99.97 per cent identical to the earliest strain Wuhan Hu-1. However, it is vital to track the evolutionary dynamics of the strains *vis-à-vis* the strains circulating globally and monitor any specific changes in the functional sites of the major viral proteins.

Delineation of circulating strains into three major evolving clades has been reflected in GISAID, with clade G apparently being one of the dominant ones. From the start of the pandemic, severity or transmission patterns have not been associated with any clade in particular. A limitation of this study was the non-availability of full genomes from other parts of India. This would enable a pan-India comparison of the circulating strains in the country. Overall, the present study revealed genetic variants in India that were similar to strains circulating in the specific regions of their origin. Continued surveillance of SARS-CoV-2 strains in India is warranted to get the complete picture of all circulating strains and identify changes that could be associated with increased virulence.

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Table II. Variable amino acid positions in the Indian full-genome sequences

Amino acid position in genome	207	378	476	671	1515	2079	2144	2796	3606	4715	4798	5538	7505	7535	7711	8027	8726	9082	9214	9455	9456
NC 045512 Wuhan-Hu-1	R	V	I	I	S	P	P	M	L	P	A	T	R	S	D	A	D	V	L	R	G
hCoV-19/India/1-27/2020|EPI_ISL_413522	.	.	V	T	.	S	.	I	F	.	V	.	I	.	.	.	.	.	.	.	.
hCoV-19/India/1-31/2020|EPI_ISL_413523	.	.	V	.	L	.	.	.	.	.	.	I	.	.	V	.	.	S	.	.	.
hCoV-19/India/1073/2020	C	I	.	.	.	.	.	I	F	.	.	.	.	.	.	.	.	F	.	.	.
hCoV-19/India/1093/2020	C	I	.	.	.	.	.	I	F	.	.	.	.	.	.	.	.	F	.	.	.
hCoV-19/India/1100/2020	C	I	.	.	.	.	.	I	F	.	.	.	.	.	.	.	.	F	.	.	.
hCoV-19/India/1104/2020	C	I	.	.	.	.	.	I	F	.	.	.	.	.	.	.	.	.	.	.	.
hCoV-19/India/1111/2020	.	I	.	.	.	.	.	F	.	.	.	.	.	.	.	.	.	.	.	.	.
hCoV-19/India/1115/2020	C	I	.	.	.	.	.	I	F	.	.	.	.	.	.	.	.	F	.	.	.
hCoV-19/India/1125/2020	.	I	.	.	.	.	.	F	.	.	.	.	.	.	.	.	.	.	.	.	.
hCoV-19/India/1616/2020	C	I	.	.	.	.	.	I	F	.	.	.	.	.	.	.	.	.	.	.	.
hCoV-19/India/1621/2020	C	I	.	.	.	.	.	I	F	.	.	.	.	.	.	.	.	.	.	.	.
hCoV-19/India/1644/2020	C	I	.	.	.	.	.	I	F	.	.	.	.	.	.	.	.	.	.	.	.
hCoV-19/India/1652/2020	C	I	.	.	.	.	.	I	F	.	.	.	.	.	.	.	.	.	.	.	.
hCoV-19/India/3118/2020	.	.	.	.	.	.	.	.	.	L	.	.	.	.	G	.	G	.	.	.	.
hCoV-19/India/3239/2020	.	.	.	.	.	.	.	.	.	L	.	.	.	.	G	.	G	.	.	.	.
hCoV-19/India/770/2020	.	.	.	.	F	.	.	.	.	L	.	.	.	.	G	.	.	.	.	.	.
hCoV-19/India/773/2020	.	.	.	.	F	.	.	.	.	L	.	.	.	.	G	.	.	.	.	.	.
hCoV-19/India/777/2020	.	.	.	.	F	.	.	.	.	L	.	.	.	.	G	.	.	.	.	.	.
hCoV-19/India/781/2020	.	.	.	.	F	.	.	.	.	L	.	.	.	.	G	.	.	.	.	.	.
hCoV-19/India/31/2020	.	.	.	.	.	.	.	.	.	L	.	.	.	.	G	.	.	.	.	K	R
hCoV-19/India/32/2020	.	.	.	.	.	.	.	.	.	L	.	.	.	.	G	.	.	.	.	K	R

Wuhan Hu-1 strain of severe acute respiratory syndrome coronaviruses 2 (SARS-CoV-2) is used as the reference strain. Strains and mutations specific to China, Iran and Italy are shown in orange, violet and brown colour, respectively. In case of Iran and Italy, only those amino acid sites are shown where at least two of the sequences share the same mutation. R, arginine; V, valine; I, isoleucine; S, serine; P, proline; M, methionine; L, leucine; A, alanine; T, threonine; D, aspartic acid; G, glycine; C, cysteine; F, phenylalanine; K, lysine

Conflicts of Interest: None.

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Supplementary Table. Acknowledgement for the list of the sequences downloaded from GISAID database that were used in the study

Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_417186	hCoV-19/South Africa/R03006-20/2020	Africa/South Africa/KZN	2020-03-21	National Institute for Communicable Diseases of the National Health Laboratory Service	National Institute for Communicable Diseases of the National Health Laboratory Service	Allam M, Kwenda S, van Heusden P, Khumalo Z, Mohale T, Subramoney K, von Gottberg, A, Ismail A, Bhiman JN
EPI_ISL_416042	hCoV-19/Hangzhou/ZJU-02/2020	Asia/China/Hangzhou	2020-01-26	State Key Laboratory for Diagnosis and Treatment of Infectious Diseases, National Clinical Research Center for Infectious Diseases, First Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, China. 310003	State Key Laboratory for Diagnosis and Treatment of Infectious Diseases, National Clinical Research Center for Infectious Diseases, First Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, China. 310003	Hangping Yao, Nanping Wu, Chao Jiang, Xiangyun Lu, Linfang Cheng, Fumin Liu, Zhigang Wu, Haibo Wu, Changzhong Jin, Min Zheng, Lanjuan Li
EPI_ISL_415458	hCoV-19/Switzerland/GE8102/2020	Europe/Switzerland/	2020-03-01	Hôpitaux universitaires de Genève Laboratoire de Virologie	Hôpitaux universitaires de Genève Laboratoire de Virologie	Laubscher F.
EPI_ISL_416035	hCoV-19/Brazil/SPBR-13/2020	South America/Brazil/Sao Paulo/Sao Paulo	2020-03-05	National Influenza Center - Instituto Adolfo Lutz	Instituto Adolfo Lutz, Interdisciplinary Procedures Center, Strategic Laboratory	Claudio Tavares Sacchi, Claudia Regina Gonçalves, Carlos Henrique Camargo, Erica Valessa Ramos Gomes, Fabiana Cristina Pereira dos Santos, Daniela Bernardes Borges da Silva, Simone Guadagnucci Morillo, Adriano Abbud, Adriana Bugno, Maria do Carmo Sampaio Tavares Timenetsky, Terezinha Maria de Paiva
EPI_ISL_411926	hCoV-19/Taiwan/3/2020	Asia/Taiwan/Taipei	2020-01-24	Taiwan Centers for Disease Control	Taiwan Centers for Disease Control	Ji-Rong Yang, Yu-Chi-Lin, Jung-Jung Mtu, Ming-Tsan-Liu
EPI_ISL_411066	hCoV-19/Fujian/13/2020	Asia/China/Fujian	2020-01-22	Fujian Center for Disease Control and Prevention	Fujian Center for Disease Control and Prevention	Chen Wei, Zhang Yanhua, He Wenxiang, Weng Yuwei
EPI_ISL_410713	hCoV-19/Singapore/7/2020	Asia/Singapore/	2020-01-27	National Public Health Laboratory, National Centre for Infectious Diseases	National Public Health Laboratory, National Centre for Infectious Diseases	Octavia S, Mak TM, Cui L, Lin RTP

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_417007	hCoV-19/Spain/Galicia201663/2020	Europe/Spain/Galicia	2020-03-07	HOSPITAL SANTA MARIA NAI	Instituto de Salud Carlos III	Iglesias-Caballero, M. Molinero Calamita, M. González-Esguevillas, M. Camarero S. Pozo F. Casas I. Jiménez, P. Jiménez, M. Zaballos, A. Monzón, S. Varona, S. Juliá, M. Cuesta, I. Garcia Costa, J.
EPI_ISL_415743	hCoV-19/Taiwan/CGMH-CGU-05/2020	Asia/Taiwan/Taoyuan	2020-02-27	Laboratory Medicine	Department of Laboratory Medicine, Lin-Kou Chang Gung Memorial Hospital, Taoyuan, Taiwan	Kuo-Chien Tsao, Yu-Nong Gong, Shu-Li Yang, Yi-Chun Liu, Chung-Guei Huang, Po-Wei Huang, Mei-Jen Hsiao, Cheng-Ta Yang, Cheng-Hsun Chiu, Chi-Hsien Huang, Kuang-Tso Le, Shu-Min Lin, Peng-Nien Huang, Kuo-Ming Lee, Guang-Wu Chen, Shin-Ru Shih
EPI_ISL_408670	hCoV-19/USA/WI1/2020	North America/USA/Wisconsin	2020-01-31	Wisconsin Department of Health Services	Pathogen Discovery, Respiratory Viruses Branch, Division of Viral Diseases, Centers for Diseases Control and Prevention	Jing Zhang, Anna Uehara, Krista Queen, Yan Li, Ying Tao, Clinton R. Paden, Xiaoyan Lu, Brian Lynch, Senthil Kumar K. Sakthivel, Brett L. Whitaker, Shifaa Kamili, Lijuan Wang, Janna R. Murray, Susan I. Gerber, Stephen Lindstrom, Suxiang Tong
EPI_ISL_416429	hCoV-19/Vietnam/CM99/2020	Asia/Vietnam/Vinhphuc	2020-02-11	National Influenza Center, National Institute of Hygiene and Epidemiology (NIHE)	National Influenza Center, National Institute of Hygiene and Epidemiology (NIHE)	Le Quynh Mai, Taichiro Takemura, Meng Ling Moi, Takeshi Nabeshima, Nguyen Le Khanh Hang, Hoang Vu Mai Phuong, Ung Thi Hong Trang, Le Thi Thanh, Nguyen Vu Son, Vuong Duc Cuong, Pham Thi Hien, Tran Thu Huong, Nguyen Phuong Anh, Pham Hong Quynh Anh, Kouichi Morita, Futoshi Hasebe, Dang Duc Anh
EPI_ISL_413711	hCoV-19/China/WF0014/2020	Asia/China	2020-02-01	Weifang Center for Disease Control and Prevention	Weifang Center for Disease Control and Prevention & BGI-Shenzhen	Qing Nie, Xingguang Li, Erik M Volz, Han Fu, Haowei Wang, Xiaoyue Xi, Wei Chen, Dehui Liu, Yingying Chen, Mengmeng Tian, Wei Tan, Junjie Zai, Wanying Sun, Jiandong Li, Junhua Li

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_417140	hCoV-19/USA/WA-S87/2020	North America/USA/Washington/King County	2020-03-01	Washington State Department of Health	Seattle Flu Study	Chu et al
EPI_ISL_413854	hCoV-19/Guangdong/2020XN4475-P0042/2020	Asia/China/Guangdong	2020-01-30	Guangdong Provincial Institution of Public Health, Guangdong Provincial Center for Disease Control and Prevention	Guangdong Provincial Institution of Public Health	Jing Lu, Louis du Plessis, Liu Zhe, Jiufeng Sun, Sarah François, Huifang Lin, Moritz Kraemer, Jingju Peng, Qianlin Xiong, Runyu Yuan, Lilian Zeng, Pingping Zhou, Chuming Liang, Tao Liu, Wei Li, Juan Su, Huanying Zheng, Kang Min, Song Tie, Bo Peng, Shisong Fang, Wenzhe Su, Kuibiao Li, Ruijin Sun, Ru bai, Xi Tang, Minfeng Liang, Nuno Faria, Josh Quick, Andrew Rambaut, Verity Hill, Wenjun Ma, Nick Loman, Oliver Pybus, Changwen Ke
EPI_ISL_406801	hCoV-19/Wuhan/WH04/2020	Asia/China/Hubei/Wuhan	2020-01-05	General Hospital of Central Theater Command of People's Liberation Army of China	BGI & Institute of Microbiology, Chinese Academy of Sciences & Shandong First Medical University & Shandong Academy of Medical Sciences & General Hospital of Central Theater Command of People's Liberation Army of China	Weijun Chen, Yuhai Bi, Weifeng Shi and Zhenhong Hu
EPI_ISL_416330	hCoV-19/Shanghai/SH0021/2020	Asia/China/Shanghai	2020-02-02	Shanghai Public Health Clinical Center, Shanghai Medical College, Fudan University	National Research Center for Translational Medicine (Shanghai), Ruijin Hospital affiliated to Shanghai Jiao Tong University School of Medicine & Shanghai Public Health Clinical Center	Shengyue Wang, Xiaonan Zhang, Gang Lu, Yun Tan, Yun Ling, Hongzhou Lu, Saijuan Chen

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_416377	hCoV-19/Shanghai/SH0074/2020	Asia/China/Shanghai	2020-02-07	Shanghai Public Health Clinical Center, Shanghai Medical College, Fudan University	National Research Center for Translational Medicine (Shanghai), Ruijin Hospital affiliated to Shanghai Jiao Tong University School of Medicine & Shanghai Public Health Clinical Center	Shengyue Wang, Xiaonan Zhang, Gang Lu, Yun Tan, Yun Ling, Hongzhou Lu, Saijuan Chen
EPI_ISL_416332	hCoV-19/Shanghai/SH0023/2020	Asia/China/Shanghai	2020-01-30	Shanghai Public Health Clinical Center, Shanghai Medical College, Fudan University	National Research Center for Translational Medicine (Shanghai), Ruijin Hospital affiliated to Shanghai Jiao Tong University School of Medicine & Shanghai Public Health Clinical Center	Shengyue Wang, Xiaonan Zhang, Gang Lu, Yun Tan, Yun Ling, Hongzhou Lu, Saijuan Chen
EPI_ISL_416398	hCoV-19/Shanghai/SH0109/2020	Asia/China/Shanghai	2020-02-02	Shanghai Public Health Clinical Center, Shanghai Medical College, Fudan University	National Research Center for Translational Medicine (Shanghai), Ruijin Hospital affiliated to Shanghai Jiao Tong University School of Medicine & Shanghai Public Health Clinical Center	Shengyue Wang, Xiaonan Zhang, Gang Lu, Yun Tan, Yun Ling, Hongzhou Lu, Saijuan Chen
EPI_ISL_410535	hCoV-19/Singapore/4/2020	Asia/Singapore/	2020-02-03	National Centre for Infectious Diseases	Programme in Emerging Infectious Diseases, Duke-NUS Medical School	Danielle E. Anderson, Martin Linster, Yan Zhuang, Jayanthi Jayakumar, David CB Lye, Yee Sin Leo, Barnaby E Young, Yvonne CF Su, Gavin JD Smith
EPI_ISL_417399	hCoV-19/Australia/NSW41/2020	Oceania/Australia/New South Wales/Sydney	2020-03-10	Centre for Infectious Diseases and Microbiology Public Health	NSW Health Pathology - Institute of Clinical Pathology and Medical Research; Westmead Hospital; University of Sydney	Dwyer DE, Rockett R, Eden J-S, Lam C, Gray K, Timms V, Gall M, Arnott A, Sadsad R, Carter I, Rahman H, Holmes EC, O'Sullivan MV, Sintchenko V, Chen SC, Maddocks S and Kok J for the 2019-nCoV Study Group

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_415478	hCoV-19/Netherlands/NA_21/2020	Europe/Netherlands/	2020-03-08	Dutch COVID-19 response team	Erasmus Medical Center	David Nieuwenhuijse, Bas Oude Munnink, Reina Sikkema, Claudia Schapendonk, Irina Chestakova, Anne van der Linden, Mark Pronk, Pascal Lexmond, Corien Swaan, Manon Haverkate, Madelief Mollers, Mart Stein, Sandra Kengne Kamga Mobou, Jeroen van Kampen, Jolanda Voermans, Aura Timen, Corine GeurtsvanKessel, Annemiek van der Eijk, Richard Molenkamp, Marion Koopmans, on behalf of the Dutch national COVID-19 response team.
EPI_ISL_414521	hCoV-19/Germany/BavPat3/2020	Europe/Germany/Munich	2020-03-02	Bundeswehr Institute of Microbiology	Bundeswehr Institute of Microbiology	Mathias C Walter, Markus H Antwerpen and Roman Wölfel
EPI_ISL_406535	hCoV-19/Foshan/20SF210/2020	Asia/China/Guangdong/Foshan	2020-01-22	Guangdong Provincial Center for Diseases Control and Prevention; Guangdong Provincial Public Health	Guangdong Provincial Center for Diseases Control and Prevention	Min Kang, Jie Wu, Jing Lu, Tao Liu, Baisheng Li, Shujiang Mei, Feng Ruan, Lifeng Lin, Changwen Ke, Haojie Zhong, Yingtao Zhang, Lirong Zou, Xuguang Chen, Qi Zhu, Jianpeng Xiao, Jianxiang Geng, Zhe Liu, Jianxiong Hu, Weilin Zeng, Xing Li, Yuhuang Liao, Xiujuan Tang, Songjian Xiao, Ying Wang, Yingchao Song, Xue Zhuang, Lijun Liang, Guan hao He, Huihong Deng, Tie Song, Jianfeng He, Wenjun Ma
EPI_ISL_410546	hCoV-19/Italy/INMI1-cs/2020	Europe/Italy/Rome	2020-01-31	INMI Lazzaro Spallanzani IRCCS	Laboratory of Virology, INMI Lazzaro Spallanzani IRCCS	Maria R. Capobianchi, Cesare E. M. Gruber, Martina Rueca, Fabrizio Carletti, Barbara Bartolini, Francesco Messina, Emanuela Giombini, Francesca Colavita, Concetta Castilletti, Eleonora Lalle, Emanuele Nicastrì, Giuseppe Ippolito.
EPI_ISL_410719	hCoV-19/Singapore/11/2020	Asia/Singapore/	2020-02-02	National Public Health Laboratory	National Public Health Laboratory	Octavia S. Mak TM, Cui L, Lin RTP

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_408667	hCoV-19/Japan/TY-WK-521/2020	Asia/Japan/Tokyo	2020-01-31	Dept. of Virology III, National Institute of Infectious Diseases	Pathogen Genomics Center, National Institute of Infectious Diseases	Tsuyoshi Sekizuka, Shutoku Matsuyama, Naganori Nao, Kazuya Shirato, Makoto Takeda, Makoto Kuroda
EPI_ISL_413648	hCoV-19/Portugal/CV63/2020	Europe/Portugal/	2020-03-01	Centro Hospitalar e Universitário de Sao Joao, Porto	Instituto Nacional de Saude (INSA)	Raquel Guiomar, Inés Costa, Pedro Pechirra, Joana Mendonça, Luís Vieira, João Tiago Guimarães, Joana Isidro, Vítor Borges, João Paulo Gomes
EPI_ISL_416742	hCoV-19/Czech Republic/ChVir1630/2020	Europe/Czech Republic/Prague	2020-02-01	NRL for Influenza, Centrum Epidemiology and Microbiology of National Institute of Public Health, Czech Republic	Charite Universitaetsmedizin Berlin, Institute of Virology	Victor M Corman, Julia Schneider, Jörn Beheim-Schwarzbach, Talitha Veith, Barbara Muehleemann, Terry Jones, Akexander Nagy, Jaromira Vecerova, Dusan Trnka, Ludmila Novakova, Helena Jirincova, Christian Drosten
EPI_ISL_417921	hCoV-19/Italy/INMI3/2020	Europe/Italy/Rome	2020-03-01	INMI Lazzaro Spallanzani IRCCS	Laboratory of Virology, INMI Lazzaro Spallanzani IRCCS	Martina Rueca, Barbara Bartolini, Francesco Messina, Cesare E. M. Gruber, Emanuela Giombini, Maria R. Capobianchi, Fabrizio Carletti, Francesca Colavita, Concetta Castilletti, Eleonora Lalle, Daniele Lapa, Giuseppe Ippolito.
EPI_ISL_418167	hCoV-19/Italy/INMI4/2020	Europe/Italy/Rome	2020-02-28	INMI Lazzaro Spallanzani IRCCS	Laboratory of Virology, INMI Lazzaro Spallanzani IRCCS	Cesare E. M. Gruber, Martina Rueca, Barbara Bartolini, Francesco Messina, Emanuela Giombini, Maria R. Capobianchi, Fabrizio Carletti, Francesca Colavita, Concetta Castilletti, Eleonora Lalle, Daniele Lapa, Giuseppe Ippolito.
EPI_ISL_417362	hCoV-19/USA/WA-UW213/2020	North America/USA/Washington	2020-03-13	UW Virology Lab	UW Virology Lab	Pavitra Roychoudhury, Hong Xie, Keith Jerome, Alexander Greninger

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_415480	hCoV-19/Netherlands/NA_23/2020	Europe/ Netherlands/	2020-03-09	Dutch COVID-19 response team	Erasmus Medical Center	David Nieuwenhuijse, Bas Oude Munnink, Reina Sikkema, Claudia Schapendonk, Irina Chestakova, Anne van der Linden, Mark Pronk, Pascal Lexmond, Corien Swaan, Manon Haverkate, Madelief Mollers, Mart Stein, Sandra Kengne Kamga Mobou, Jeroen van Kampen, Jolanda Voermans, Aura Timen, Corine GeurtsvanKessel, Annemiek van der Eijk, Richard Molenkamp, Marion Koopmans, on behalf of the Dutch national COVID-19 response team.
EPI_ISL_413587	hCoV-19/Netherlands/Tilburg_1364286/2020	Europe/ Netherlands/ Tilburg	2020-03-03	Foundation Elisabeth-Tweesteden Ziekenhuis	Erasmus Medical Center	David Nieuwenhuijse, Bas Oude Munnink, Reina Sikkema, Claudia Schapendonk, Irina Chestakova, Anne van der Linden, Mark Pronk, Pascal Lexmond, Corien Swaan, Manon Haverkate, Madelief Mollers, Mart Stein, Sandra Kengne Kamga Mobou, Jeroen van Kampen, Jolanda Voermans, Aura Timen, Corine GeurtsvanKessel, Annemiek van der Eijk, Richard Molenkamp, Marion Koopmans, on behalf of the Dutch national COVID-19 response team.

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_413591	hCoV-19/Netherlands/ Zeewolde_1365080/2020	Europe/ Netherlands/ Zeewolde	2020-03-02	MHC Flevoland	Erasmus Medical Center	David Nieuwenhuijse, Bas Oude Munnink, Reina Sikkema, Claudia Schapendonk, Irina Chestakova, Anne van der Linden, Mark Pronk, Pascal Lexmond, Corien Swaan, Manon Haverkate, Madelief Mollers, Mart Stein, Sandra Kengne Kanga Mobou, Jeroen van Kampen, Jolanda Voermans, Aura Timen, Corine GeurtsvanKessel, Annemiek van der Eijk, Richard Molenkamp, Marion Koopmans, on behalf of the Dutch national COVID-19 response team.
EPI_ISL_417923	hCoV-19/Italy/INMI5/2020	Europe/Italy/Rome	2020-03-04	INMI Lazzaro Spallanzani IRCCS	Laboratory of Virology, INMI Lazzaro Spallanzani IRCCS	Francesco Messina, Barbara Bartolini, Martina Rueca, Cesare E. M. Gruber, Emanuela Giombini, Maria R. Capobianchi, Fabrizio Carletti, Francesca Colavita, Concetta Castilletti, Eleonora Lalle, Daniele Lapa, Giuseppe Ippolito.
EPI_ISL_416141	hCoV-19/Denmark/ SSI-09/2020	Europe/Denmark/ Copenhagen	2020-03-03	Department of Virus and Microbiological Special diagnostics, Statens Serum Institut, Copenhagen, Denmark.	Statens Serum Institute	Morten Rasmussen, Maiken Worsoe Rosenstjerne, Anders Fomsgaard
EPI_ISL_414019	hCoV-19/Switzerland/ GE3121/2020	Europe/ Switzerland/ Geneva	2020-02-27	Laboratoire de Virologie, HUG	Swiss National Reference Centre for Influenza	LAUBSCHER Florian <i>et al.</i>
EPI_ISL_415787	hCoV-19/Peru/010/2020	South America/ Peru/Lima	2020-03-10	Laboratorio de Referencia Nacional de Virus Respiratorio. Instituto Nacional de Salud. Peru	Laboratorio de Referencia Nacional de Referencia y Biología Molecular. Instituto Nacional de Salud. Peru	Carlos Padilla Rojas, Priscila Lope Pari, Karolyn Vega Chozo, Johanna Balbuena Torres, Omar Caceres Rey, Hemri Bailon Calderon, Maribel Huaranga Nuñez, Nancy Rojas Serrano

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_416428	hCoV-19/ Vietnam/39607/2020	Asia/Vietnam/ Quangning	2020-03-07	National Influenza Center, National Institute of Hygiene and Epidemiology (NIHE)	National Influenza Center, National Institute of Hygiene and Epidemiology (NIHE)	Le Quynh Mai, Taichiro Takemura, Meng Ling Moi, Takeshi Nabeshima, Nguyen Le Khanh Hang, Hoang Vu Mai Phuong, Ung Thi Hong Trang, Le Thi Thanh, Nguyen Vu Son, Vuong Duc Cuong, Pham Thi Hien, Tran Thu Huong, Nguyen Phuong Anh, Pham Hong Quynh Anh, Kouichi Morita, Futoshi Hasebe, Dang Duc Anh
EPI_ISL_412912	hCoV-19/Germany/ Baden-Wuerttemberg-1/2020	Europe/Germany/ Baden-Wuerttemberg	2020-02-25	State Health Office Baden-Wuerttemberg	Charité Universitätsmedizin Berlin, Institute of Virology	Victor M Corman, Julia Schneider, Barbara Mühlemann, Talitha Veith, Jörn Beheim-Schwarzbach, Terry Jones, Rainer Oehme, Silke Fischer, Christian Drosten
EPI_ISL_415629	hCoV-19/Scotland/ EDB004/2020	Europe/United Kingdom/Scotland	2020-03-04	Virology Department, Royal Infirmary of Edinburgh, NHS Lothian	Virology Department, Royal Infirmary of Edinburgh, NHS Lothian	McHugh M, Dewar R, O'Toole Á, Rambaut A, Williams TC, Templeton K
EPI_ISL_413555	hCoV-19/Wales/PHW1/2020	Europe/United Kingdom/Wales	2020-02-27	Wales Specialist Virology Centre	Public Health Wales Microbiology Cardiff	Catherine Moore, Cen Sabu, Joanne Watkins, Sally Corden, Tom Connor
EPI_ISL_414027	hCoV-19/Scotland/ CVR05/2020	Europe/United Kingdom/Scotland	2020-03-04	West of Scotland Specialist Virology Centre, NHSGGC	MRC-University of Glasgow Centre for Virus Research	Emma Thomson, Antonia Ho; Kathy Smollett, Daniel Mair, Stephen Carmichael, Ana da Silva Filipe; Richard Orton, David L Robertson; Alasdair MacLean, Rory Gunson.
EPI_ISL_416426	hCoV-19/Hungary/ mb11/2020	Europe/Hungary/ Budapest	2020-03-17	Virological Research Group, Szentágothai Research Centre, University of Pécs	Bioinformatics Research Group, Szentágothai Research Centre, University of Pécs	Péter Urbán, Endre Gábor Tóth, Gábor Kemenesi, Róbert Herczeg, Attila Gyenesi, Ferenc Jakab
EPI_ISL_416519	hCoV-19/New Zealand/20VR0189/2020	Oceania/New Zealand/Auckland	2020-03-02	Auckland Hospital	Institute of Environmental Science and Research (ESR)	Matt Storey, Xiaoyun Ren, Gary McAuliffe, Sally Roberts, Matthew Blakiston, Erasmus Smit, Lauren Jelly, Joep de Ligt

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_417390	hCoV-19/Australia/ NSW27/2020	Oceania/Australia/ New South Wales/ Sydney	2020-03-08	Centre for Infectious Diseases and Microbiology Public Health	NSW Health Pathology - Institute of Clinical Pathology and Medical Research; Westmead Hospital; University of Sydney	Sadsad R, Carter I, Rahman H, Holmes EC, O'Sullivan MV, Sintchenko V, Chen SC, Maddocks S, Kok J, Dwyer DE, Rockett R, Eden J-S, Lam C, Gray K, Timms V, Gall M and Arnott A for the 2019-nCoV Study Group
EPI_ISL_416744	hCoV-19/Hungary/49/2020	Europe/Hungary/ Baranya	2020-03-20	Virological Research Group, Szentágothai Research Centre	Bioinformatics Research Group, Szentágothai Research Centre	Péter Urbán, Endre Gábor Tóth, Gábor Kemenesi, Robert Herczeg, Attila Gyenesei, Ferenc Jakab
EPI_ISL_414586	hCoV-19/Ireland/ Limerick-19934/2020	Europe/Ireland/ Limerick	2020-03-03	UCD National Virus Reference Laboratory	UCD National Virus Reference Laboratory	Michael Carr, Gabriel Gonzalez, Jonathan Dean, Suzie Coughlan, Alison Murphy, Kevin Byrne, Ken Wolfe, Jeff Connell, Brendan Loftus, Cillian F De Gascun
EPI_ISL_417016	hCoV-19/Belgium/ ULG-6503/2020	Europe/Belgium/ Liège	2020-03-13	Department of Clinical Microbiology	GIGA Medical Genomics	Durkin Keith, Artesi Maria, Bontems Sébastien, Boreux Raphaël, Meex Cécile, Melin Pierrette, Hayette Marie-Pierre, Bours Vincent.
EPI_ISL_417430	hCoV-19/Belgium/ RT-03035/2020	Europe/Belgium/ Vorst	2020-03-03	KU Leuven, Clinical and Epidemiological Virology	KU Leuven, Clinical and Epidemiological Virology	Joan Marti-Carerras, Tony Wawina, Bert Vanmechelen, Piet Maes
EPI_ISL_414646	hCoV-19/Finland/ FIN-266/2020	Europe/Finland/ Huslab	2020-03-04	Department of Virology and Immunology, University of Helsinki and Helsinki University Hospital, Huslab Finland	Department of Virology, Faculty of Medicine, University of Helsinki, Helsinki, Finland	Teemu Smura, Hannimari Kallio-Kokko, Olli Vapalahti

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_416481	hCoV-19/Georgia/Tb-712/2020	Asia/Georgia/Tbilisi	2020-03-16	R. G. Lugar Center for Public Health Research, National Center for Disease Control and Public Health (NCDC) of Georgia.	R. G. Lugar Center for Public Health Research, National Center for Disease Control and Public Health (NCDC) of Georgia.	Gvantsa Chanturia, Marine Murtskhvaladze, Nato Kotaria, Ann Machablishvili, Lela Sabadze, Mari Gavashelidze, Ana Papkiauri, Meri Pantulalata, Gvantsa Brachveli, Tata Imnadze, Tamar Jashiasvili, Tea Tevdoradze, Ketevan Sidamonidze, Ekaterine Khmaladze, Ekaterine Zhghenti, Roena Sukhiasvili, Mariam Zakalashvili, Lela Urushadze, Magda Dgebuadze, Giorgi Tomashvili, Davit Tsaguria, Ekaterine Zangaladze, Nino Berishvili, Adam Kotorashvili, Maia Alkhazashvili, Irma Burjanadze, Anna Kasradze, Khatuna Zakhashvili, Paata Imnadze, Amiran Gamkrelidze.
EPI_ISL_416524	hCoV-19/Japan/SMU-0311S2/2020	Asia/Japan/Saitama	2020-03-11	Saitama Medical University Hospital	Saitama Medical University	Kazuo Imai
EPI_ISL_413999	hCoV-19/Switzerland/AG0361/2020	Europe/Switzerland/Argovie	2020-02-27	Laboratoire de Virologie, HUG	Swiss National Reference Centre for Influenza	LAUBSCHER Florian <i>et al.</i>
EPI_ISL_415585	hCoV-19/Canada/BC_65034/2020	North America/Canada/British Columbia	2020-03-04	BCCDC Public Health Laboratory	BCCDC Public Health Laboratory	Harrigan, Prystajecky, Krajden, Lee, Kamelian, Lapointe, Choi, Hoang, Sekirov, Levett, Tyson, Snutch, Loman, Quick, Li, Gilmour
EPI_ISL_412975	hCoV-19/Australia/NSW05/2020	Oceania/Australia/New South Wales/Sydney	2020-02-28	Centre for Infectious Diseases and Microbiology Laboratory Services	NSW Health Pathology - Institute of Clinical Pathology and Medical Research; Westmead Hospital; University of Sydney	Eden J-S, Carter I, Rahman H, Holmes EC, Rockett R, O'Sullivan MV, Sintchenko V, Chen SC, Maddocks S, Kok J and Dwyer DE for the 2019-nCoV Study Group
EPI_ISL_416458	hCoV-19/Kuwait/KUI2/2020	Asia/Kuwait/Hawali	2020-03-02	Virology laboratory Ministry of Health Kuwait sequenced at Dasman Diabetes Institute	Dasman Diabetes Institute	Fahd Al-Mulla, Sumi John, Sara Alqabandi, Rasheeba iqbal, Motasem Melhem, Ebaa alOzauri, Qais Al-Duwairi

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_417031	hCoV-19/Australia/QLDID919/2020	Oceania/Australia/Queensland/Gold Coast	2020-03-11	Pathology Queensland	Public Health Virology Laboratory	Bixing Huang, Alyssa Pyke, Amanda De Jong, Andrew Van Den Hurk, Carmel Taylor, David Warrilow, Doris Genge, Elisabeth Gamez, Glen Hewitson, Ian Maxwell Mackay, Inga Sultana, Jamie McMahon, Jean Barcelon, Judy Northill, Mitchell Finger, Natalie Simpson, Neelima Nair, Peter Burtonclay, Peter Moore, Sarah Wheatley, Sean Moody, Sonja Hall-Mendelin, Timothy Gardam, and Frederick Moore
EPI_ISL_406597	hCoV-19/France/IDF0373/2020	Europe/France/Ile-de-France/Paris	2020-01-23	Department of Infectious and Tropical Diseases, Bichat Claude Bernard Hospital, Paris	National Reference Center for Viruses of Respiratory Infections, Institut Pasteur, Paris	Mélanie Albert, Marion Barbet, Sylvie Behillil, Méline Bizard, Angela Brisebarre, Flora Donati, Vincent Enouf, Maud Vanpeene, Sylvie van der Werf, Yazdan Yazdanpanah, Xavier Lescure.
EPI_ISL_416521	hCoV-19/Saudi Arabia/SCDC-3321/2020	Asia/Saudi Arabia/	2020-03-10	Public Health Laboratory	Public Health Laboratory, Saudi CDC	Albarrag, A
EPI_ISL_414524	hCoV-19/England/200991076/2020	Europe/United Kingdom/England	2020-03-01	Respiratory Virus Unit, Microbiology Services Colindale, Public Health England	Respiratory Virus Unit, Microbiology Services Colindale, Public Health England	Monica Galiano, Shalhahan Miah, Angie Lackenby, Omolola Akinbami, Tiina Talls, Leena Bhaw, Richard Myers, Steven Platt, Kirstin Edwards, Jonathan Hubb, Joanna Ellis, Maria Zambon

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_416477	hCoV-19/Georgia/Tb-390/2020	Asia/Georgia/Tbilisi	2020-03-08	R. G. Lugar Center for Public Health Research, National Center for Disease Control and Public Health (NCDC) of Georgia.	R. G. Lugar Center for Public Health Research, National Center for Disease Control and Public Health (NCDC) of Georgia.	Marine Murtskhaladze, Nato Kotaria, Ann Machablishvili, Lela Sabadze, Mari Gavashelidze, Ana Papkauri, Meri Pantsulaia, Gvantsa Brachveli, Tata Immadze, Tamar Jashishvili, Tea Tevdoradze, Ketevan Sidamonidze, Ekaterine Khmaladze, Ekaterine Zhghenti, Roena Sukhishvili, Mariam Zakalashvili, Lela Urushadze, Magda Dgebuadze, Giorgi Tomashvili, Davit Tsaguria, Ekaterine Zangaladze, Nino Berishvili, Gvantsa Chanturia, Adam Kotorashvili, Maia Alkhazashvili, Irma Burjanadze, Anna Kasradze, Khatuna Zakhashvili, Paata Immadze, Amiran Gamkrelidze.
EPI_ISL_417034	hCoV-19/Brazil/AMBR-02/2020	South America/Brazil/Amazonas State/Manaus	2020-03-16	Laboratorio de Ecologia de Doencas Transmissíveis na Amazonia, Instituto Leonidas e Maria Deane - Fiocruz Amazonia	Laboratorio de Ecologia de Doencas Transmissíveis na Amazonia, Instituto Leonidas e Maria Deane - Fiocruz Amazonia	Valdinete Nascimento, André Corado, Fernanda Nascimento, Ágatha Costa, Debora Duarte, Luciana Gonçalves, Michele Jesus, Sérgio Luz, Felipe Naveca
EPI_ISL_415503	hCoV-19/Netherlands/NoordBrabant_46/2020	Europe/Netherlands/Noord Brabant	2020-03-11	Dutch COVID-19 response team	Erasmus Medical Center	David Nieuwenhuijse, Bas Oude Munnink, Reina Sikkema, Claudia Schapendonk, Irina Chestakova, Anne van der Linden, Mark Pronk, Pascal Lexmond, Corien Swaan, Manon Haverkate, Madelief Mollers, Mart Stein, Sandra Kengne Kamga Mobou, Jeroen van Kampen, Jolanda Voermans, Aura Timen, Corine GeurtsvanKessel, Annemiek van der Eijk, Richard Molenkamp, Marion Koopmans, on behalf of the Dutch national COVID-19 response team.

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_414577	hCoV-19/Chile/Talca-1/2020	South America/Chile/Talca	2020-03-02	Hospital de Talca, Chile	Instituto de Salud Publica de Chile	Andrés E. Castillo, Bárbara Parra, Paz Tapia, Alejandra Acevedo, Jaime Lagos, Winston Andrade, Loredana Arata, Gabriel Leal, Gisselle Barra, Carolina Tambley, Javier Tognarelli, Patricia Bustos, Soledad Ulloa, Rodrigo Fasce, Jorge Fernández.
EPI_ISL_407071	hCoV-19/England/01/2020	Europe/United Kingdom/England	2020-01-29	Respiratory Virus Unit, Microbiology Services Colindale, Public Health England	Respiratory Virus Unit, Microbiology Services Colindale, Public Health England	Monica Galiano, Shahjahan Miah, Richard Myers, Angie Lackenby, Omolola Akinbami, Tiina Talts, Leena Bhaw, Kirstin Edwards, Jonathan Hubb, Joanna Ellis, Maria Zambon
EPI_ISL_414520	hCoV-19/Germany/BavPat2/2020	Europe/Germany/Munich	2020-03-02	Bundeswehr Institute of Microbiology	Bundeswehr Institute of Microbiology	Mathias C Walter, Markus H Antwerpen and Roman Wölfel
EPI_ISL_414008	hCoV-19/England/200960041/2020	Europe/United Kingdom/England	2020-02-27	Respiratory Virus Unit, Microbiology Services Colindale, Public Health England	Respiratory Virus Unit, Microbiology Services Colindale, Public Health England	Monica Galiano, Shahjahan Miah, Angie Lackenby, Omolola Akinbami, Tiina Talts, Leena Bhaw, Richard Myers, Steven Platt, Kirstin Edwards, Jonathan Hubb, Joanna Ellis, Maria Zambon
EPI_ISL_414522	hCoV-19/England/200990002/2020	Europe/United Kingdom/England	2020-02-28	Respiratory Virus Unit, Microbiology Services Colindale, Public Health England	Respiratory Virus Unit, Microbiology Services Colindale, Public Health England	Monica Galiano, Shahjahan Miah, Angie Lackenby, Omolola Akinbami, Tiina Talts, Leena Bhaw, Richard Myers, Steven Platt, Kirstin Edwards, Jonathan Hubb, Joanna Ellis, Maria Zambon
EPI_ISL_412028	hCoV-19/Hong Kong/VN20001061/2020	Asia/Hong Kong	2020-01-22	Hong Kong Department of Health	School of Public Health, The University of Hong Kong	Dominic N.C. Tsang, Daniel K. W. Chu, Leo L.M. Poon, Malik Peiris
EPI_ISL_416538	hCoV-19/New Zealand/20VR0275/2020	Oceania/New Zealand/Wellington	2020-03-15	Wellington Hospital	Institute of Environmental Science and Research (ESR)	Wellington SCL, Wellington Hospital, Riddiford Street, Newtown, Wellington 6021, New Zealand

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Accession ID	Virus name	Location	Collection date	Originating laboratory	Submitting laboratory	Authors
EPI_ISL_416489	hCoV-19/USA/WI-02/2020	North America/ USA/Wisconsin/ Dane County	2020-03-15	University of Wisconsin-Madison AIDS Vaccine Research Laboratory	University of Wisconsin-Madison AIDS Vaccine Research Laboratory	Katarina Braun and Gage Moreno
EPI_ISL_411929	hCoV-19/South Korea/SNU01/2020	Asia/South Korea/	2020-01-01	unknown	Department of Clinical Diagnostics	Park, W.B., Kwon, N.-J., Choi, S.-J., Kang, C.K., Choe, P.G., Kim, J.Y., Yun, J., Lee, G.-W., Seong, M.-W., Kim, N., Seo, J.-S. and Oh, M.-D.
EPI_ISL_414476	hCoV-19/USA/NY1-PV08001/2020	North America/ USA/New York	2020-02-29	MSHS Clinical Microbiology Laboratories	MSHS Pathogen Surveillance Program	Gopi Patel, Emilia Sordillo, Melissa Gitman, Alberto Paniz-mondolfi, Matthew Hernandez, Shelcie Fabre, Jose Polanco, Ana Sylvia Gonzalez-Reiche, Zenab Khan, Nancy Francoeur, Melissa Smith, Robert Sebra, Lisa Miorin, Wen-chun Liu, Randy Albrecht, Judith Aberg, Florian Krammer, Adolfo Garcia-Sarstre, Viviana Simon, Harm van Bakel
EPI_ISL_416432	hCoV-19/Saudi Arabia/KAIMRC-Alghoribi/2020	Asia/Saudi Arabia/ Riyadh	2020-03-07	Clinical Microbiology Lab	Infectious Disease Research Department, King Abdullah International Medical Research Center (KAIMRC)	Majed Alghoribi, Sadeem Alhayli, Abdulrahman Alswaji, Liliane Okdah, Sameera Al Johani, Michel Doumith
EPI_ISL_415128	hCoV-19/Brazil/ES-225/2020	South America/ Brazil/Espirito Santo/Vila Velha	2020-02-29	LACEN/ES - Laboratório Central de Saúde Pública do Espírito Santo	Instituto Oswaldo Cruz FIOCRUZ - Laboratory of Respiratory Viruses and Measles (LVRs)	Paola Resende, Allison Fabri, Joilson Xavier, Sunando Roy, Fernando Motta, Aline Mattos, Milene Miranda, Cristiana Garcia, Braulia Caetano, Maria Ogrzewalska, Jonathan Lopes, Luciana Appolinario, Maria Nóbrega, Marilda Siqueira
EPI_ISL_416746	hCoV-19/France/Valence_425/2020	Europe/France/ ARA	2020-03-03	CNR Virus des Infections Respiratoires - France SUD	CNR Virus des Infections Respiratoires - France SUD	Bal, Antonin; Destras, Gregory; Gaymard, Alexandre; Bouscambert-Duchamp, Maudé; Cheynet, Valérie; Brengel-Pesce, Karen; Morfin-Sherpa, Florence; Valette, Martine; Josset, Laurence; Lina, Bruno.

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EPI_ISL_415601	hCoV-19/USA/WA-UW73/2020	North America/USA/Washington	2020-03-10	UW Virology Lab	UW Virology Lab	Pavitra Roychoudhury, Hong Xie, Keith Jerome, Alexander Greninger
EPI_ISL_417212	hCoV-19/NewZealand/CoV002/2020	Oceania/New Zealand/Otago	2020-03-11	Dunedin Hospital	University of Otago	M.E. Quiñones-Mateu, B. Lawley, J. Grant, R. Harfoot, J. Ussher
EPI_ISL_412869	hCoV-19/South Korea/KCDC05/2020	Asia/South Korea/Seoul	2020-01-30	Division of Viral Diseases, Center for Laboratory Control of Infectious Diseases, Korea Centers for Diseases Control and Prevention	Division of Viral Diseases, Center for Laboratory Control of Infectious Diseases, Korea Centers for Diseases Control and Prevention	Jeong-Min Kim, Yoon-Seok Chung, Namjoo Lee, Mi-Seon Kim, Sang Hee Woo, Hye-Jun Jo, Sehee Park, Heui Man Kim, Myung Guk Han
EPI_ISL_415577	hCoV-19/Canada/BC_69243/2020	North America/Canada/British Columbia	2020-02-20	BCCDC Public Health Laboratory	BCCDC Public Health Laboratory	Harrigan, Prystajecky, Krajden, Lee, Kamelian, Lapointe, Choi, Hoang, Sekirov, Levett, Tyson, Snutch, Loman, Quick, Li, Gilmour
EPI_ISL_413490	hCoV-19/New Zealand/01/2020	Oceania/New Zealand/Auckland	2020-02-27	Auckland Hospital	Institute of Environmental Science and Research (ESR)	Matt Storey, Xiaoyun Ren, Gary McAuliffe, Sally Roberts, Matthew Blakiston, Erasmus Smit, Lauren Jelly, Joep de Light
EPI_ISL_415644	hCoV-19/Georgia/Tbilisi	Asia/Georgia/Tbilisi	2020-02-28	R. G. Lugar Center for Public Health Research, National Center for Disease Control and Public Health (NCDC) of Georgia.	R. G. Lugar Center for Public Health Research, National Center for Disease Control and Public Health (NCDC) of Georgia.	Nato Kotaria, Marine Murtskhvaladze, Ann Machablishvili, Lela Sabadze, Mari Gavashelidze, Ana Papkauri, Meri Pantsulata, Gvantsa Brachveli, Tata Imnadze, Tamar Jashiaishvili, Tea Tevdoradze, Ketevan Sidamonidze, Ekaterine Khmaladze, Ekaterine Zhghenti, Roena Sukhiasvili, Mariam Zakalashvili, Lela Urushadze, Magda Dgebuadze, Giorgi Tomashvili, Davit Tsaguria, Ekaterine Zangaladze, Nino Berishvili, Gvanisa Chanturia, Adam Kotorashvili, Maia Alkhazashvili, Irma Burjanadze, Anna Kasradze, Khatuna Zakhashvili, Paata Imnadze, Amiran Gamkrelidze.

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EPI_ISL_413862	hCoV-19/Guangdong/ GD2020086-P0021/2020	Asia/China/ Guangdong	2020-02-01	Guangdong Provincial Institution of Public Health, Guangdong Provincial Center for Disease Control and Prevention	Guangdong Provincial Institution of Public Health	Jing Lu, Louis du Plessis, Liu Zhe, Jiufeng Sun, Sarah François, Huifang Lin, Moritz Kraemer, Jingju Peng, Qianlin Xiong, Runyu Yuan, Lilian Zeng, Pingping Zhou, Chuming Liang, Tao Liu, Wei Li, Juan Su, Huanying Zheng, Kang Min, Song Tie, Bo Peng, Shisong Fang, Wenzhe Su, Kuibiao Li, Ruijin Sun, Ru bai, Xi Tang, Minfeng Liang, Nuno Faria, Josh Quick, Andrew Rambaut, Verity Hill, Wenjun Ma, Nick Loman, Oliver Pybus, Changwen Ke
EPI_ISL_416327	hCoV-19/Shanghai/ SH0014/2020	Asia/China/ Shanghai	2020-01-28	Shanghai Public Health Clinical Center, Shanghai Medical College, Fudan University	National Research Center for Translational Medicine (Shanghai), Ruijin Hospital affiliated to Shanghai Jiao Tong University School of Medicine & Shanghai Public Health Clinical Center	Shengyue Wang, Xiaonan Zhang, Gang Lu, Yun Tan, Yun Ling, Hongzhou Lu, Saijuan Chen
EPI_ISL_416886	hCoV-19/Malaysia/ MKAK-CL-2020- 6430/2020	Asia/Malaysia/ Selangor	2020-02-20	National Public Health Laboratory	Malaysia Genome Institute	Mohd Noor Mat Isa, Irmí Suhayu Sapian, Yusuf Muhammd Noor, Hezreen Iqbal, Mohd Faizal Abu Bakar, Enizza Kassim, Shamsidar Sopie, Azrin Ahmad, Norazfa Johari, Norazimah Tajudin, Selvanesan Sengol, Yu Kie Chem, Hani Mat Hussin, Shahrul Hisham Zainal Ariffin
EPI_ISL_415588	hCoV-19/Canada/ BC_83109/2020	North America/ Canada/British Columbia	2020-03-05	BCCDC Public Health Laboratory	BCCDC Public Health Laboratory	Harrigan, Prystajeky, Krajden, Lee, Kamelian, Lapointe, Choi, Hoang, Sekirov, Levett, Tyson, Snutch, Loman, Quick, Li, Gilmour

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EPI_ISL_416388	hCoV-19/Shanghai/SH0091/2020	Asia/China/Shanghai	2020-02-05	Shanghai Public Health Clinical Center, Shanghai Medical College, Fudan University	National Research Center for Translational Medicine (Shanghai), Ruijin Hospital affiliated to Shanghai Jiao Tong University School of Medicine & Shanghai Public Health Clinical Center	Shengyue Wang, Xiaonan Zhang, Gang Lu, Yun Tan, Yun Ling, Hongzhou Lu, Saijuan Chen
EPI_ISL_413550	hCoV-19/Nigeria/Lagos01/2020	Africa/Nigeria/Lagos	2020-02-27	Centre for Human and Zoonotic Virology (CHAZVY), College of Medicine University of Lagos/Lagos University Teaching Hospital (LUTH), part of the Laboratory Network of the Nigeria Centre for Disease Control (NCDC)	African Centre of Excellence for Genomics of Infectious Diseases (ACEGID), Redeemer's University, Ede, Osun State, Nigeria	Oluniyi P.E., Ajogbasile F.V., Kayode A., Oguzie J., Folarin O.A., Ihekweazu C. Happi C.T.
EPI_ISL_417027	hCoV-19/USA/UT-00009/2020	North America/USA/Utah	2020-03-20	Utah Public Health Laboratory	Utah Public Health Laboratory	Erin Young, Kelly Oakeson
EPI_ISL_414477	hCoV-19/Czech Republic/951/2020	Europe/Czech Republic/Usti nad Labem	2020-03-01	The National Institute of Public Health Center for Epidemiology and Microbiology	State Veterinary Institute Prague	Alexander Nagy, Oldrich Bartos, Helena Jirincova, Klara Labska, Ludmila Novakova, Olga Storkanova, Dusan Trnka, Jaromira Vecerova
EPI_ISL_417314	hCoV-19/England/20112112106/2020	Europe/United Kingdom/England	2020-03-10	Respiratory Virus Unit, Microbiology Services Colindale, Public Health England	Respiratory Virus Unit, Microbiology Services Colindale, Public Health England	Monica Galiano, Shahjahan Miah, Angie Lackenby, Omolola Akinbami, Tiina Talts, Leena Bhaw, Richard Myers, Steven Platt, Kirstin Edwards, Jonathan Hubb, Joanna Ellis, Maria Zambon
EPI_ISL_415590	hCoV-19/Canada/BC_78548/2020	North America/Canada/British Columbia	2020-03-05	BCCDC Public Health Laboratory	BCCDC Public Health Laboratory	Harrigan, Prystajecky, Krajden, Lee, Kamelian, Lapointe, Choi, Hoang, Sekirov, Levett, Tyson, Snutch, Loman, Quick, Li, Gilmour

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EPI_ISL_416315	hCoV-19/Hong Kong/ CUHK2/2020	Asia/Hong Kong/	2020-02-19	Department of Microbiology, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong SAR, China	Department of Microbiology, Faculty of Medicine, Chinese University of Hong Kong, Hong Kong SAR, China	Zigui Chen, Paul KS Chan
EPI_ISL_406799	hCoV-19/Wuhan/ WH02/2019	Asia/China/Wuhan	2019-12-31	General Hospital of Central Theater Command of People's Liberation Army of China	BGI & Institute of Microbiology, Chinese Academy of Sciences & Shandong First Medical University & Shandong Academy of Medical Sciences & General Hospital of Central Theater Command of People's Liberation Army of China	Weijun Chen, Yuhai Bi, Weifeng Shi and Zhenhong Hu
EPI_ISL_414934	hCoV-19/Shandong/ LY001/2020	Asia/China/ Shandong	2020-01-21	Shandong Provincial Center for Disease Control and Prevention	Beijing Institute of Microbiology and Epidemiology	Xiao-Lin Jiang, Xiao-Li Zhang, Xiang-Na Zhao, Cun-Bao Li, Jie Lei, Zeng-Qiang Kou, Wen-Kui Sun, Yang Hang, Feng Gao, Sheng-Xiang Ji, Can-Fang Lin, Bo Pang, Ming-Xiao Yao, Guo-Lin Wang, Lin Yao, Li-Jun Duan, Xiao Wei, Dian-Ming Kang, Mai-Juan Ma
EPI_ISL_413747	hCoV-19/China/ WF0017/2020	Asia/China/	2020-02-01	Weifang Center for Disease Control and Prevention	Weifang Center for Disease Control and Prevention & BGI-Shenzhen	Qing Nie, Xingguang Li, Erik M Volz, Han Fu, Haowei Wang, Xiaoyue Xi, Wei Chen, Dehui Liu, Yingying Chen, Mengmeng Tian, Wei Tan, Junjie Zai, Wanying Sun, Jiandong Li, Junhua Li
EPI_ISL_414639	hCoV-19/USA/ NY-NYUMC1/2020	North America/ USA/New York/ Nassau County	2020-03-04	NYU Langone Health	Departments of Pathology and Medicine, New York University School of Medicine	John Chen, Dacia Dimartino, Xiaojun Feng, Adriana Heguy, Megan Hogan, Emily Huang, George Jour, Christian Marier, Matthew T. Maurano, Mark J. Mulligan, Peter Meyn, Marie Samanovic-Golden, Amy Rapkiewicz, Guomiao Shen, Matija Snuderl, Gael Westby, Paul Zappile

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EPI_ISL_413523	hCoV-19/India/1-31/2020	Asia/India/Kerala	2020-01-31	Indian Council of Medical Research-National Institute of Virology	National Influenza Center, Indian Council of Medical Research-National Institute of Virology	Potdar V, Yadav PD, Choudhary ML, Shete-Aich A
EPI_ISL_413522	hCoV-19/India/1-27/2020	Asia/India/Kerala	2020-01-27	Indian Council of Medical Research - National Institute of Virology	National Influenza Center, Indian Council of Medical Research - National Institute of Virology	Potdar V, Yadav PD, Choudhary ML, Shete-Aich A