

# THE LANCET

## Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

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## Supplementary information

### *Definition of chunyun*

*Chunyun*, also known as the Spring Festival travel season, is a period in China with extremely high traffic load around the Lunar New Year. It begins 15 days before the Lunar New Year's Day and lasts for 40 days. Before the first day of Spring Festival, passengers usually leave from developed coastal cities and railway interchange cities such as Beijing, Shanghai, Shenzhen and Guangzhou to less developed regions. The passenger flow direction is reversed after the Spring Festival. *Chunyun* 2019 was from 21 January 2019 to 1 March 2019 while *chungyun* 2020 is from 10 January 2020 to 18 February 2020.

### *Mobility data*

The mobility data were from three sources:

- a) The monthly number of domestic and international flight bookings from Wuhan in January to February 2019 obtained from Official Airline Group (OAG)
- b) The daily number of domestic passengers by means of transportation (i.e. air, train and road) recorded by Tencent's LBS (location-based services) database from Wuhan to 334 prefecture-level cities in mainland China from 6 January to 7 March 2019 (<https://heat.qq.com/>)
- c) The domestic passenger volumes from and to Wuhan during *chungyun* 2020 estimated by Wuhan Municipal Transportation Management Bureau in the press releases in December 2019 [15]

Since the passengers recorded by the LBS database were only those using Tencent's services (e.g. WeChat, QQ, PUBG and Tencent Maps etc.), we calibrated the passenger volumes recorded in b) by comparing the number of passengers by air in b) with the actual number of domestic flight bookings in a). We found that the number of passengers in a) and b) were highly correlated, with the Pearson's correlation coefficient of 0.944 (among the top 40 domestic destinations).

Domestic outbound passengers by air consists 86.5% of all outbound air volume. We first selected the top 40 destination cities which accounted for 94% of all outbound domestic flight volume of Wuhan and calculated the ratio of daily number of domestic passengers by air between OAG and Tencent. Then the ratios of the top 40 cities were weighted by the number of bookings of OAG and averaged during the period from 6 January to 7 March 2019 to obtain a scaling ratio  $\gamma$  to upscale the number of domestic passengers by air, train and road recorded in Tencent's LBS database. The domestic passenger volumes from all 334 prefecture-level cities recorded in 2) were scaled up with  $\gamma$  as the estimates of actual passenger volumes by air, train and road. The

estimated passenger volumes during *chunyun* 2019 were used to estimate passenger volumes in *chunyun* 2020 from Wuhan by adjusting the difference in the overall volumes between 2019 and 2020.

**Table S1. Exported cases to cities outside of mainland China as of 18:00 HKT on 28 Jan 2020**

Country/region	City	Sex	Age	Date of symptom onset	Date of confirmation	Time between symptoms onset and confirmation (days)
Thailand	Bangkok	F	61	1/5/2020	1/12/2020	7
Thailand	Bangkok	F	74	1/5/2020	1/17/2020	12
Thailand	Bangkok	M	68	1/19/2020	1/19/2020	0
Thailand	Nakhon Pathom	F	73	12/31/2019	1/22/2020	22
Thailand	Bangkok	F	33	1/21/2020	1/24/2020	3
Thailand	-	-	-	-	1/26/2020	-
Thailand	-	-	-	-	1/26/2020	-
Thailand	-	-	-	-	1/27/2020	-
Thailand	-	-	-	-	1/28/2020	-
Thailand	-	-	-	-	1/28/2020	-
Thailand	-	-	-	-	1/28/2020	-
Thailand	-	-	-	-	1/28/2020	-
Thailand	-	-	-	-	1/28/2020	-
Thailand	-	-	-	-	1/28/2020	-
Vietnam	Hanoi	M	66	1/17/2020	1/23/2020	6
Vietnam	Hanoi	M	28	1/20/2020	1/23/2020	3
Japan	Kanagawa	M	35	1/3/2020	1/10/2020	7
Japan	Tokyo	M	40+	1/14/2020	1/24/2020	10
Japan	Tokyo	F	30+	1/21/2020	1/25/2020	4
Japan	Aichi Prefecture	M	40+	1/26/2020	1/28/2020	2
Japan	Aichi Prefecture	M	40	1/23/2020	1/26/2020	3
Japan <sup>1</sup>	Nara Prefecture	M	60	1/14/2020	1/28/2020	14
Singapore	Singapore	M	66	1/20/2020	1/23/2020	3
Singapore	Singapore	F	53	1/21/2020	1/24/2020	3
Singapore	Singapore	M	37	1/21/2020	1/24/2020	3
Singapore	Singapore	M	36	1/23/2020	1/26/2020	3
Singapore	Singapore	M	56	1/25/2020	1/28/2020	3
Singapore	Singapore	M	35	1/24/2020	1/28/2020	4
Singapore	Singapore	F	56	-	1/27/2020	-
South Korea	Seoul	F	35	1/17/2020	1/20/2020	3
South Korea	Seoul	M	55	1/10/2020	1/24/2020	14
South Korea		M	54	1/22/2020	1/26/2020	4
South Korea		M	55	1/21/2020	1/27/2020	6

United States	Snohomish	M	30 +	1/19/2020	1/20/2020	1
United States	Chicago	F	60	1/16/2020	1/24/2020	8
United States	Orange County	-	-	-	1/26/2020	-
United States	Los Angeles	-	-	-	1/26/2020	-
United States	Arizona	-	-	1/22/2020	1/26/2020	4
France	Bordeaux	M	48	1/23/2020	1/24/2020	1
France	Paris	M	31	1/19/2020	1/25/2020	6
France	Paris	F	30	1/23/2020	1/25/2020	2
Nepal		M	31	1/13/2020	1/24/2020	11
Australia	Sydney	M	53	1/20/2020	1/25/2020	5
Australia	Sydney	M	43	1/20/2020	1/25/2020	5
Australia	Sydney	M	35	1/7/2020	1/25/2020	18
Australia	Melbourne	M	50 +	1/23/2020	1/25/2020	2
Australia	Sydney	F	21	-	1/27/2020	-
Malaysia <sup>2</sup>		F	65	No symptoms	1/25/2020	-
Malaysia <sup>2</sup>		M	2	No symptoms	1/25/2020	-
Malaysia <sup>2</sup>		M	11	No symptoms	1/25/2020	-
Malaysia	Johor Bahru	M	40	1/23/2020	1/25/2020	2
Canada	Toronto	M	50 +	1/23/2020	1/26/2020	3
Canada	Toronto	F	50 +	-	1/27/2020	-
Cambodia	Sihanoukville City	M	60	1/26/2020	1/27/2020	1
Germany	Starnberg	M		-	1/27/2020	-
Sri Lanka	Colombo	F	43	1/25/2020	1/27/2020	2
Taiwan	Taipei	F	55	1/11/2020	1/21/2020	10
Taiwan		M	50 +	1/20/2020	1/24/2020	4
Taiwan		F	50 +	1/21/2020	1/24/2020	3
Taiwan		F	50 +	1/22/2020	1/26/2020	4
Taiwan		F	50 +	1/25/2020	1/27/2020	2
Taiwan		F	70 +	1/25/2020	1/28/2020	3
Taiwan		F	70	1/25/2020	1/28/2020	3

			+			
Hong Kong <sup>3</sup>	Hong Kong	M	39	-	1/22/2020	-
Hong Kong <sup>3</sup>	Hong Kong	M	56	1/19/2020	1/22/2020	3
Hong Kong <sup>3</sup>	Hong Kong	F	62	1/20/2020	1/25/2020	5
Hong Kong <sup>3</sup>	Hong Kong	F	62	1/23/2020	1/25/2020	2
Hong Kong <sup>3</sup>	Hong Kong	M	63	1/23/2020	1/25/2020	2
Hong Kong <sup>3</sup>	Hong Kong	M	47	-	1/26/2020	-
Hong Kong <sup>3</sup>	Hong Kong	M	63	-	1/26/2020	-
Hong Kong <sup>3</sup>	Hong Kong	F	68	-	1/26/2020	-
Macau <sup>3</sup>	Macau	F	52	1/21/2020	1/21/2020	0
Macau <sup>3</sup>	Macau	M	66	1/22/2020	1/22/2020	0
Macau <sup>3</sup>	Macau	F	58	1/23/2020	1/26/2020	3
Macau <sup>3</sup>	Macau	F	39	1/25/2020	1/26/2020	1
Macau <sup>3</sup>	Macau	F	21	1/25/2020	1/26/2020	1
Macau <sup>3</sup>	Macau	M	15	No symptoms	1/27/2020	-
Macau <sup>3</sup>	Macau	F	67	1/26/2020	1/28/2020	2

<sup>1</sup>This case was not included because he got infected locally in Japan after close contacts with tourists from Wuhan.

<sup>2</sup> Identified from close contacts of Singapore cases

<sup>3</sup> These cases were not included in the estimation of outbreak size because they transit in Shenzhen/Zhuhai before coming to Hong Kong/Macau.

**Table S2. Social and personal non-pharmaceutical interventions that have been implemented in mainland China in January 2020**

<b>Social non-pharmaceutical interventions</b>	<b>Date</b>	<b>Estimated effectiveness [17]</b>	<b>Region</b>
All mass gathering activities are cancelled during lunar new year holiday Major tourist attractions closed The lunar new year holiday has been extended to Feb 2, and it could be further extended to Feb 7	1/23 - 1/24 - 1/27 -	Massive social distancing was estimated to reduce 30–50% of transmission in the 1918 influenza pandemic	<b>Nationwide</b>
Long-haul buses suspended between Beijing and other provinces Long-haul buses suspended between Tianjian/Shandong Province and other provinces	1/26 - 1/26 -		<b>Beijing-Tianjin-Hebei Metropolitan Region</b> Beijing, Tianjin
The lunar new year holiday has been extended to Feb 8 in Suzhou The winter vacation of all schools has been extended to Feb 17 in Suzhou The winter vacation of all schools has been extended in Zhejiang Province The winter vacation of all schools has been extended in Shanghai	1/26 - 1/26 - 1/27 - 1/27 -		<b>Yangtze River Delta Economic Zone</b> Shanghai, Hangzhou, Nanjing
Lockdown of Wuhan  Public transportation suspended in 16 cities in Hubei Province Major train stations closed in Hubei Province Lockdown of Ezhou and Yichang The winter vacation of all schools has been extended in Hubei Province	1/24 -  1/25 - 1/25 - 1/25 - 1/25 -		<b>Middle Yangtze River Valley Megalopolis</b> Wuhan, Changsha, Nanchang, Heifei Jiujiang, Yueyang
The lunar new year holiday has been extended to Feb 8 in Guangdong Province The winter vacation of all schools has been extended to Feb 17–24 in Guangdong Province	1/27 - 1/28 -		<b>Pearl River Delta Economic Zone</b> Guangzhou, Shenzhen
<b>Personal non-pharmaceutical interventions</b>	<b>Date</b>	<b>Estimated effectiveness [48]</b>	<b>Region</b>
Face mask plus hand hygiene in reducing the risk of influenza transmission	1/18 -	9%	<b>Nationwide</b>