Real-time nowcast and forecast on the extent of the Wuhan CoV outbreak, domestic and international spread

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Nowcasting
No. of confirmed cases

As of 25 Jan
Estimation of 2019-nCoV epidemic size in Wuhan

As of 25 Jan

$R_0 = 2.13 \ (1.92-2.31)$, Doubling time = 6.2 (5.4-7.4) days

No. of cases (base case): 25,630 (12,260-44,440)

No. of infections (base case): 43,590 (19,522-78,087)

The number of cases was smaller than the number of infections because some infected individuals were still in their incubation period.
Wuhan is Central China’s transportation hub
Estimation of domestic exports by train, air and road

As of 25 Jan

<table>
<thead>
<tr>
<th>City</th>
<th>No. of infections imported from Wuhan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beijing</td>
<td>150 (72-260)</td>
</tr>
<tr>
<td>Shanghai</td>
<td>129 (62-224)</td>
</tr>
<tr>
<td>Chongqing</td>
<td>318 (145-570)</td>
</tr>
<tr>
<td>Guangzhou</td>
<td>123 (59-215)</td>
</tr>
<tr>
<td>Shenzhen</td>
<td>87 (41-152)</td>
</tr>
<tr>
<td>Chengdu</td>
<td>88 (40-156)</td>
</tr>
<tr>
<td>Xi’an</td>
<td>73 (33-130)</td>
</tr>
<tr>
<td>Hangzhou</td>
<td>47 (21-83)</td>
</tr>
<tr>
<td>Guiyang</td>
<td>29 (12-53)</td>
</tr>
<tr>
<td>Nanning</td>
<td>35 (15-64)</td>
</tr>
<tr>
<td>Fuzhou</td>
<td>38 (16-69)</td>
</tr>
<tr>
<td>Tianjin</td>
<td>32 (13-58)</td>
</tr>
<tr>
<td>Xiamen</td>
<td>38 (16-68)</td>
</tr>
<tr>
<td>Kunming</td>
<td>37 (15-67)</td>
</tr>
<tr>
<td>Ningbo</td>
<td>20 (8-37)</td>
</tr>
<tr>
<td>Wenzhou</td>
<td>28 (11-52)</td>
</tr>
<tr>
<td>Qingdao</td>
<td>18 (7-34)</td>
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<tr>
<td>Quanzhou</td>
<td>27 (10-50)</td>
</tr>
</tbody>
</table>

This calculation underestimated the number of cases exported to Hong Kong and Macau because a substantial proportion of travellers from mainland China transited at Shenzhen, Guangzhou and Zhuhai and hence not tractable in our aggregated mobility data.
Forecasting
Quarantine of movement would have limited effects

BSGS: 53% of all international air travel
70% of all international air travel outside Asia

Wuhan not quarantined

Wuhan quarantined from 23 January 2020 onwards

Megapolis
Beijing
Shanghai
Guangzhou
Shenzhen
Chongqing
Quarantine of movement would have limited effects

BSGS: 53% of all international air travel
70% of all international air travel outside Asia
Preparedness of the 2019-nCoV outbreak

- 2019-nCoV may be about to become a global epidemic
- Self-sustaining human-to-human spread is already present in all major Chinese cities
  - Seeding outside mainland China and subsequent local establishment may become inevitable, unless some or all of the following interventions are deployed quickly
- Substantial, draconian measures limiting population mobility should be taken immediately
  - Cancellation of mass gatherings, school closures and instituting work-from-home arrangements
- Should containment fail and local transmission is established, mitigation measures during previous major outbreaks, e.g. SARS, MERS or pandemic influenza could serve as a useful reference template
- Regions with the closest travel links with major Chinese ports, preparedness plans should be readied for deployment at short notice