

Supporting information file

Wuhan and Hubei COVID-19 mortality analysis reveals the critical role of timely supply of medical resources

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Methods

Sources of data

We collected the cumulative number of confirmed, dead and recovered cases (from Jan 21 to March 3, 2020) of COVID-19 patients from official websites of the National Health Commission of China and Hubei Provincial Health Commissions. Number of reserved beds from designated hospitals (from Jan 31 to Feb 24, 2020) were collected from the website of Wuhan Health Commission. Number of makeshift beds from temporary hospitals were collected from websites of multiple newspapers (e.g. Yangzi River Daily). Numbers of the aided health workers by other provinces in China were collected from the websites of multiple internet news media (e.g., https://www.sohu.com/a/375244432_116132; <https://baijiahao.baidu.com/s?id=1659863252153777173&wfr=spider&for=pc>; https://www.thepaper.cn/newsDetail_forward_6077587)

Calculation of COVID-19 mortality and recovery rates

Denote $C(t)$, $D(t)$ and $R(t)$ as the cumulative numbers of confirmed cases, deaths and recovered patients at day t in a specific region, respectively. Crude fatality ratio (CFR) and crude recovery ratio (CRR) are calculated as follows:

$$CFR(t) = D(t) / C(t)$$

$$CRR(t) = R(t) / C(t)$$

The mortality rate at day t is expressed as follows:

$$M(t) = [D(t) - D(t-1)] / [C(t-1) - D(t-1) - R(t-1)]$$

The recovery rate at day t is expressed as follows:

$$Re(t) = [R(t) - R(t-1)] / [C(t-1) - D(t-1) - R(t-1)]$$

Results

Table S1 Parameters of simulated exponential decay and growth functions for the COVID-19 mortality and recovery rates, respectively.

| Regions | China | Hubei | Outside Hubei | Wuhan | Outside Wuhan |
|------------|--|------------------|------------------|------------------|------------------|
| parameters | Fitting with exponential decay mode ($y=y_0+Ae^{-(x/t_1)}$) for daily mortality rate | | | | |
| R^2 | 0.86114 | 0.92529 | 0.38549 | 0.82016 | 0.32498 |
| y_0 | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 |
| A | 0.02166±0.00176 | 0.03723±0.00235 | 0.00957±0.00319 | 0.03852±0.0037 | 0.02663±0.00879 |
| t_1 | 7.06159±0.66075 | 6.52985±0.46806 | 2.20822±0.56442 | 8.73214±1.01259 | 5.80624±2.11055 |
| | Fitting with exponential growth mode ($y= y_0+Ae^{(x/t)}$) for daily recovery rate | | | | |
| R^2 | 0.96371 | 0.94889 | 0.9465 | 0.88056 | 0.9486 |
| y_0 | 0±0 | 0±0 | 0±0 | 0±0 | 0±0 |
| A | 0.00436±4.78E-04 | 0.00292±4.45E-04 | 0.00991±0.00121 | 0.00217±5.47E-04 | 0.00433±7.07E-04 |
| t_1 | 13.43254±0.55782 | 11.99897±0.60954 | 14.79103±0.76109 | 11.4073±0.90491 | 11.78049±0.62738 |

Table S2 Numbers of health workers aided by different provinces/cities in China as of 1 Feb 2020 ^a

| | | | | | | | | | | |
|------------------|-----------|---------|---------|---------|----------------|----------|---------|--------------|----------|---------------|
| Provinces/Cities | Beijing | Tianjin | Hebei | Shanxi | Inner Mongolia | Liaoning | Jilin | Heilongjiang | Shanghai | Jiangsu |
| Number | 1215 | 1289 | 1090 | 1509 | 798 | 2045 | 1179 | 1534 | 1608 | 2757 |
| Provinces/Cities | Zhejiang | Anhui | Fujian | Jiangxi | Shandong | Henan | Hunan | Guangdong | Guangxi | Hainan |
| Number | 1985 | 1324 | 1366 | 1201 | 1782 | 1262 | 1458 | 2452 | 961 | 843 |
| Provinces/Cities | Chongqing | Sichuan | Guizhou | Yunnan | Shanxi | Gansu | Qinghai | Ningxia | Xinjiang | Xinjiang Army |
| Number | 1614 | 1458 | 1401 | 1132 | 919 | 776 | 239 | 787 | 387 | 107 |

^a A total of 38478 health workers are aided by other provinces, and they do not include 3844 health workers aided by the People's Liberation Army of China.

Table S3 Distribution of the 38478 aided health workers in different cities of Hubei as of 1 Feb 2020

| | | | | | | | | | |
|------------------|----------|-----------|---------|---------|-----------|----------|-----------|-------------|---------|
| Cities | Wuhan | Shiyan | Ezhou | Enshi | Huanggang | Huangshi | Jingmen | Jingzhou | Suizhou |
| Number | 31097 | 130 | 839 | 130 | 1197 | 347 | 303 | 826 | 391 |
| Provinces/Cities | Xianning | Xiangyang | Xiaogan | Yichang | Xiantao | Tianmen | Qianjiang | Shennongjia | |
| Number | 493 | 637 | 1337 | 265 | 243 | 150 | 71 | 22 | |

Figure S1

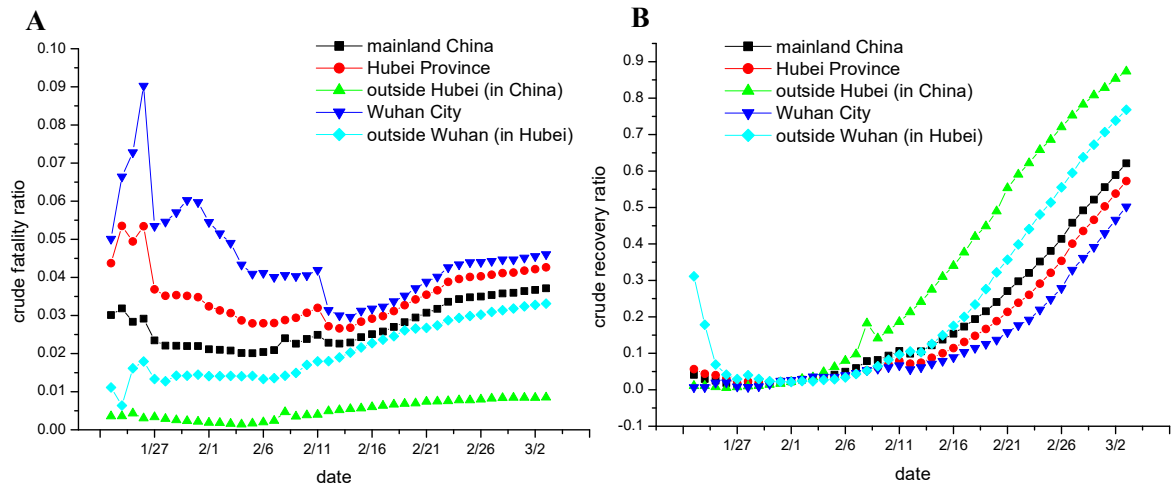


Figure S1. Crude fatality ratio and crude recovery ratio for COVID-19 in China over time and by location, as of 3 March 2020

Crude fatality ratio and crude recovery ratio are the reported cumulative deaths and cumulative recovered patients among the cumulative confirmed cases for each day, respectively. For detail, refer to the Methods section.