Mega city public health policy and Hospital management of COVID-19
-Experience from Shanghai

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The epidemic trend in Shanghai

Sources: HZ Lu, JW Ai, WH Zhang et al. medRxiv
2020.02.19.20025031; doi: https://doi.org/10.1101/2020.02.19.2002503
The epidemics trend of Shanghai (actual vs. predicted)

- The previous epidemics trend prediction of Shanghai by several studies if the transmission was not stopped.
- Shanghai has indeed managed to stopped the exponential growth in less than 2 weeks.

Multiple measures taken by the Shanghai government in the early stage of the epidemics

The population travelling to or leaving Shanghai has significantly decreased by approximately 50%.

All gathering activities and most of the recreational sites including restaurants, theatres and etc. were closed.

Shanghai extended the Spring Festival holidays to 17 days from Jan 24th until Feb 9th to minimize the possible infections from patients in their incubation period.

All citizens were encouraged to stay at home unless for necessary working, shopping, or medical treatment.
Multiple measures in medical and health control

- Shanghai opened 110 designated fever clinics.
- **ALL patients who met 1 epidemiology criteria + 1 clinical relevant symptoms** can go to these clinics.
- If the physicians thought the patient to meet the criteria of suspected COVID-19 infections, the patient would be admitted into the quarantine ward and CDC staff would come for sampling and epidemiological question.
- If nucleic acid test turned our positive, **all patients were enrolled into the designated hospital in Shanghai**
A cohort study from Huashan Hospital, Shanghai

<table>
<thead>
<tr>
<th>Age, median (Range)</th>
<th>COVID-19 positive cases ( \text{N}=20 )</th>
<th>COVID-19 negative case ( \text{N}=33 )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>37 (26-66)</td>
<td>39 (22-88)</td>
<td>0.882</td>
<td></td>
</tr>
</tbody>
</table>

| Sex                  | COVID-19 positive cases \( \text{N}=20 \) | COVID-19 negative case \( \text{N}=33 \) |
|----------------------|---------------------------------|---------------------------------|-----|
| Male                 | 10 (50.0%)                      | 16 (48.5%)                      |

| Signs and symptoms (Range) | COVID-19 positive cases \( \text{N}=20 \) | COVID-19 negative case \( \text{N}=33 \) |
|-----------------------------|---------------------------------|---------------------------------|-----|
| Fever                       | 16 (80.0%)                      | 17 (51.5%)                      |
| Dry cough                   | 11 (55.0%)                      | 19 (57.6%)                      |
| Diarrhea                    | 3 (15.0%)                       | 4 (12.1%)                       |
| Fatigue                     | 2 (10.0%)                       | 2 (6.1%)                        |
| Headache                    | 3 (15.0%)                       | 1 (3.0%)                        |
| Vomiting                    | 1 (5.0%)                        | 0 (0.0%)                        |
| Abdominal pain              | 1 (5%)                          | 0 (0.0%)                        |

<table>
<thead>
<tr>
<th>Laboratory Findings (Range)</th>
<th>COVID-19 positive cases ( \text{N}=20 )</th>
<th>COVID-19 negative case ( \text{N}=33 )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>White blood cell count, ( \times 10^9/\text{L} )</td>
<td>4.21 (2.79-11.32)</td>
<td>8.05 (5.41-11.91)</td>
<td>0.001</td>
</tr>
<tr>
<td>Neutrophil count, ( \times 10^9/\text{L} )</td>
<td>2.88 (0.99-7.95)</td>
<td>5.25 (2.83-11.22)</td>
<td>0.000</td>
</tr>
<tr>
<td>Lymphocyte count, ( \times 10^9/\text{L} )</td>
<td>1.21 (0.30-3.32)</td>
<td>1.58 (0.21-4.64)</td>
<td>0.077</td>
</tr>
</tbody>
</table>
## Use of chest CT, SARS-CoV-2 RT-PCR and multi-plex PCR (or rapid influenza antigen or flu RT-PCR tests) in Huashan Hospital Shanghai

<table>
<thead>
<tr>
<th>Diagnostic methods</th>
<th>Laboratory-confirmed cases (n=20)</th>
<th>Laboratory-confirmed non-COVID (n=33)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2019-nCoV identification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suspected chest CT signs</td>
<td>20/20</td>
<td>20/33</td>
</tr>
<tr>
<td>First time SARS-CoV-2 PCR positive</td>
<td>14/20</td>
<td>0/33</td>
</tr>
<tr>
<td>Second time SARS-CoV-2 PCR positive</td>
<td>3/6</td>
<td>0/33</td>
</tr>
<tr>
<td>mNGS positive for SARS-CoV-2</td>
<td>20/20</td>
<td>0/33</td>
</tr>
<tr>
<td><strong>Other respiratory infection pathogens</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct antigen Flu A+B test positive</td>
<td>0/20</td>
<td>0/33</td>
</tr>
<tr>
<td>Multiplex PCR positive for other pathogens</td>
<td>5/20</td>
<td>7/20</td>
</tr>
<tr>
<td>mNGS positive for other pathogens</td>
<td>11/20</td>
<td>23/33</td>
</tr>
</tbody>
</table>

JW Ai, HC Zhang et al.
medRxiv2020.02.13.20022673; doi: https://doi.org/10.1101/2020.02.13.20022673
Co-infections in the COVID-19 patients

Non NCP cases

- novel coronavirus (2019-nCoV) pneumonia
- non-novel coronavirus (2019-nCoV) pneumonia

NCP Cases with co-infection status

- Rhinovirus/Enterovirus
- Influenza B
- Haemophilus parainfluenzae
- Candida albicans
- Respiratory Syncytial Virus
- Klebsiella aerogenes
- Non-coinfection cases

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Chest CT alone could not precisely diagnose COVID-2019 due to sometimes similar radiological presentations.
Recommended diagnostic flow diagram (1).

1. **Suspected NCP patients**
   - Collect respiratory specimens
   - PCR for other pathogens/Direct antigen test (if applicable)
   - **First time SARS-CoV-2 PCR**
     - **Positive**
     - **Negative**
       - **Second time SARS-CoV-2 PCR**
Recommended diagnostic flow diagram (2).
Timely diagnosis would lead to timely admission of the patients to prevent further local transmission.

The mean incubation period is 6.4 days (95% CI 5.3 to 7.6), and the mean onset-admission interval was 5.5 days (95% CI, 5.1 to 5.9, SD 3.5) in Shanghai.

KEY POINTS of medical and health control in Shanghai and China

All suspected patients should be tested at least twice by CDC

All nucleic tests and treatment are free

All diagnosed patients should be admitted to designated hospital

All close contacts of the diagnosed patients were traced and quarantined for 14 days, and all close contacts of the diagnosed patients received SARS-CoV-2 RT-PCR tests
Early control of the local transmission is the key to stop the diseases spreading

Shanghai’s data showed effective control of the local cases (green bars)

Early control of the local transmission is the key to stop the diseases spreading

Italy’s data showed epidemics mainly due to local transmission

Sources: Huashan Hospital
Failure to control local transmission could lead to spikes in total cases

Disease trend among different regions after a total of 50 cases were reported

Sources: Huashan Hospital
Death cases could sharply increase if epidemics control failed and cause medical resources shortage

Death cases trend among different regions after the first case was reported

Sources: Huashan Hospital
Some supporting reasons for Shanghai management

If not controlled at the early stage, medical resources (especially ICU resources) might in the end face severe shortage, and causing sharp rising of mortality rate (the percentage of severe cases of COVID-19 is around 10-20%)

In Wuhan city without effective control in the early stage, there are 5000 critically ill patients right now. On the contrary, only 5 critically ill patients in Shanghai today.
However ......

If the pandemics failed to be controlled globally, how will we cope with COVID-19?

Management similar to that of seasonal flu? Vaccine?

How to balance between epidemics control to avoid medical (ICU especially) resources shortage and social vitality?

In the end, each country and every state should adapt to its own suitable methods
Thank you!