Use of geospatial information to cope with COVID-19: Korean experience

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I. COVID-19 Outbreak and Response

Definition of COVID-19

February 11, 2020

- New Coronavirus Disease Officially Named COVID-19 By The World Health Organization
- "COVI" comes from coronavirus. The "D" stands for disease. The 19 represents 2019, the year the virus was first identified, in December.
I. COVID-19 Outbreak and Response

Details of Occurrence

1. (1.20) Korea's first corona 19 patient, raising the risk alert for infectious diseases to “Caution”
2. (1.24) Second Patient Occurrence in Korean Intrigued from Wuhan, China
3. (1.27) Infectious Disease Crisis Alert Up to “Warning”
4. (2.18) Daegu OO church related first confirmed patient
5. (2.20) The death of a confirmed patient at Cheongdo OO Hospital (The first case of death in Korea)
6. (2.23) Infectious Disease Crisis Alert Up to “Serious”
7. (3.22) Start “Enhanced Social Distancing”
8. (5.6) Start “Distancing in Daily Life”
9. (6.1) 11,503 confirmed cases, 271 dead

Cumulative Number of COVID-19 Confirmed on 1 June 2020

Number of COVID-19 Confirmed Cases
I. COVID-19 Outbreak and Response

Response System (Severe Phase)

Response System of Central and Local Governments

<table>
<thead>
<tr>
<th>Crisis Alert Phase</th>
<th>Central Government</th>
<th>Local Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>④ Sever Phase</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Central Disaster Control Headquarters
(Korea Centers for Disease Control & Prevention)

Central Disaster and Safety Countermeasures Headquarters
(Prime minister)

Central Disaster Management Headquarters
(Ministry of Health and Welfare)

Pan-governement Countermeasures Support Headquarters
(Ministry of the Interior and Safety)

Local Disaster and Safety Management Headquarters
(local governments)

Infectious Disease Prevention and Control Teams
(local governments)

Roles of Central and Local Governments

Central Disaster Management Headquarters
(Ministry of Health and Welfare)

Central Disaster Control Headquarters
(Korea Centers for Disease Control & Prevention)

Isolation

Local Disaster and Safety Management Headquarters
(local governments)

Local Government
(Provincial and Metropolitan City Level)

City, County, District
(public health center)

Local Hospitals


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# I. COVID-19 Outbreak and Response

## Strategy of Distancing Campaign

Depending on the intensive level of COVID-19 outbreak, social distancing and distancing in daily life are applied depending on the level of severity.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td><strong>Personal and Collective Hygiene Management</strong></td>
</tr>
<tr>
<td></td>
<td>(Compliance with Prevention Rules)</td>
</tr>
<tr>
<td>Phase II</td>
<td><strong>Distancing in Daily Life</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Allowance Principle</strong></td>
</tr>
<tr>
<td></td>
<td>(Goal) Control of new infections at a manageable level within the prevention network</td>
</tr>
<tr>
<td></td>
<td><strong>Limited Allowance</strong></td>
</tr>
<tr>
<td></td>
<td>(Goal) Maintain a trend of decreasing new cases</td>
</tr>
<tr>
<td></td>
<td>(Public) Partial Operation</td>
</tr>
<tr>
<td></td>
<td>(Private) Self-restraint recommendations, industry restrictions</td>
</tr>
<tr>
<td>Phase III</td>
<td><strong>Social Distancing</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Prohibition Principle, Compulsory Measures</strong></td>
</tr>
<tr>
<td></td>
<td>(Goal) Suppression of occurrence to the level that the medical system can handle</td>
</tr>
<tr>
<td></td>
<td>(Public) Outage of operation</td>
</tr>
<tr>
<td></td>
<td>(Private) Interruption recommendations, industry restrictions</td>
</tr>
<tr>
<td></td>
<td><strong>Enhanced Social Distancing</strong></td>
</tr>
</tbody>
</table>
### Distancing in Daily Life

‘Distancing in Daily Life’ is a long-term, continuous prevention system for new daily life that thoroughly prevents infection while maintaining daily life and economic and social activities.

<table>
<thead>
<tr>
<th>Personal Prevention</th>
<th>Basic Rules</th>
<th>Supplementary Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>① Stay home for 3~4 days if you’re sick.</td>
<td>① Wear a mask</td>
</tr>
<tr>
<td></td>
<td>② Keep a distance of two arms’ length between you and other people.</td>
<td>② Disinfect environment</td>
</tr>
<tr>
<td></td>
<td>③ Wash your hands for 30 seconds. Cough/sneeze into your sleeve.</td>
<td>③ Comply with the rules for senior citizens aged 65 or older and high-risk groups</td>
</tr>
<tr>
<td></td>
<td>④ Ventilate your space at least twice a day and disinfect regularly.</td>
<td>④ Healthy lifestyle</td>
</tr>
<tr>
<td></td>
<td>⑤ Keep in touch with family and friends while maintaining physical distancing.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Collective Prevention</th>
<th>Basic Rules</th>
<th>Supplementary Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>① Working together as a member of Community</td>
<td>(Rule) Harmonization of daily life and prevention, learning and participation, creative use</td>
</tr>
<tr>
<td></td>
<td>② Designating an in-community prevention manager</td>
<td>• 12 ministries, 31 detailed guidelines for business sites, public transportation, restaurants, department stores, etc.</td>
</tr>
<tr>
<td></td>
<td>③ Creating and complying with community prevention guidelines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>④ The prevention manager actively performs his role.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>⑤ Actively cooperate with the prevention manager</td>
<td></td>
</tr>
</tbody>
</table>
## II. Use of Information for managing COVID-19

**Data for managing COVID-19**

<table>
<thead>
<tr>
<th>Target</th>
<th>Aim of Data Use</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Prevention</td>
<td>Support for individual prevention through the distancing campaign strategies</td>
<td>Web/App Application of Public Mask Information</td>
</tr>
<tr>
<td>Collective Prevention</td>
<td>Analysis of epidemiological investigation to respond to collective prevention</td>
<td>Web/App Application of Confirmed Patient Information</td>
</tr>
<tr>
<td>Management of Confirmed Patients</td>
<td>Information for monitoring confirmed cases and health management</td>
<td>Epidemiological Investigation System for COVID-19 Confirmed Patient</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Web/App Application of Self-Quarantine Designees</td>
</tr>
</tbody>
</table>
## II. Use of Information for managing COVID-19

### Data Description

<table>
<thead>
<tr>
<th>Individual Prevention</th>
<th>Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public Mask Information</td>
<td>• Sales location and Inventory Information on public mask</td>
</tr>
<tr>
<td></td>
<td>Test Center Information</td>
<td>• Location and guide about test centers for COVID-19</td>
</tr>
<tr>
<td></td>
<td>Individual Confirmed Patient Information</td>
<td>• Locations, means of transportation, and routes of individual confirmed patients</td>
</tr>
<tr>
<td></td>
<td>Clean Zone Information</td>
<td>• Disinfection and location information for multi-use facilities (“Clean Zone”)</td>
</tr>
<tr>
<td>Collective Prevention</td>
<td>Patient Location/Movement Information</td>
<td>• Spatial and temporal information is disclosed to the extent possible, except for the information that can be specified by an individual.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Disclosure of places and means of transportation and movement of confirmed patients which can be used to identify the possible contacts with the patients</td>
</tr>
<tr>
<td>Management of Confirmed Patients</td>
<td>Confirmed patients in quarantine facilities</td>
<td>• Information on the number of patients in quarantine, released, hospitalized, discharged, and deceased</td>
</tr>
<tr>
<td></td>
<td>Patients under investigation or in self-quarantine</td>
<td>• Monitoring information of violators for self-quarantine through electronic wristband (safety band) and self-quarantine app</td>
</tr>
</tbody>
</table>
Ⅱ. Use of Information for managing COVID-19

Web/App Application of Public Mask Information

Provide public mask information through web/app application by integrating the public mask information provided by Health Insurance Review & Assessment Service with pharmacy address data.
Ⅱ. Use of Information for managing COVID-19

Web/App Application of Public Mask Information

<Screenshot of Mask Alarm Service>

- Location-Based Service
- User’s Destination Search

Closest Pharmacy Location
- Status of Mask Stock
- Business Hours
- Time when New Mask Come in
- Update Time for Status Data of Mask Stock

Status of mask stock
II. Use of Information for managing COVID-19

Web/App Application of Confirmed Cases Information

Provide patient information through web/app application by integrating the confirmed patient information provided by Korea Centers for Disease Control and Prevention (KCDC) with the patient’s location data while protecting privacy.
II. Use of Information for managing COVID-19

Web/App Application of Patient Location Information

<Screenshot of COVID-19 Map Service>

- COVID-19 Stats
- Occurrence time of the confirmed cases by local government and test center
- Visited places and time by the patient

Occurring time of the confirmed cases and test center

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/16</td>
<td>코로나19 감염소방소 선발진료소</td>
</tr>
<tr>
<td>4/18</td>
<td>코로나19 감염소방소 선발진료소</td>
</tr>
<tr>
<td>4/26</td>
<td>코로나19 감염소방소 선발진료소</td>
</tr>
<tr>
<td>4/26</td>
<td>코로나19 감염소방소 선발진료소</td>
</tr>
</tbody>
</table>

The time passed after the initial visit by the patient

- 4 days or more and 9 days or less
- 24 hours or more and 4 days or less
- 24 hours or less
## Use of Information for managing COVID-19

### Epidemiological Investigation System for COVID-19 Confirmed Patient

<table>
<thead>
<tr>
<th>Input</th>
<th>Scope of the system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Information of COVID-19 Confirmed Patient</strong></td>
<td><strong>Output</strong></td>
</tr>
<tr>
<td>- Access log and time of base transceiver station (BTS) to patient’s smart phone</td>
<td>Remove privacy data of patient</td>
</tr>
<tr>
<td>- Credit card use history</td>
<td>Share location and time of patient’s movement path and places visited</td>
</tr>
<tr>
<td>- Credit card merchant address</td>
<td></td>
</tr>
<tr>
<td>- Transportation payment details</td>
<td></td>
</tr>
</tbody>
</table>

### Geospatial Information

- Location and Coverage of BTS
- Vehicle Route Information
- Road Network Public Transport Facility
- Location of Card Merchant

### Movement Path Analysis

- Patient’s BTS-based movement path
- Buildings and stores visited by confirmer

### Integrated

- Inform the public (especially who might have contacted the confirmed patient based on the movement path) and actively induce the test through the Web/App application

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II. Use of Information for managing COVID-19

Web/App Application of Self-Quarantine Designee Management

Wearing a safety band is recommended for the violators of the self-quarantine conditions. If they do not agree, they are transferred to the quarantine facility.

- Arrest
- Monitoring and Alarming
  - Dispatching on-site (Dedicated official, Ministry of Health, Police)
- A dedicated official

App for Monitoring and Health Care of Self-Quarantine Designee

Collecting Data through Smart Phone App

Personal Data
- Name
- Date of Birth
- Gender
- Nationality
- Phone Number
- Guardian Contact Number

Geospatial Data
- Current Location
- Motion Detection
- Self-Quarantine Location

Safety Band on Wrist
- Link with Smart Phone’s Bluetooth

Monitoring and Detecting Anomalies of the Following Conditions:
- Departure within 20m of self-quarantine
- Delete app for monitoring and health care of self-quarantine designee
- When there is no movement for a certain period of time
- When the mobile phone is turned off
- In case of network disconnection
- When the safety band is damaged
- When distancing from mobile phone

Location of Base Transceiver Station (BTS) of Mobile Carrier

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Ⅲ. Standard and COVID-19

International Standardization of “K-Prevention Model”

Policy Council

“K-Prevention Model”
- Development of the international standardization roadmap for the 'K-Prevention Model'
- Policy support for the international standardization

Target Domain for Standardization

① Inspection and Confirmation
- Reverse transcription polymerase chain reaction (RT-PCR), diagnostic methodology and kits
- Operation Procedure of drive-through test center
- Operation Procedure of walk-through test center

② Epidemiological Investigation and Monitoring
- Requirement for development of mobile application to manage and monitor self-quarantine patient
- Methodology of automatic transmission and integration of remote self-diagnosis results and electronic medical record (EMR)

③ Quarantine and Health Care
- Digital log sharing of confirmed patients, privacy protection method
- Standard model of operation of daily-life therapy center
- Guidelines for personal hygiene and prevention of infection
- How to ensure access to adequate treatment for the vulnerable people
Ⅲ. Standard and COVID-19

**Geospatial Standard Issues**

| Data Collection | • Guidelines for personal location data collection for identification and monitoring of confirmed patients and the protection of personal information |
| Data Sharing | • Producing and sharing geospatial data for infectious disease among public agencies and private citizens for rapid individual and collective prevention |
| Data Use | • Rapid inspection and quality management of infectious disease data collected through citizen participation |
| Data Analysis | • Spatio-temporal data model for disease spread simulation |
IV. Conclusion

- **Geospatial information is critical** in the response to infectious diseases such as COVID-19
  - GI needs to be combined with other information from various sources
  - Personal as well as administrative data need to be integrated and provided to the public in *near-real time*

- One of the key factors in building the rapid response system to COVID-19 in Korea is the existence of **solid NSDI and data sharing system** through “public data portal”
  - Many Open-API have been developed for ease of public data use
  - By using these APIs, many applications were quickly developed combining data from various sources
  - One of the first COVID-19 Map applications was developed by a university student
IV. Conclusion

- Dissemination of information in timely manner is critical in controlling the spread of the disease.
  - Rapid identification of all possible contacts – test – isolate/cure cycle is based on the premise that the necessary information is available and delivered to the right person at the right time with necessary instructions
  - Geospatial standards played and will continue to play an important role in supporting this cycle
  - However, considering the disastrous impact of the infectious disease on economy and society, we need to work more closely with other domains to make the better integration of information
Questions
THANK YOU