COVID-19 Pandemic Response with ICT and AI: The Case of Korea

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1 Flattening the curve with preemptive tests
Flattening the curve in Korea

[Graph showing confirmed cases in the Republic of Korea from 1200 to 0, with dates and numbers of cases marked along the x-axis and 0 to 1200 new cases along the y-axis. The graph shows a peak in confirmed cases with a recent decline.]

Source: cdc.go.kr
Preemptive tests for COVID-19

Total COVID-19 tests

Source: ourworldindata.org/covid-testing
Preemptive tests for COVID-19

Total COVID-19 tests per 1,000 people

Source: ourworldindata.org/covid-testing

Note: For testing figures, there are substantial differences across countries in terms of the units, whether or not all labs are included, the extent to which negative and pending tests are included and other aspects. Details for each country can be found at the linked page.
An artificial intelligence-based big data system made possible to develop a test kit quickly. It would have taken 2-3 months without the AI system.
MEDIP COVID-19

- Developed by Medical IP, a company for AI medical image analysis platform and medical 3D printing
- AI based medical image analysis software
- Diagnose Covid-19 and pneumonia in 1 minute
- Quantify the amount of virus in grams (g) using AI technology

Source: Medical World News (2020.3.21) ; MTN News (2020.4.1).
2. Social Distancing and Contact Tracing
Aftermath of the MERS crisis in 2015

- The Emergency Operations Center (EOC) under the Korea Centers for Disease Control and Prevention (KCDC) was established to control and command for public health crisis responses on Sep. 1 2015.

Source: Ministry of Health and Welfare (MHW)
Act on Personal Information Protection

**Article 23** forbids the processing of sensitive data of individuals unless
1) explicit approval is obtained from data subject,
2) processing of sensitive information is permitted or requested by relevant laws and regulations.

While the Act has the legal basis for **allowing exceptions to Article 23 in cases of emergency situations** that require the temporary treatment of individual information for **the purposes of public health, safety and security**.
The Emergency Operations Center (EOC) is currently operating the “Covid-19 Analysis Support System” which is based on smart-city technology system using big data analytics. For the system to work properly, individuals’ locational and travel data, medical records, sex, age, nationality etc. must be collected, processed and provided to and between agencies involved.

Act on Prevention and Management of Infectious Disease

Article 76-2 para1 stipulates that government agencies, public organizations, medical organizations, establishments, and individuals are obligated to meet the request for information from the Ministry of Health and Welfare and/or KCDC for dealing with public health issues.

Article 76-2 para2 recently empowered “Province, City, and local administrative authorities” in addition to the existing authorities (MHW, KCDC) to request for locational data of confirmed patients etc. for the purpose of dealing with the Covid-19 crisis (amended on Mar 4, 2020).
Smart Quarantine Information System

- **Airlines**
  - Incoming passengers’ information
  - Quarantine inspection

- **Ministry of foreign affairs**
  - Passport information (Korean nationals)
    - Passport No., resident registration No., address, contact info.
  - Consult & report

- **KCDC**
  - Mobile subscribers’ information (Roaming service information)
  - Immigration records (foreign nationals)
    - Country of exit & entry, and info. of foreign residents in Korea
  - Foreigners’ entry declarations
  - Enter overseas travelers’ information into DUR & Health Insurance Systems
  - System linkage
  - Alert healthcare facilities of patients coming from contaminated countries

- **National Health Insurance Corporation**
  - National Health Insurance Review & Assessment Service

- **Local Health Center**
  - Take measures

- **Healthcare Facilities**
  - Take measures

- **Symptomatic persons**
  - Asymptomatic persons (Entering Korea)
  - Inform risks & guidelines for reporting (Automatic SMS)
  - Consult & report (Call 109)

- **Persons returning from abroad**
  - Take measures

Source: Lee, Sun Gui (2020.3.27)
Covid-19 Analysis Support System

**Analysis of Confirmed Case**
- Before: Direct Analysis by epidemiology investigator (within 24 hrs)
- After: Automatic analysis via system (within 10 min)

**Access and Management of Personal Information**
- Before: Manual access and management, lacking precision
- After: Computer-automated management

**Relationship among Agencies**
- Before: Need to contact each agency, work overload
- After: 28 agencies communicate and share information via emergency operation center

Source: MOLIT (2020.3.25)
Self-Diagnosis Mobile Application

**Outline**
- To monitor and to control people who are required to self-quarantine

**Functions**
- Register personal information and addresses for self-quarantine
- Self-quarantine → Automatically inform the designated officer
- Automatically notify the designated officer when a quarantined patient is not abiding stay-at-home order
- Provide self-quarantine instructions and the designated officer’s contact
Date of latest Self-diagnosis (最近の自己診断提出日時): 2020.03.19 19:06

**Daily Self-Diagnosis**

(一日自己診断チェック)

**Start Self-Diagnosis**

(自己診断開始)

**The Nearest Designated Medical Clinic**

(近くのコロナ専用診療所)

**View**

Only Korean Version is Available (コロナ専用診療所の確認)

**Edit**

(特別検査証の修正)

**KDCS Call Center (1339)** is available 24/7/365

Version: release 2.1.1

[open source logo]

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**Special Quarantine Declaration**

* Passport No. (パスポート番号)

Please Enter Your Passport Number.

* Please select the Region you have visited or actually lived in the last 14 days.

(最近14日以内に訪問したり、実際に滞在地域を選択してください。)

Select (国番号選択)

* Phone Number (携帯電話番号)

PHONE NUMBER VERIFICATION (携帯電話番号確認)

Emergency Contact in Korea (韓国で連絡可能な知人の電話番号)

Please input numbers only, except a hyphen.

Name of School in Korea (韓国内の学校名)

Please enter the name of the school.

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**Self-diagnosis result submitted.**

If you have any abnormal symptoms, please call 1339

(自己診断結果を送信しました。異常症状がある場合は、1339までにお電話ください)

**Proceed with Daily Self Health Check**

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Source: Lee, Sun Gui (2020.3.27)
Hancom AI Check25 (AI call center)

- Hancom* has offered a free AI call center system based on voice recognition and analysis technology
- Checks the body condition (temperature, fever, cough, etc.) → turn responses into data and analyze them
- Allows to monitor the status of targets at a glance
- Resolves the problems of manpower shortage and system overload

* a comprehensive IT group in South Korea

Source: Southerton (2020.3.21)
Korea Centers for Disease Control & Prevention Call Center

- Provide information and guidelines on major infectious diseases
- Provide information on infectious diseases that can affect overseas travelers
- Provide information on travel vaccinations
- Provide information on the methods of preventing, and the standards and process of reporting, notifiable infectious diseases
- Provide other KCDC information and connects you to a person in charge

Service Hours
KCDC Call Center is available 24/7/365
All the services are toll free only in Korea (international rates are charged outside of Korea)

Call-back Service
You will be offered a callback when all lines are busy.

For Foreigners
Please call 1345 (Immigration Contact Center) operated by the Ministry of Justice.
Service Hours : 09:00-22:00

Language : Korean, Chinese, English, Vietnamese, Thai, Japanese, Mongolian, Indonesian/Malay, French, Bengali, Urdu, Russian, Nepali, Khmer, Burmese, German, Spanish, Filipino, Arabic, Sinhala
The purpose of the Act on Basic Disaster and Safety Management is to reflect increased authority to send to central and local governments by type of disaster, improvement of fine dust transmission standards, and increase the capacity of mobile phone disaster text broadcasting (4G, 90 characters) to reflect the action tips for each disaster situation.

The purpose of this Act is to establish disaster and safety management systems of the State and local governments and to prescribe matters necessary for the disaster prevention, preparedness, response, and recovery, activities for safety culture, and disaster and safety management, in order to preserve national land against various disasters and to protect citizens' lives, bodies, and property.

This Act enacted on March. 11, 2004

The State and local governments should actively disclose information about safety and make it convenient for anyone to use.

This Article newly inserted on Dec. 3, 2019

"disaster and safety communications network" means a wireless communications network built and operated by a disaster management agency, emergency rescue agency, or emergency rescue and relief support agency to use for disaster management affairs or for consolidated supervision at disaster scenes.

For efficiently performing disaster broadcasting for the prediction, alert, and notification of a disaster or for the emergency measures and disaster management, a Central Disaster Broadcasting Consultative Committee may be established under the Central Committee. This Act authorizes the government to send mobile text messages (4G, 90 characters) to reflect the action tips for each disaster situation.
Public Masks and Open Data
Leveraging existing System and open data

How to manage the supply of masks: DUR (Drug Utilization Review)

The government utilized DUR system to prevent repeated sales of masks to the same person. DUR system is real-time drug safety inspection program which checks the patient’s medication history.

Source: www.hira.co.kr

* The government limits the number of masks people can buy to two per week to deal with a lack of supplies of masks and implemented 5-day rotation system for mask distribution depending on their year of birth.
Leveraging existing system and open data

The case of public-private cooperation: Mask App Service

1. ‘Public Mask Data’ are collected on portal of HIRA (Health Insurance Review and Assessment Service)

2. NIA (National Information Society Agency) modifies the ‘Public Mask Data’*
   * data: name and location of the store, the code of store, amount in stock, date, etc.

3. NAVER, Kakao, and KT provide ‘Public Mask Data’ in the form of open API for developers

4. Cloud companies (NBP(NAVER Business Platform), KT, NHN, Koscom) provide the developers with Cloud for application development and operation

5. Launching web and mobile services based on cloud

Source: Chung, Tai. M (2020.3.27)
## Providing open government data through portal

The Ministries released open data related to COVID-19 via data portal (www.data.go.kr) in the form of file data or open API.

<table>
<thead>
<tr>
<th>Organization (Data Provider)</th>
<th>Open Government Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Insurance Review &amp; Assessment Service</td>
<td>Information on real-time numbers of available masks, COVID-19 hospitals, etc.</td>
</tr>
<tr>
<td>The Ministry of Foreign Affairs</td>
<td>Information on global/regional COVID-19 situations and safety measures</td>
</tr>
<tr>
<td>The Ministry of Health and Welfare</td>
<td>Information on drive-through COVID-19 testing stations, COVID-19 screening center, designated public relief hospitals, etc.</td>
</tr>
<tr>
<td>The Ministry of Patriots and Veterans Affairs</td>
<td>Information on COVID-19 hospitals for veterans</td>
</tr>
</tbody>
</table>

## Disclosure of COVID-19 patients’ movement paths

Central and local government entities disclose the movement paths of infected patients as per the Infectious Disease Control and Prevention Act.

Source: www.data.go.kr
Leveraging existing system and open data

Processing Datasets
The private-sector companies have processed the open government data and shared datasets

<table>
<thead>
<tr>
<th>Developer</th>
<th>Shared Platform</th>
<th>Datasets</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINDs Lab</td>
<td>Git-hub (social coding platform)</td>
<td>Visualization of the passage of COVID-19 patients</td>
</tr>
<tr>
<td>Hanyang Univ.</td>
<td>Kaggle (a subsidiary of Google LLC, data analytics &amp; machine learning platform)</td>
<td>Structured COVID-19 datasets by categories</td>
</tr>
</tbody>
</table>

Source: ETNews (2020.3.24)

Developing Websites and Mobile Apps
The variety of website and mobile apps have been developed to provide COVID-19 information to the public

<table>
<thead>
<tr>
<th>App</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corona 100m</td>
<td>The app Corona 100m sends an alert to users when they come within 100 meters (328 feet) of a location previously visited by a confirmed patient.</td>
</tr>
<tr>
<td>KMA Corona Fact</td>
<td>The app KMA Corona Fact launched by Korea Medical Association, provides the number of confirmed patients, suspected patients and deaths from the coronavirus as well as links to global websites such as Baidu, WHO, etc.</td>
</tr>
<tr>
<td>Corona Doctor</td>
<td>The app Corona Doctor tracks the movements and information of confirmed patients, and provides information on designated hospitals and quarantine locations.</td>
</tr>
<tr>
<td>Corona Map</td>
<td>The app Corona Map marks in different colors the exact locations where each confirmed patient has been.</td>
</tr>
</tbody>
</table>


HIRA. HIRA system, total solution for value-based healthcare purchasing. Available at [https://www.hira.or.kr/eng/ebook/00_Page_img/extra/00.pdf](https://www.hira.or.kr/eng/ebook/00_Page_img/extra/00.pdf)


Medical World News. (2020.3.21). “Developed MEDIP COVID19, a corona 19 CT analysis software, and distributed worldwide for free.” (in Korean) Available at http://www.medicalworldnews.co.kr/news/view.php?idx=1510934763&sm=w_total&stx=%EC%86%8C%ED%94%84%ED%8A%B8%EC%9B%A8%EC%96%B4&stx2=&w_section1=&sdate=&edate=


THANK YOU