

# COVID-19 & Government response



2<sup>nd</sup> November 2021

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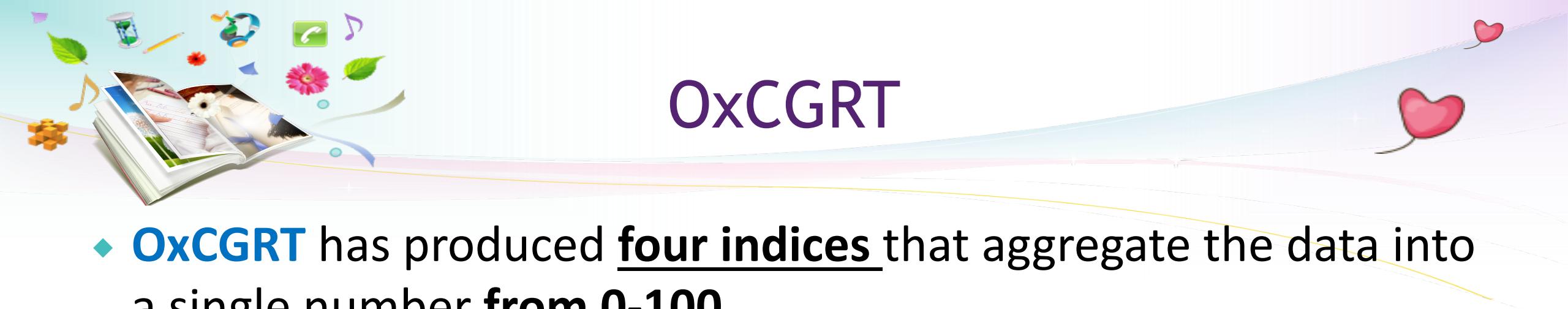
- 01    OxCGRT
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# COVID-19 Government Response Tracker

- ◆ oxCGRT = The **Oxford COVID-19 Government Response Tracker**
- ◆ If we can index the policy changes of each government over time, it will be helpful to analyze **how effective these policies** were in actual containment of COVID-19.
- ◆ **OxCGR**T collects systematic information on policy measures that governments have taken to tackle COVID-19.

"A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker)." Nature Human Behaviour. <https://doi.org/10.1038/s41562-021-01079-8>



# OxCGR

- ◆ OxCGR has produced four indices that aggregate the data into a single number from 0-100.
- ◆ The index cannot say **whether** a government's policy has been implemented effectively.



# Indices of OxCGRT



- ◆ **Overall government response index**

- The index records how the response of governments has varied over all indicators in the database, becoming **stronger** or **weaker** over the course of the outbreak. It is calculated using all ordinal indicators.

- ◆ **Containment and health index**

- The index combines 'lockdown' restrictions and closures with measures such as testing policy and contact tracing, short term investment in healthcare, as well investments in vaccines. It is calculated using all ordinal containment and closure policy indicators and health system policy indicators.



# Indices of OxCGRT

- ◆ **Stringency index**

- The index records the strictness of 'lockdown style' policies that primarily **restrict people's behaviour**. It is calculated using all ordinal containment and closure policy indicators, plus an indicator recording public information campaigns.

- ◆ **Economic support index**

- The index records measures such as **income support** and **debt relief**. It is calculated using all ordinal economic policies indicators.



# Indices of OxCGRT

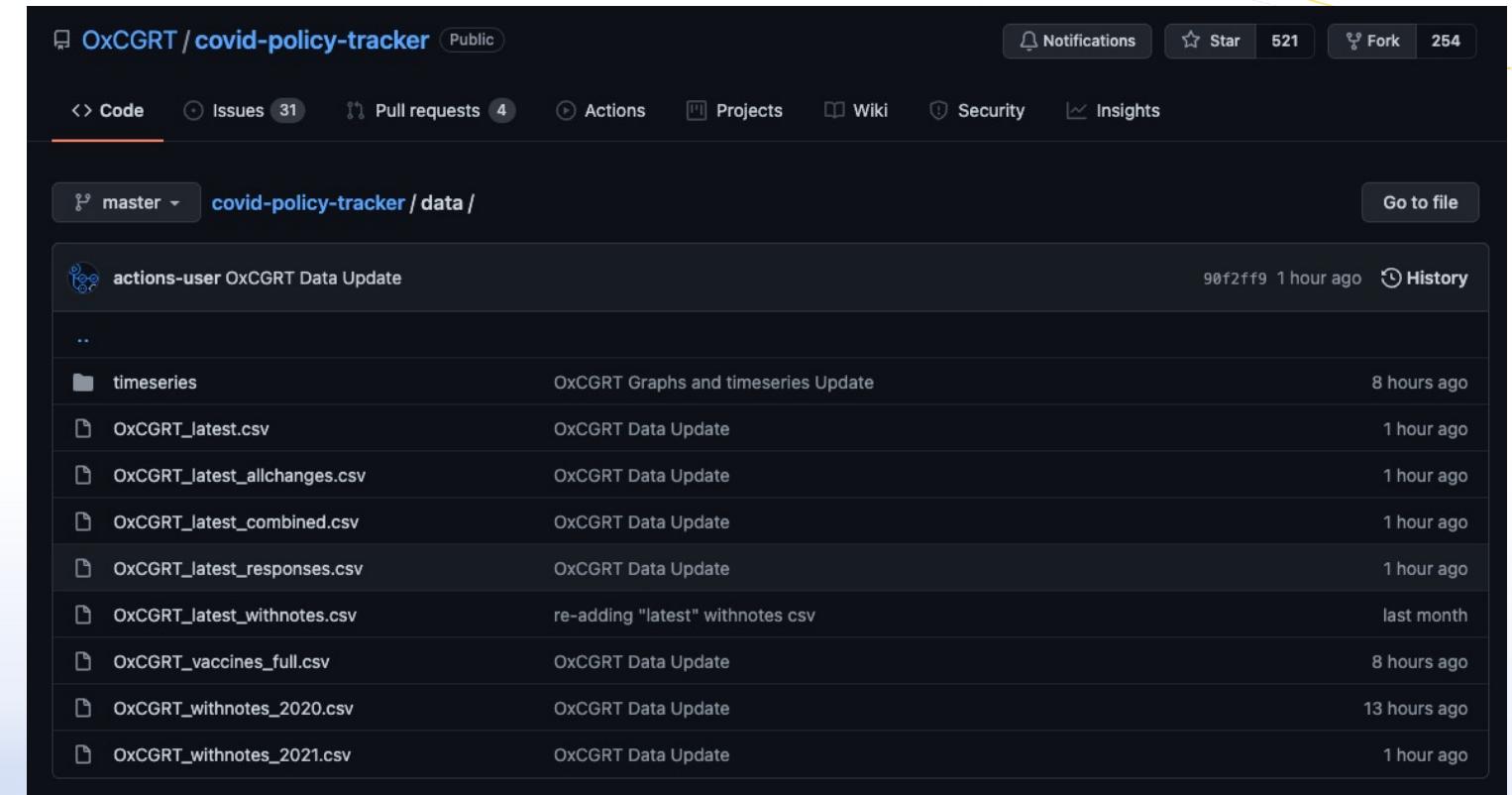
- ◆ **Risk of openness index**

- The index is based on the recommendations set out by the World Health Organization (WHO) of the measures that should be put in place before Covid-19 response policies can be safely relaxed.

# Data sets of OxCGRT

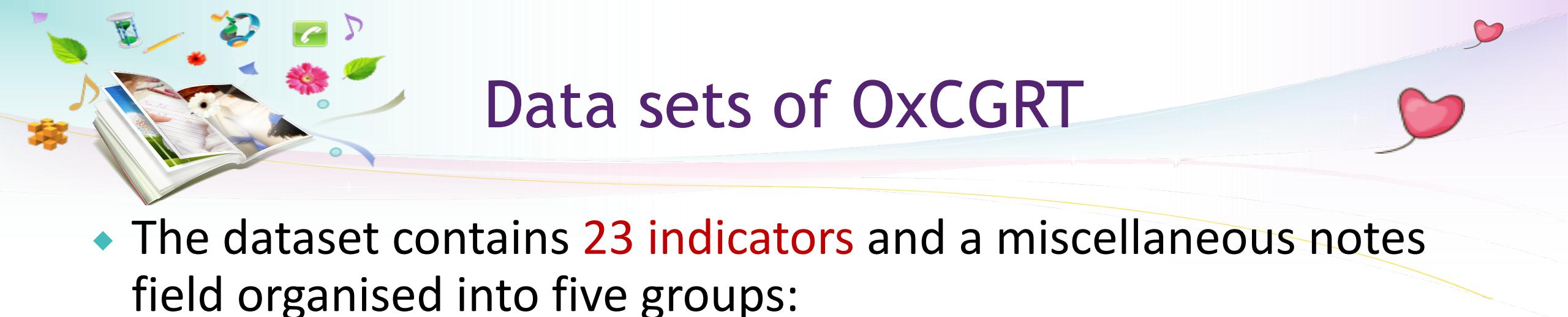
GitHub URL:

<https://github.com/OxCGRt/covid-policy-tracker/tree/master/data>



The screenshot shows the GitHub repository page for 'OxCGRt / covid-policy-tracker'. The repository is public, has 521 stars, 254 forks, and 31 issues. The 'Code' tab is selected. In the 'data' directory, there is a file named 'actions-user OxCGRT Data Update' and a folder named 'timeseries'. The 'timeseries' folder contains several CSV files: 'OxCGRt\_latest.csv', 'OxCGRt\_latest\_allchanges.csv', 'OxCGRt\_latest\_combined.csv', 'OxCGRt\_latest\_responses.csv', 'OxCGRt\_latest\_withnotes.csv', 'OxCGRt\_vaccines\_full.csv', 'OxCGRt\_withnotes\_2020.csv', and 'OxCGRt\_withnotes\_2021.csv'. The 'OxCGRt\_latest\_withnotes.csv' file was updated 'last month'. The other files were updated between 1 hour ago and 8 hours ago.

File/Folder	Description	Last Updated
actions-user OxCGRT Data Update		90f2ff9 1 hour ago
..		
timeseries	OxCGRt Graphs and timeseries Update	8 hours ago
OxCGRt_latest.csv	OxCGRt Data Update	1 hour ago
OxCGRt_latest_allchanges.csv	OxCGRt Data Update	1 hour ago
OxCGRt_latest_combined.csv	OxCGRt Data Update	1 hour ago
OxCGRt_latest_responses.csv	OxCGRt Data Update	1 hour ago
OxCGRt_latest_withnotes.csv	re-adding "latest" withnotes csv	last month
OxCGRt_vaccines_full.csv	OxCGRt Data Update	8 hours ago
OxCGRt_withnotes_2020.csv	OxCGRt Data Update	13 hours ago
OxCGRt_withnotes_2021.csv	OxCGRt Data Update	1 hour ago



# Data sets of OxCGRT

- ◆ The dataset contains **23 indicators** and a miscellaneous notes field organised into five groups:
  - **C** - containment and closure policies (indicators C1-C8)
  - **E** - economic policies (indicators E1-E4)
  - **H** - health system policies (indicators H1-H8)
  - **V** - vaccination policies (indicators V1-3)
  - **M** - miscellaneous policies



# Containment & closure policies of OxCGRT

ID	Name	Description	Measurement	Coding
C1	C1_School closing	Record closings of schools and universities	Ordinal scale	0 - no measures 1 - recommend closing or all schools open with alterations resulting in significant differences compared to non-Covid-19 operations 2 - require closing (only some levels or categories, eg just high school, or just public schools) 3 - require closing all levels Blank - no data



# Economic policies of OxCGRT

ID	Name	Description	Measurement	Coding
E1	E1_Income support (for households)	<p>Record if the government is providing direct cash payments to people who lose their jobs or cannot work.</p> <p>Note: only includes payments to firms if explicitly linked to payroll/salaries</p>	Ordinal scale	<p>0 - no income support</p> <p>1 - government is replacing less than 50% of lost salary (or if a flat sum, it is less than 50% median salary)</p> <p>2 - government is replacing 50% or more of lost salary (or if a flat sum, it is greater than 50% median salary)</p> <p>Blank - no data</p>



# Health system policies of OxCGRT

ID	Name	Description	Measurement	Coding
H1	H1_Public information campaigns	Record presence of public info campaigns	Ordinal scale	0 - no Covid-19 public information campaign 1 - public officials urging caution about Covid-19 2- coordinated public information campaign (eg across traditional and social media) Blank - no data



# Vaccination policies of OxCGRT

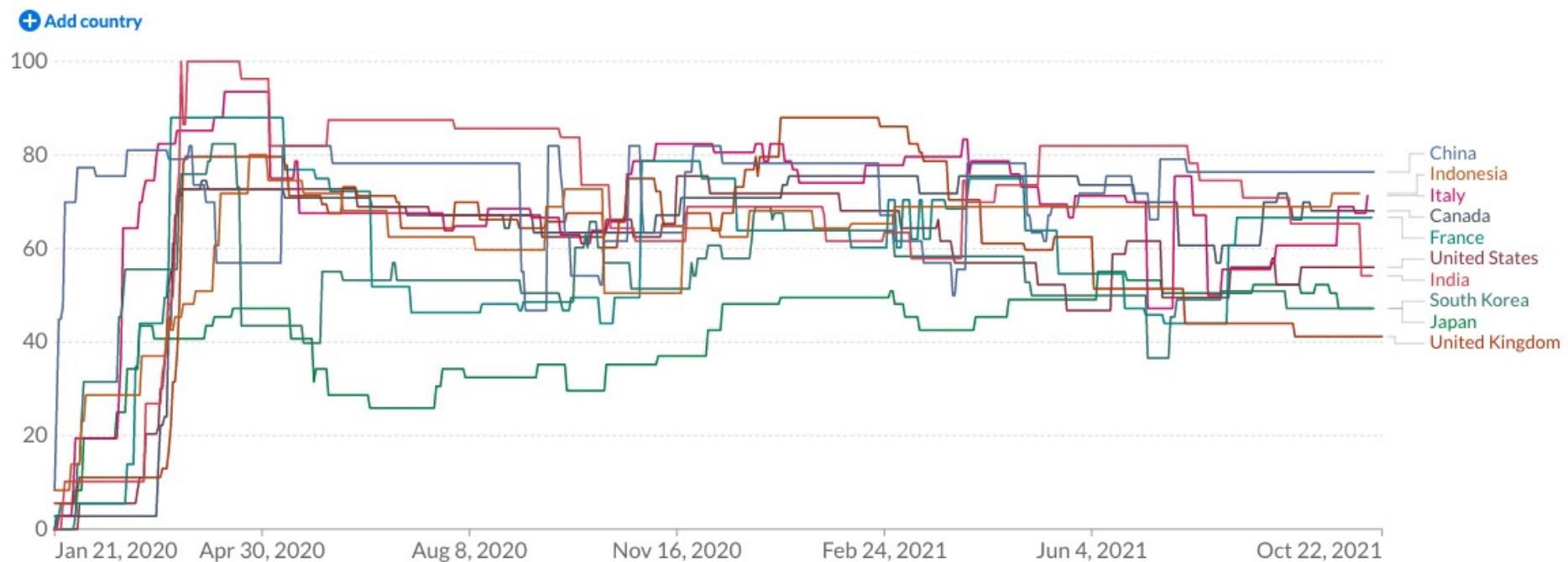
ID	Name	Description	Measurement	Coding
V1	V1_Vaccine prioritisation (summary)	Reports the existence of a prioritised plan for vaccine rollout	Ordinal scale	Blank – no data 0 - no plan 1 – a prioritised plan is in place 2 – universal/general eligibility; no prioritisation between groups

# COVID-19 Stringency Index

## COVID-19 Stringency Index

The stringency index is a composite measure based on nine response indicators including school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100 (100 = strictest). If policies vary at the subnational level, the index shows the response level of the strictest subregion.

Our World  
in Data



Source: Oxford COVID-19 Government Response Tracker, Blavatnik School of Government, University of Oxford – Last updated 22 October 2021, 15:13 (London time)

CC BY

► Jan 21, 2020

Oct 22, 2021

CHART

MAP

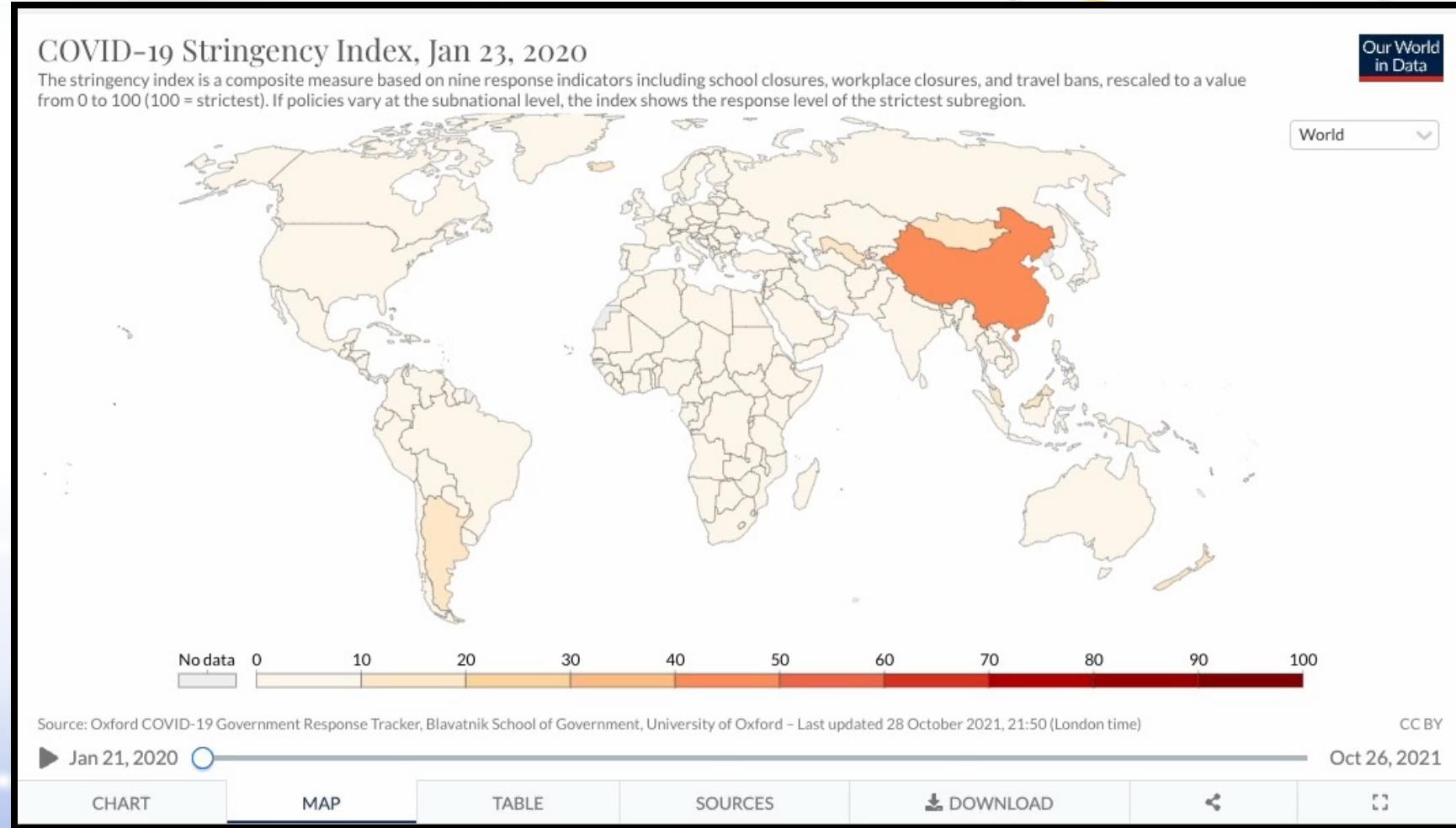
TABLE

SOURCES

DOWNLOAD



# COVID-19 Stringency Index map (world)





02

## Case Study



# Case 1: Forecasting imported COVID-19 cases in South Korea using mobile roaming data

PLOS ONE

RESEARCH ARTICLE

## Forecasting imported COVID-19 cases in South Korea using mobile roaming data

Soo Beom Choi<sup>1,2</sup>, Insung Ahn<sup>1,2\*</sup>

<sup>1</sup> Department of Data-centric Problem Solving Research, Korea Institute of Science and Technology Information, Daejeon, Republic of Korea, <sup>2</sup> Center for Convergent Research of Emerging Virus Infection, Korea Research Institute of Chemical Technology, Daejeon, Republic of Korea

\* [isahn@kisti.re.kr](mailto:isahn@kisti.re.kr)



### Abstract

As the number of global coronavirus disease (COVID-19) cases increases, the number of imported cases is gradually rising. Furthermore, there is no reduction in domestic outbreaks. To assess the risks from imported COVID-19 cases in South Korea, we suggest using the daily risk score. Confirmed COVID-19 cases reported by John Hopkins University Center, roaming data collected from Korea Telecom, and the Oxford COVID-19 Government Response Tracker index were included in calculating the risk score. The risk score was highly correlated with imported COVID-19 cases after 12 days. To forecast daily imported COVID-19 cases after 12 days in South Korea, we developed prediction models using simple linear regression and autoregressive integrated moving average, including exogenous variables (ARIMAX). In the validation set, the root mean squared error of the linear regression model using the risk score was 6.2, which was lower than that of the autoregressive integrated moving average (ARIMA, 22.3) without the risk score as a reference. Correlation coefficient of ARIMAX using the risk score (0.925) was higher than that of ARIMA (0.899). A possible reason for this time lag of 12 days between imported cases and the risk score could be the delay that occurs before the effect of government policies such as closure of airports or lockdown of cities. Roaming data could help warn roaming users regarding their COVID-19 risk status and inform the national health agency of possible high-risk areas for domestic outbreaks.

### OPEN ACCESS

**Citation:** Choi SB, Ahn I (2020) Forecasting imported COVID-19 cases in South Korea using mobile roaming data. PLoS ONE 15(11): e0241466. <https://doi.org/10.1371/journal.pone.0241466>

**Editor:** Qiang Zeng, South China University of Technology, CHINA

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**Published:** November 4, 2020

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**Data Availability Statement:** Data underlying the study belong to third-party sources and are available as follows. Daily series of imported cases of COVID-19 in South Korea are available from daily reports of the Korea Centers for Disease Control and Prevention (<http://ncov.mohw.go.kr/en>). The number of daily confirmed COVID-19 cases in other countries is available from the COVID-19 data repository of the John Hopkins University Center at GitHub (<https://github.com/CSEISG/covid19>). Population data are available from Worldometer (<https://www.worldometers.info/coronavirus/#countries>). The

### Introduction

Since coronavirus disease (COVID-19) was first reported in Wuhan in December 2019, a total of 11 451 030 confirmed cases, including 534 320 deaths, have been reported in 188 countries as of July 6, 2020 [1]. The first imported case in South Korea was reported on January 20, 2020; the traveler had arrived from Wuhan, China [2]. The number of confirmed COVID-19 cases in South Korea rapidly increased February 19, 2020 onward, and Daegu city was identified as the epicenter of regional spread [2]. To delay the spread of COVID-19 without vaccines, governments in most countries have implemented nonpharmaceutical interventions such as home isolation, social distancing, airport closures, and international travel bans [3]. In Germany, the number of daily confirmed COVID-19 cases decreased after the enforcement of lockdown but increased after the lockdown was eased [4]. To prevent another COVID-19

### ◆ Purpose:

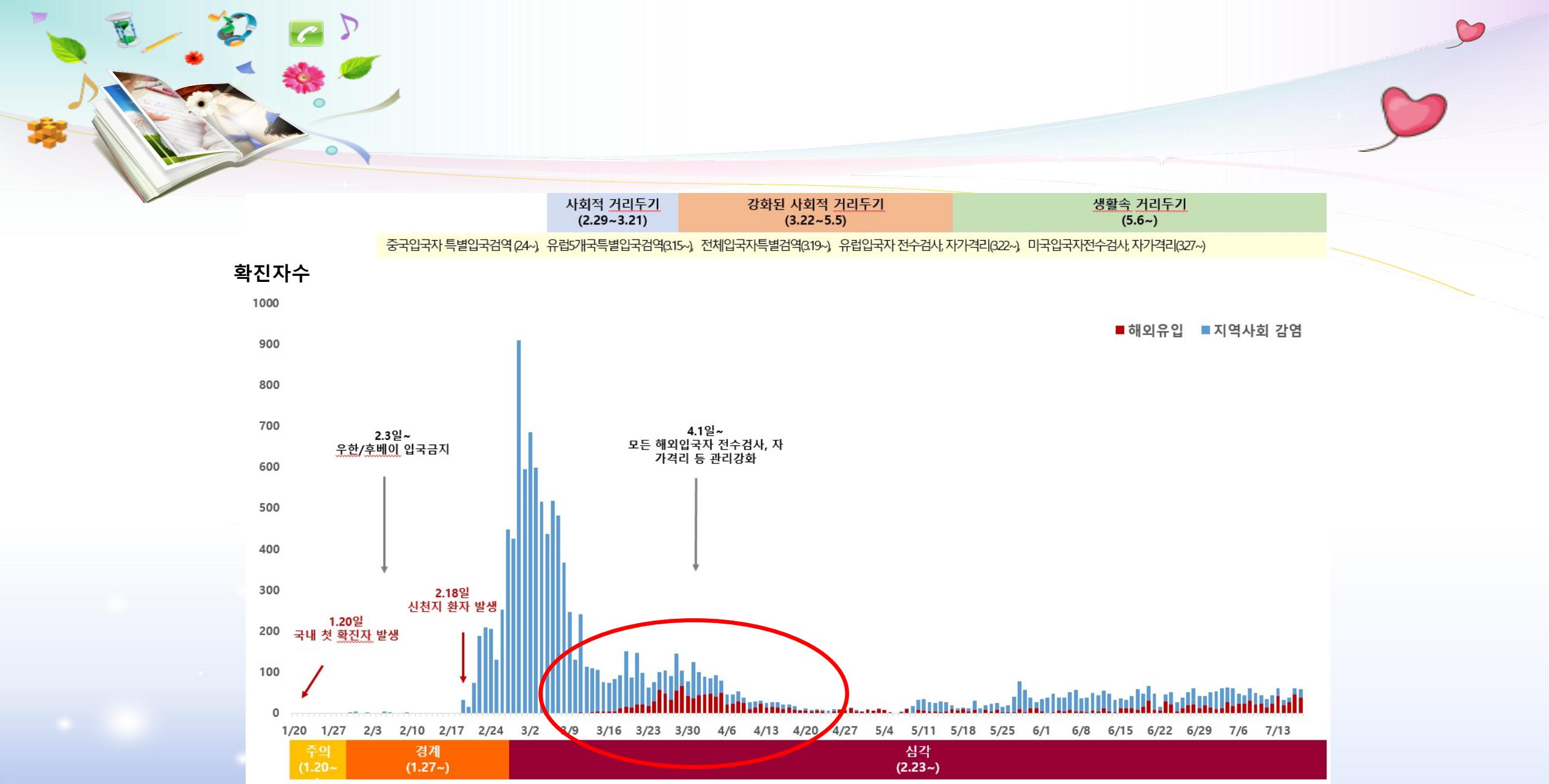
❖ Predicting the risk score from imported COVID-19 cases in Korea

### ◆ Data:

1) Confirmed COVID-19 cases reported by John Hopkins University

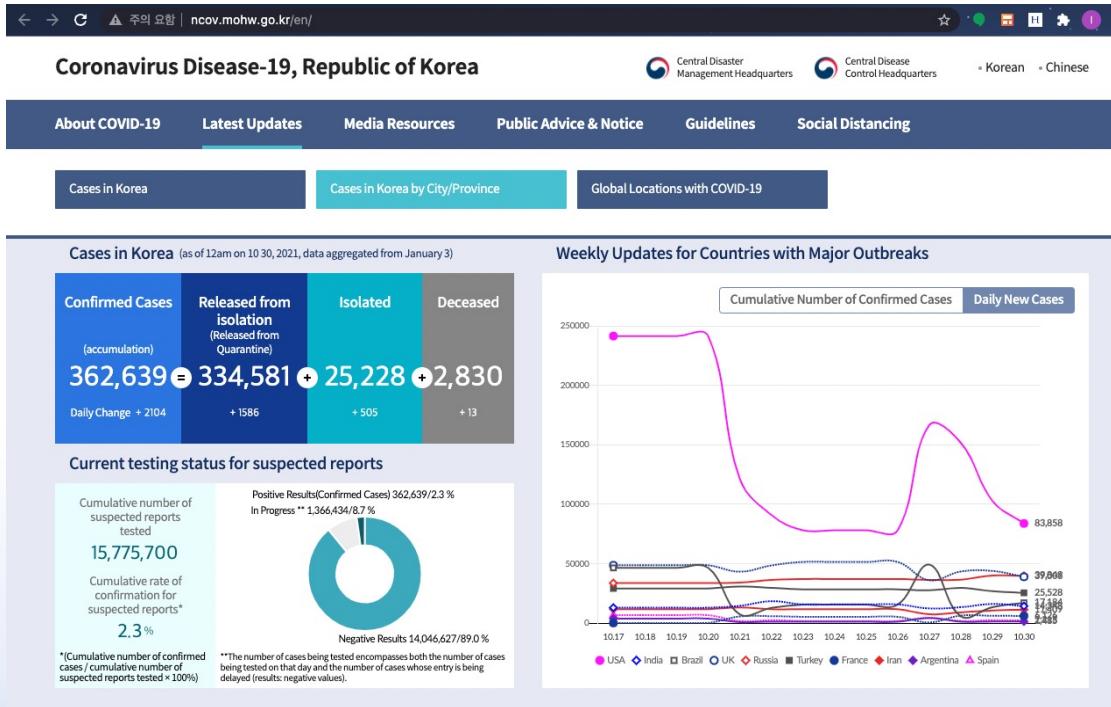
2) Roaming data collected from Korea Telecom

3) The Oxford COVID-19 Government Response Tracker index



출처: 질병관리청 2020년 7월20일 COVID-19 보도자료

# Case 1: Forecasting imported COVID-19 cases in South Korea using mobile roaming data

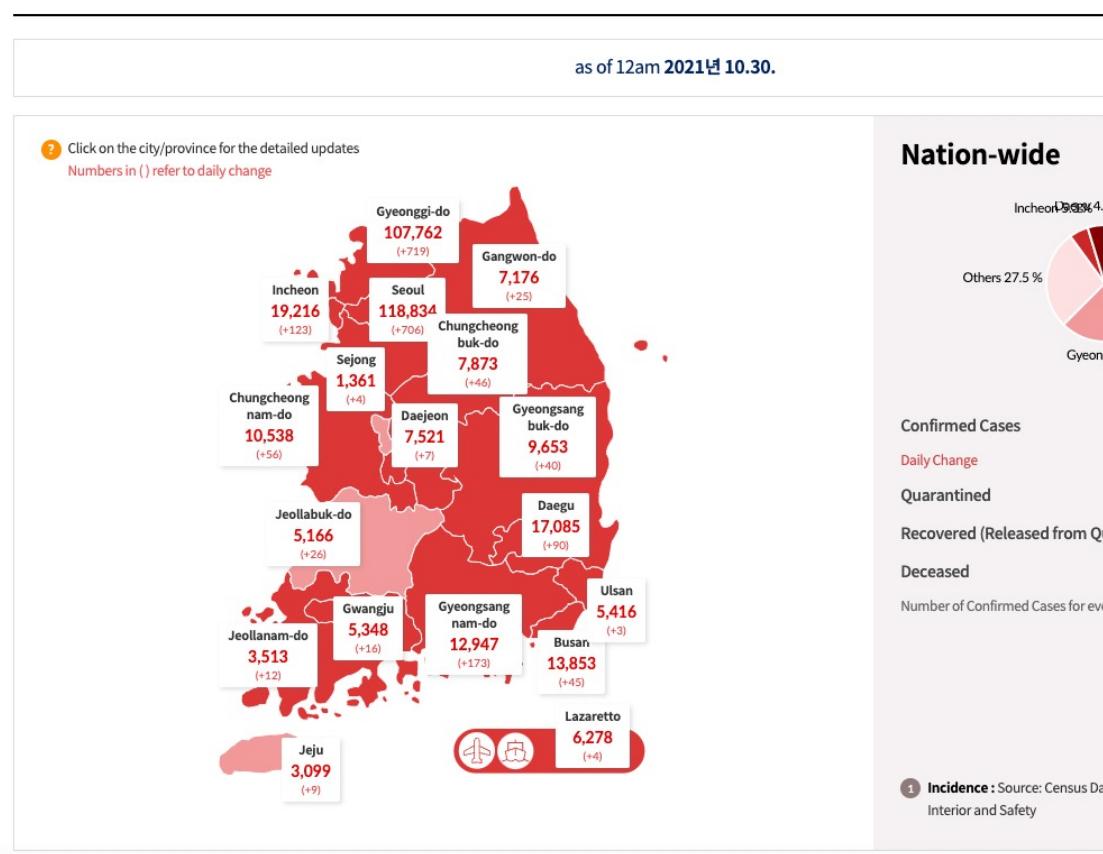


## ◆ Data collection

- The daily series of **imported cases of COVID-19 in South Korea** from January 22, 2020 to July 12, 2020 that are publicly available from daily reports of the Korea Centers for Disease Control and Prevention (KCDC)

# Case 1: Forecasting imported COVID-19 cases in South Korea using mobile roaming data

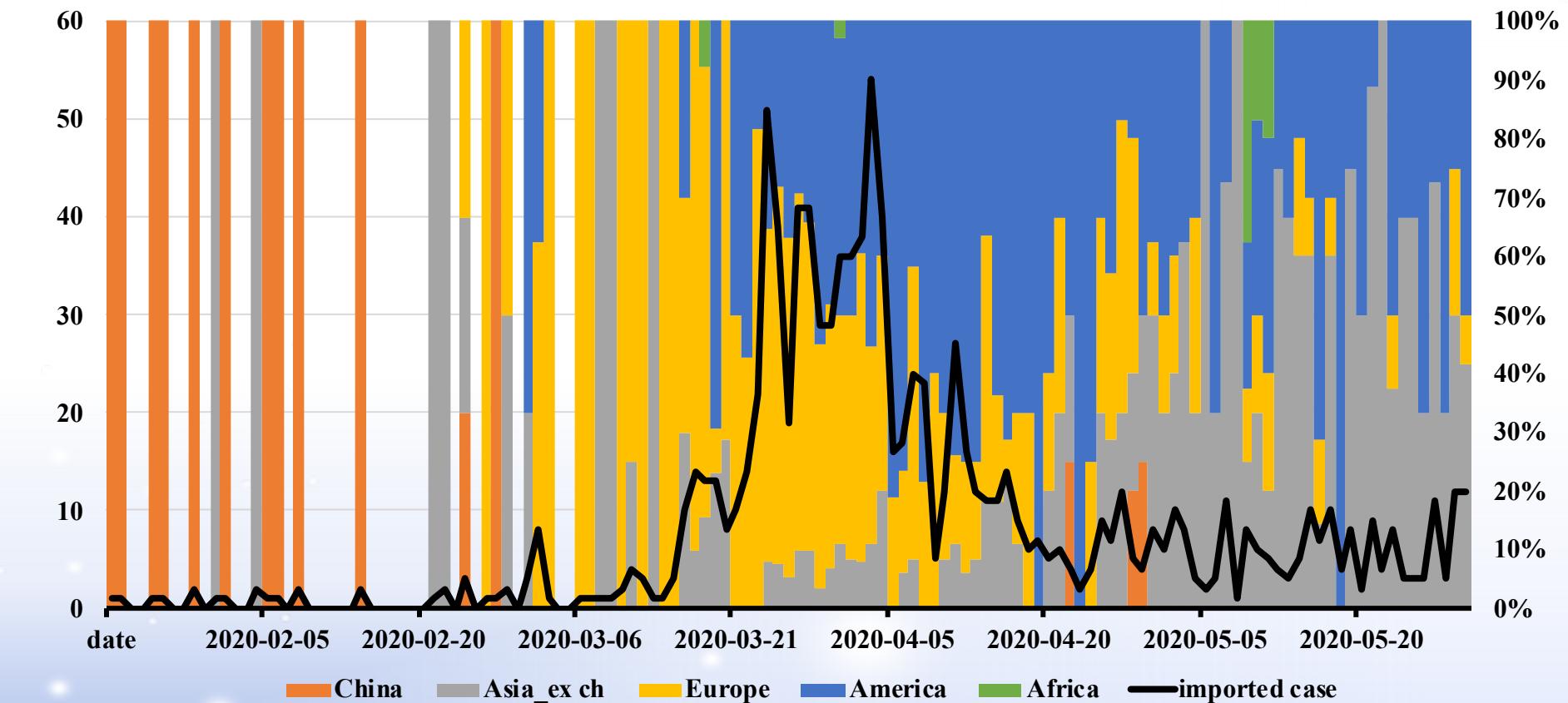
## Cases in Korea by City/Province



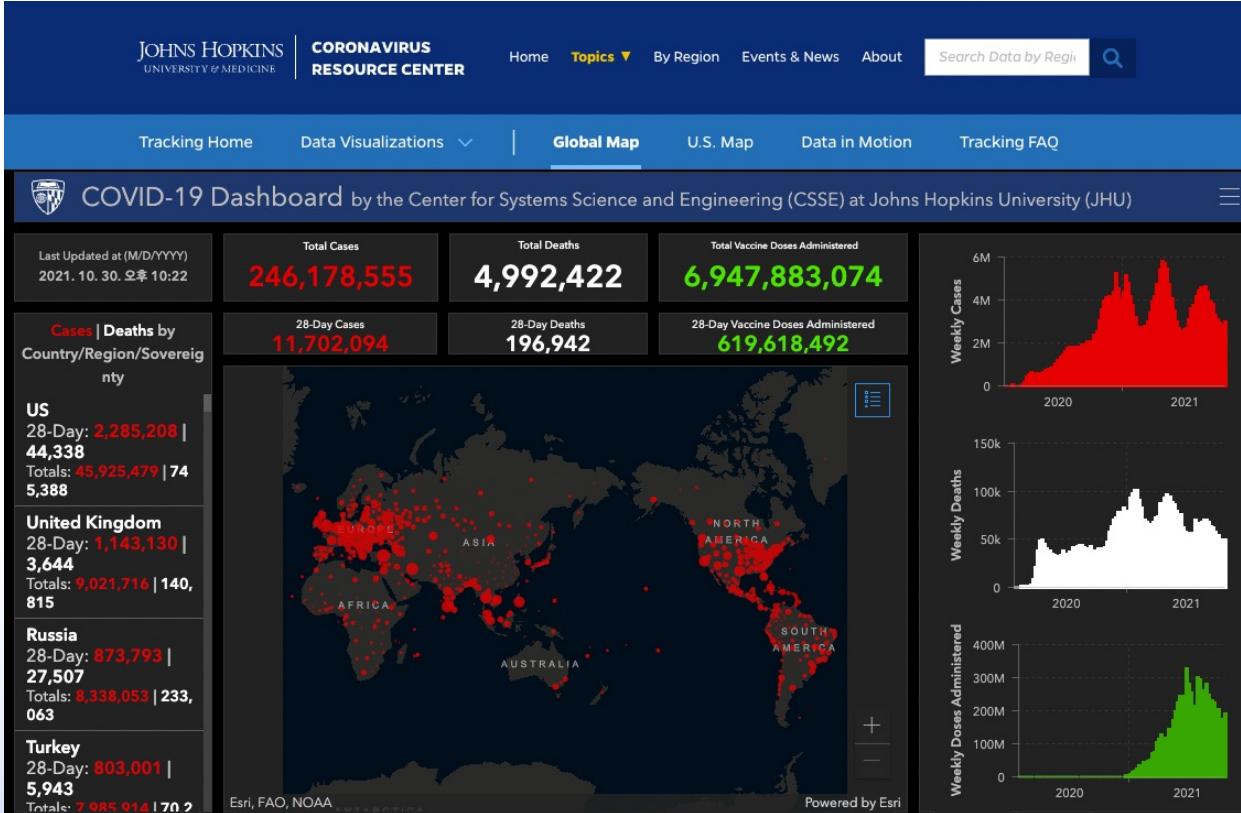
City/Province	Daily Change			Confirmed Cases				
	Daily Change	Local outbreak	Imported cases	Confirmed Cases	Isolated	Released from Quarantine	Deceased	Incidence (*)
Total	2,104	2,089	15	362,639	25,228	334,581	2,830	700
Seoul	706	704	2	118,834	11,447	106,599	788	1229
Busan	45	45	0	13,853	431	13,262	160	408
Daegu	90	89	1	17,085	569	16,257	259	706
Incheon	123	122	1	19,216	1,655	17,454	107	653
Gwangju	16	15	1	5,348	74	5,245	29	369
Daejeon	7	7	0	7,521	152	7,315	54	514
Ulsan	3	3	0	5,416	49	5,311	56	477
Sejong	4	4	0	1,361	26	1,333	2	382
Gyeonggi-do	719	713	6	107,762	7,977	98,858	927	803
Gangwon-do	25	25	0	7,176	237	6,872	67	465
Chungcheongbuk-do	46	46	0	7,873	472	7,319	82	492
Chungcheongnam-do	56	56	0	10,538	668	9,811	59	497
Jeollabuk-do	26	26	0	5,166	285	4,815	66	286

확진자수

## COVID-19 imported case in South Korea



# Case 1: Forecasting imported COVID-19 cases in South Korea using mobile roaming data



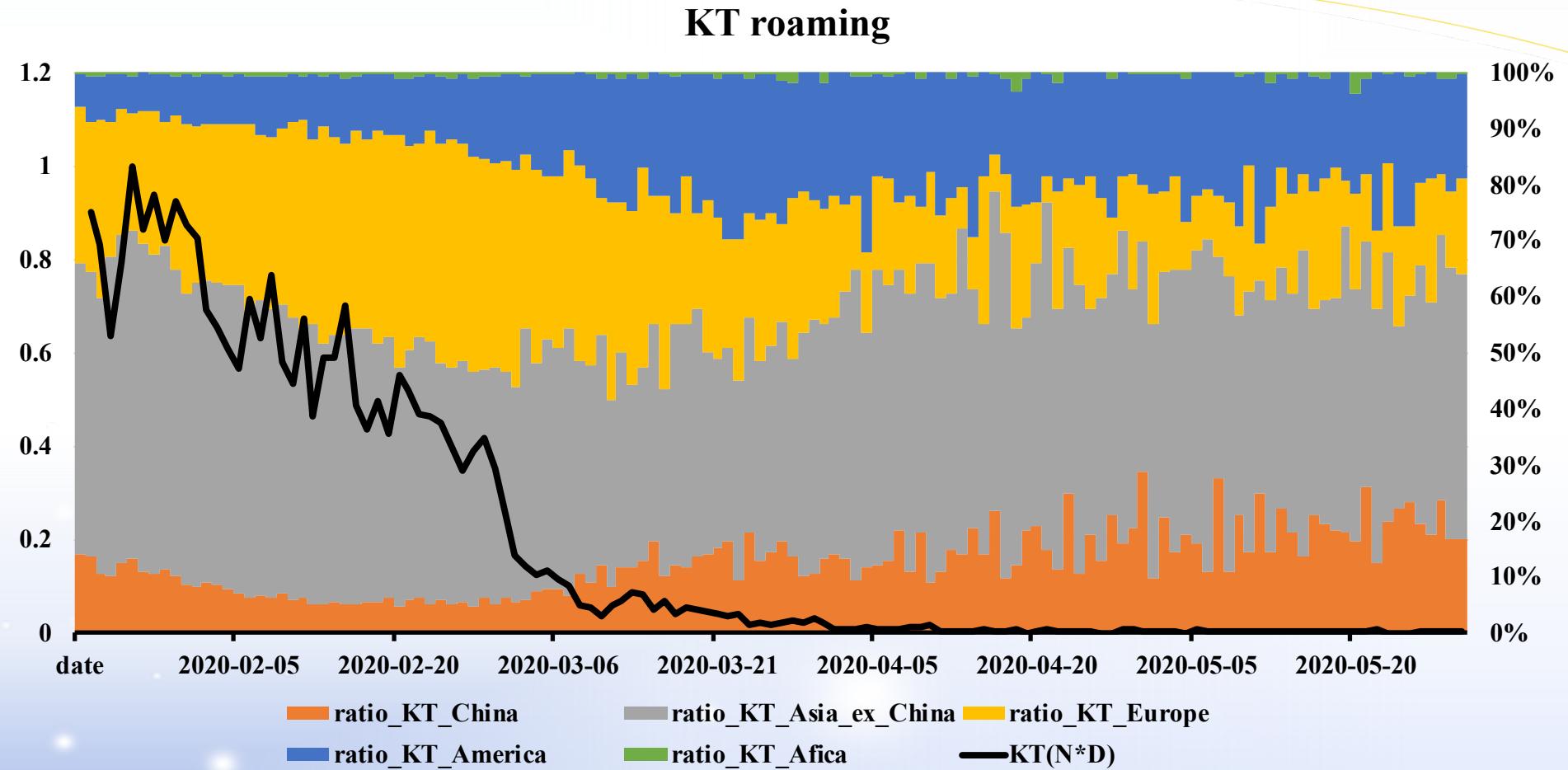
- ◆ Data collection
  - The number of daily confirmed COVID-19 cases in other countries is reported by the John Hopkins University Center and is publicly available in the COVID-19 data repository at Github.

# Case 1: Forecasting imported COVID-19 cases in South Korea using mobile roaming data

The screenshot shows the homepage of the 'Data Safe Zone' (데이터안심구역) website. At the top, there are links for '서비스안내' (Service Guide), '이용신청' (Application), '활용사례' (Case Studies), and '참여소통' (Participation). Below this is a banner with a graph and Korean text: '데이터를 그림으로 쉽게 요약 정보로 간단하게 데이터 시각화' (Simplify data visualization into summary information). To the right, there's a section titled '제공 데이터 조회' (Data Source Selection) with icons for various sectors: 금융 (Finance), 유통 (Retail), 통신 (Telecommunications), 물류 (Logistics), 의료 (Healthcare), 문화 (Culture), 환경 (Environment), 에너지 (Energy), 기업 (Business), and 교통 (Transportation). A blue button says '안심구역 이용신청' (Apply for Data Safe Zone) and a grey button says '이용절차 안내' (Procedure Guide). At the bottom, there's a section titled '연계기관 분석 플랫폼' (Linked Agency Analysis Platform) with three sub-options: '보건의료빅데이터 개방 시스템' (Healthcare Big Data Open System), '보건의료빅데이터 개방 시스템' (Healthcare Big Data Open System), and '자동차 종합 정보 개방 서비스' (Automobile Comprehensive Information Open Service).

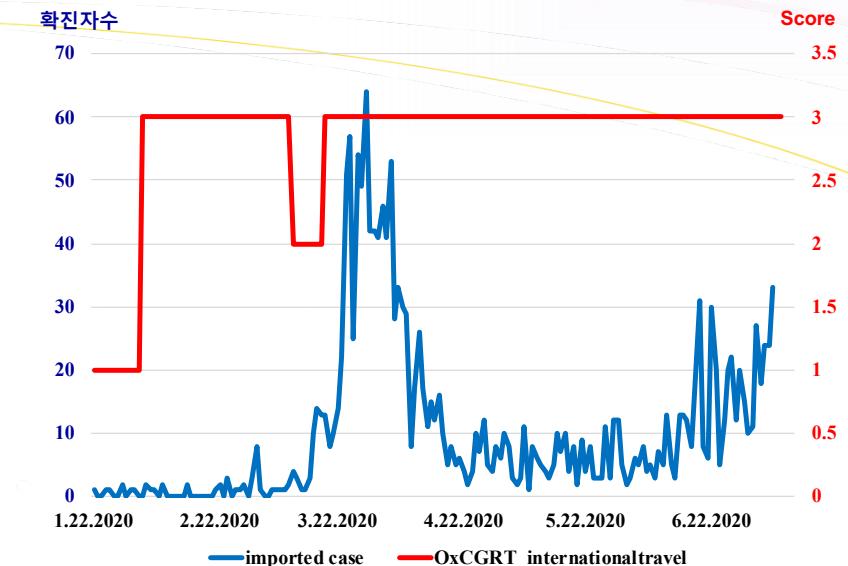
## ◆ Data collection

- The Mobile roaming data were supported by KT, the second-largest telecommunications service provider holding 31.6% of the market share among mobile phone service providers in South Korea in 2019



# Case 1: Forecasting imported COVID-19 cases in South Korea using mobile roaming data

- ◆ Data collection
  - The “International Travel Controls” index in the “Closures and Containment” section of the OxCGRT, which records international travel restrictions.



C8	C8_International travel controls	Record restrictions on international travel  Note: this records policy for foreign travellers, not citizens	Ordinal scale	0 - no restrictions 1 - screening arrivals 2 - quarantine arrivals from some or all regions 3 - ban arrivals from some regions 4 - ban on all regions or total border closure Blank - no data
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# Case 1: Forecasting imported COVID-19 cases in South Korea using mobile roaming data





## Case 1: Forecasting imported COVID-19 cases in South Korea using mobile roaming data

### ◆ Risk score

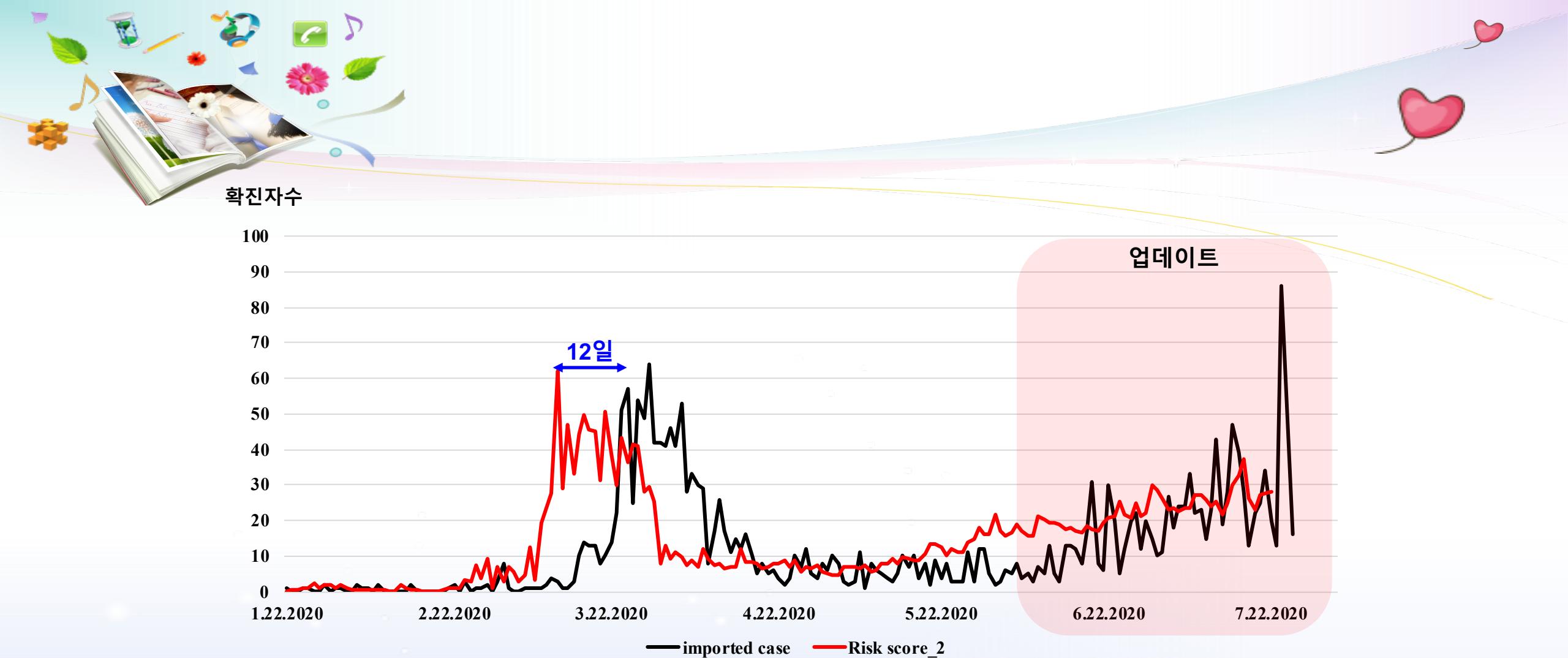
- The incidence rate is the number of COVID-19 cases ( $N_{covid}$ ) divided by country-specific population ( $P$ ), and the **global incidence rate** is the sum of the incidence rates of all countries ( $k$ ).
  - **Global incidence**[t] =  $\sum(k = \text{country})N_{covidk}[t]/P_k$
- The **KT roaming data** are the product of the number of roaming users ( $NRoaming$ ) and the average of days traveled ( $DRoaming$ ).
  - **Roaming**[t] =  $NRoaming[t] \times \text{Average}(DRoaming)[t]$



# Case 1: Forecasting imported COVID-19 cases in South Korea using mobile roaming data

## ◆ Risk score

- The risk of imported COVID-19 cases is proportional to the incidence rate of global COVID-19 cases, the number of roaming users, and the duration of travel.
- The risk is inversely proportional to the government response index.
  - Risk score[t] = Roaming[t] × Incidence[t]/Govern[t]



## Risk score 2

Input variables:

- Google trend \* 한국공항공사 (KT roaming data 대체)
- 전세계확진자, 인구수, OxCGRT index



## Case 1: Forecasting imported COVID-19 cases in South Korea using mobile roaming data

### ◆ Conclusions

- **The risk score** had a negative time lag of **12 days** and is eligible as an input variable for the 12 days forecast of imported COVID-19 cases in South Korea.
- **The roaming data** could help warn roaming users that they are at a high risk of contracting COVID-19 and inform the KCDC of possible high-risk areas for domestic outbreaks using the residency information of travelers returning to South Korea.
- Finally, we suggested **using the risk score to forecast imported COVID-19 cases after 12 days**.



# Assignments





# Assignments

1. Visit the Oxford index site, download the required index data, and store it in the database. You decide for yourself what kind of index to use.
2. Perform a simple correlation analysis between the incidence information of COVID-19 in the country of interest and the Oxford index.



# About Cross Evaluation among Classmates

1. **The 15-minute presentation** videos submitted for the midterm will be posted on Gather.town with their respective numbers assigned.
2. **Student voting** will be held for two weeks from the start date.
3. Each individual has **five votes**, and the five who receive the most votes will receive some extra points in the midterm evaluation.
4. For detailed evaluation methods and access to Gather.town, the TA will notify you by e-mail and LMS.

# THANK YOU

