COVID-19 Pandemic: Implications for Humanities

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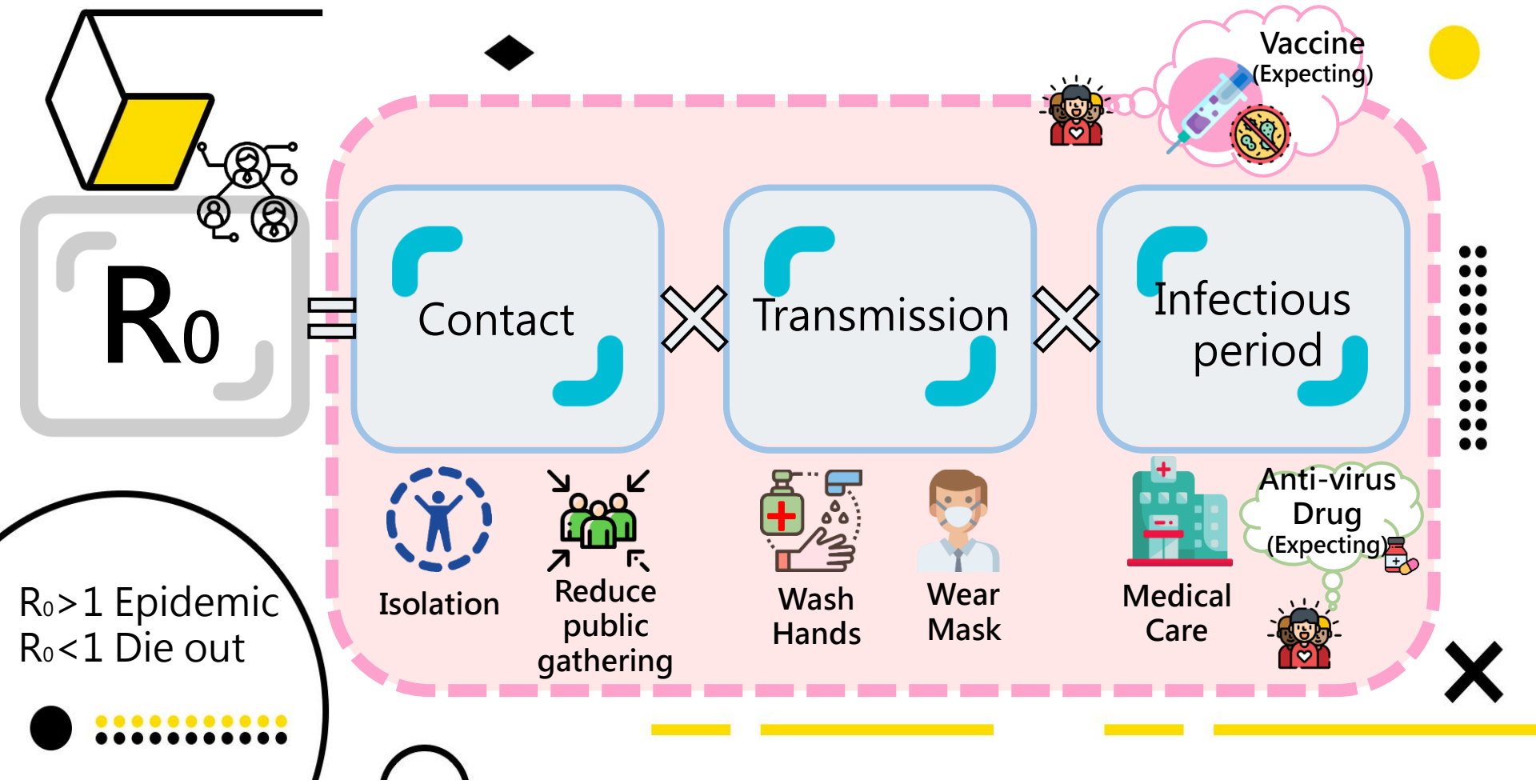
Systematic Thinking in Spread and Prevention of COVID-19

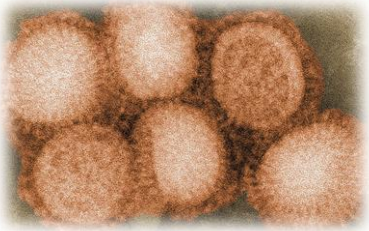


- R_0:Basic Reproductive Number

Re-emerging Global Pandemic

1918 Flu Pandemic

Jan 1918 – Dec 1920



H1N1

Impact

~500 million persons infected world-wide

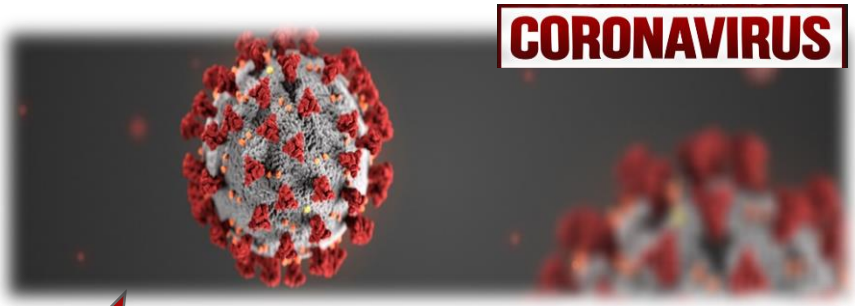
50~100 million deaths

Case fatality 15 %

R_0= 1.80

2019 COVID19

Dec 2019 –March 2020



Current

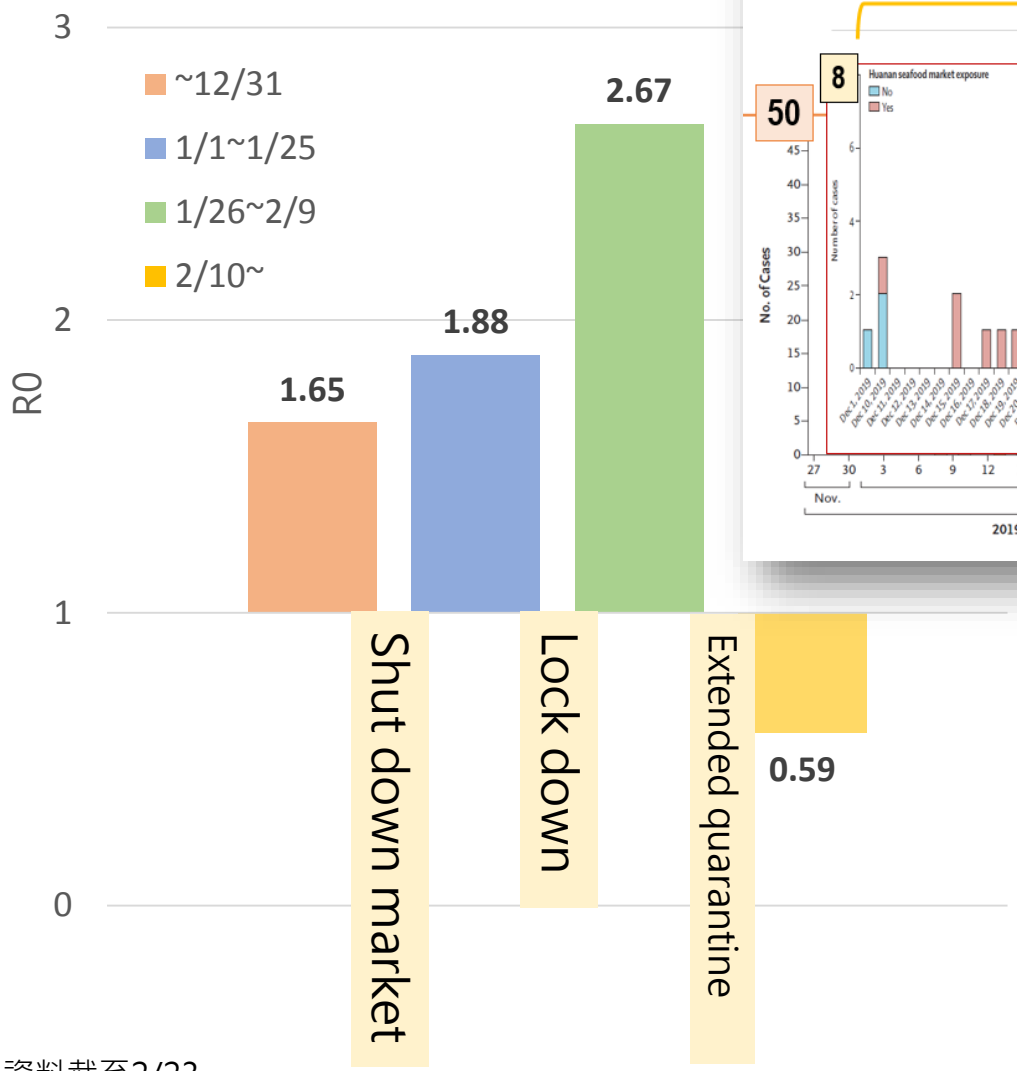
720 thousand persons infected world-wide

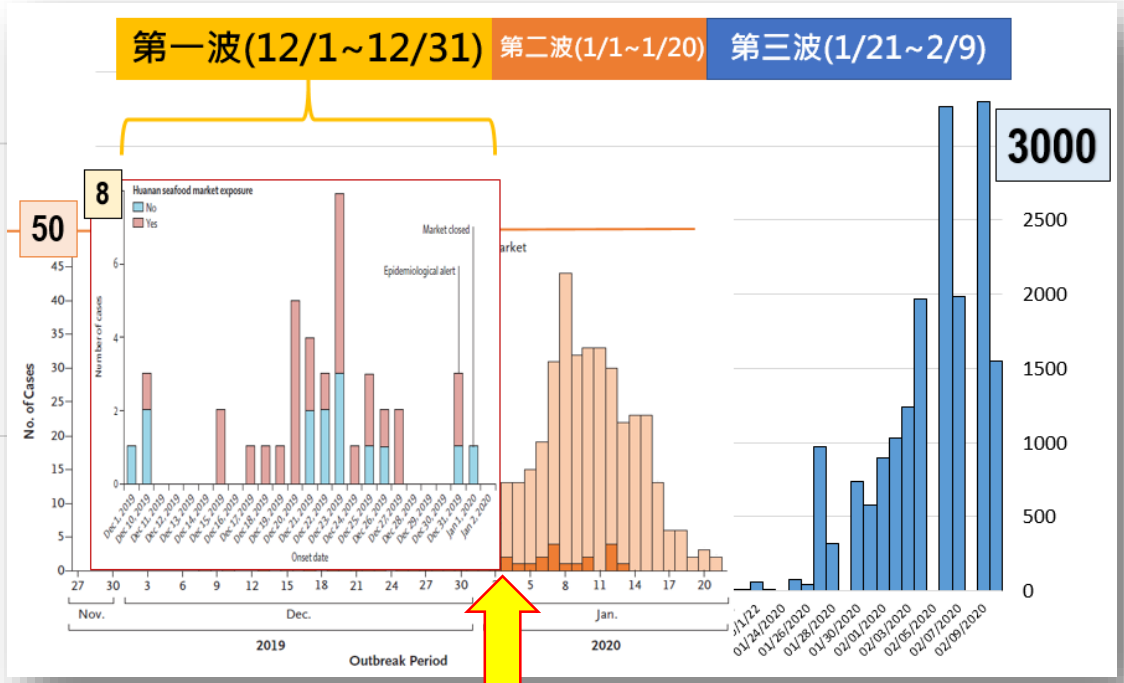
33 thousand deaths

Case fatality 5 %

R_0= 2.25

COVID-19 Epidemic in China

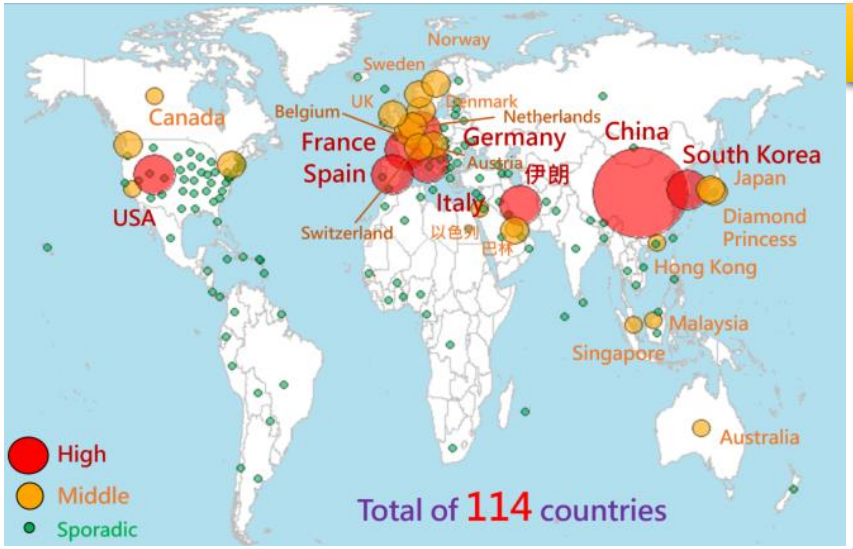




Best time to block beyond borders and reducing public gatherings

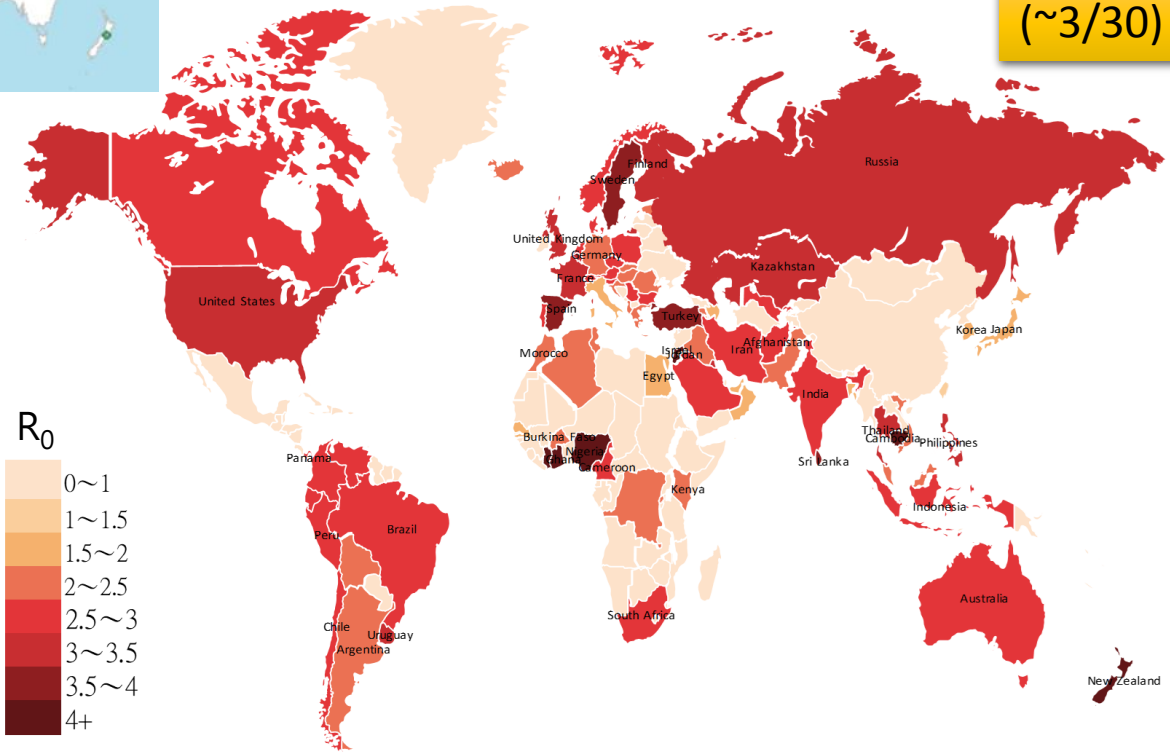
資料截至2/23

COVID-19 Pandemic



(~3/11)

(~3/30)



Global disease burden of COVID-19

	Hubei	China (Not include Hubei)	Other countries	Total
Confirmed Cases	67801	14398	702115	784314
Death (Mortality %)	3186 (4.7%)	122 (0.8%)	34330 (4.9%)	37638 (4.8%)
Recovered (%)	62889 (93%)	13035 (91%)	89364 (13%)	165288 (21%)

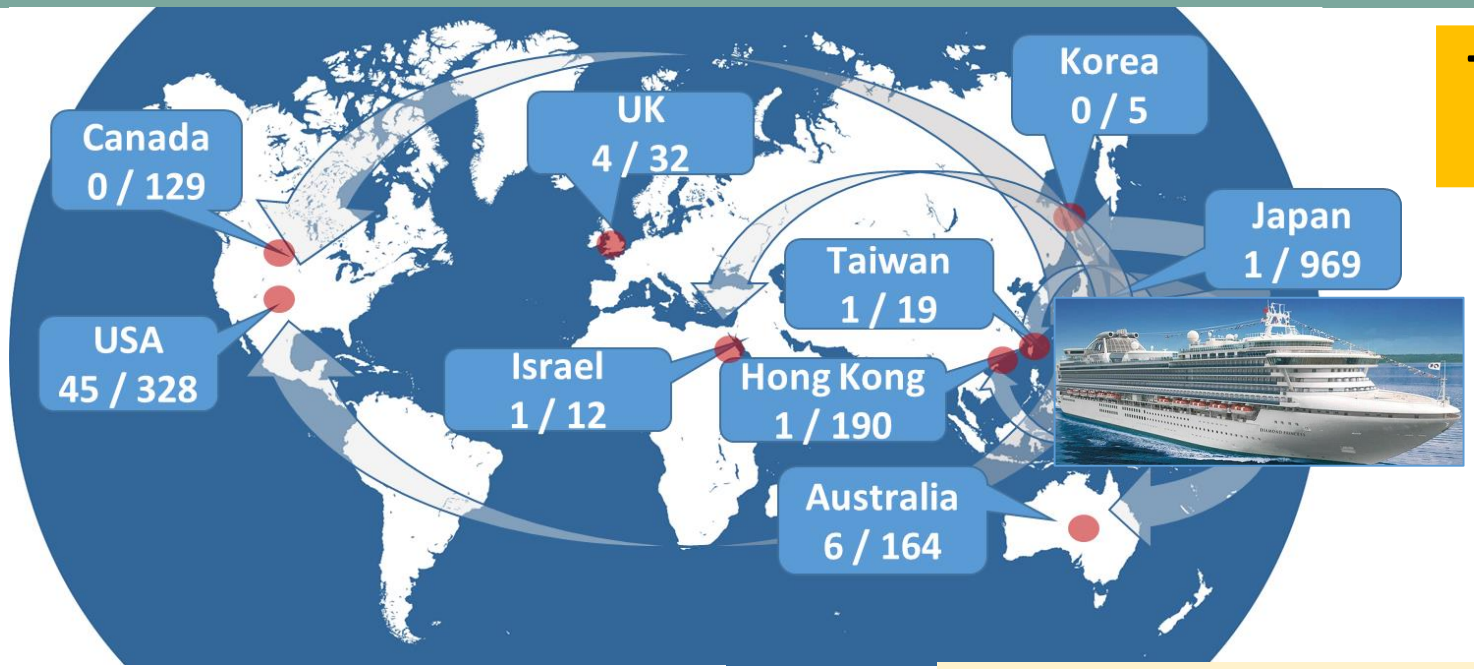
(Data source till 3/31 9:00AM)

COVID-19:
International and Domestic Prevention Strategies

1. **Border Quarantine & Isolation**
   (1) Isolation
   (2) Quarantine

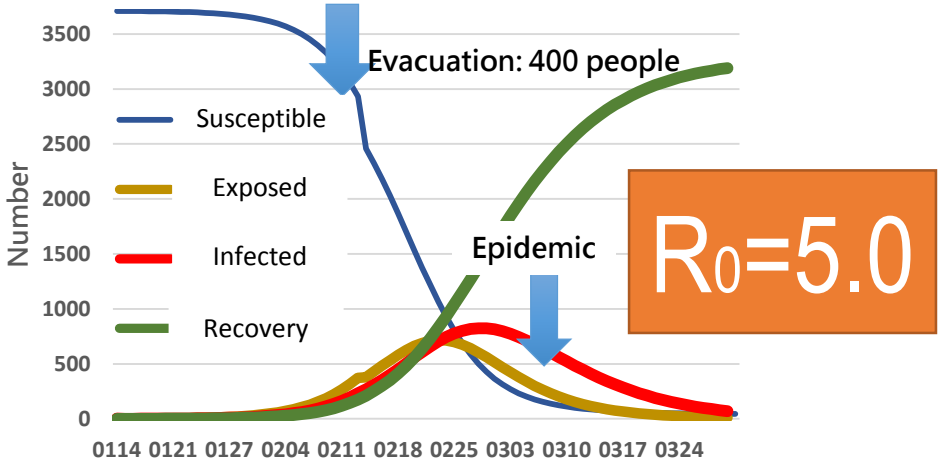
2. **Mitigation Plan**
   (1) Social distancing measure
      - Closure of workplace/school
      - Reducing large gatherings
   (2) Personal prevention
      - Wear a mask and wash your hands frequently
   (3) Environmental sanitation
      - disinfection and ventilation

COVID-19 transmission on Diamond Princess



706/3711
(~3/5 10:00)

Dynamic Prediction



R_0=5.0

$$\frac{ds(t)}{dt} = -\beta \cdot s(t) \cdot i(t)$$

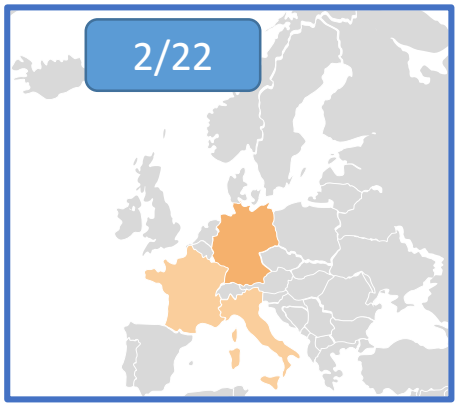
$$\frac{de(t)}{dt} = \beta \cdot s(t) \cdot i(t) - \sigma \cdot e(t)$$

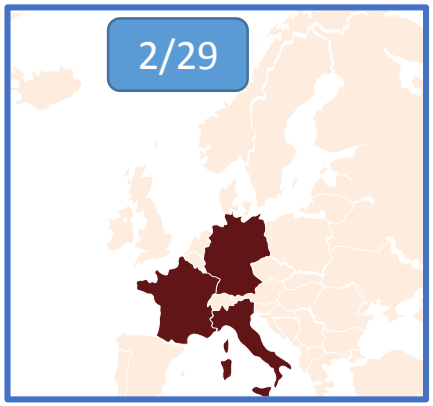
$$\frac{di(t)}{dt} = \sigma \cdot e(t) - \alpha \cdot i(t)$$

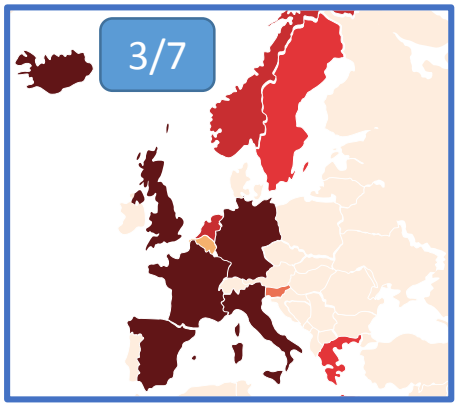
$$\frac{dr(t)}{dt} = \alpha \cdot i(t)$$

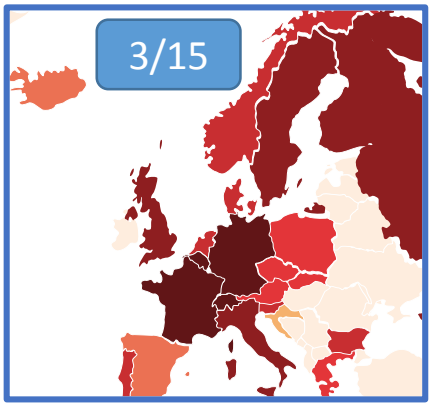
Trend of R_0

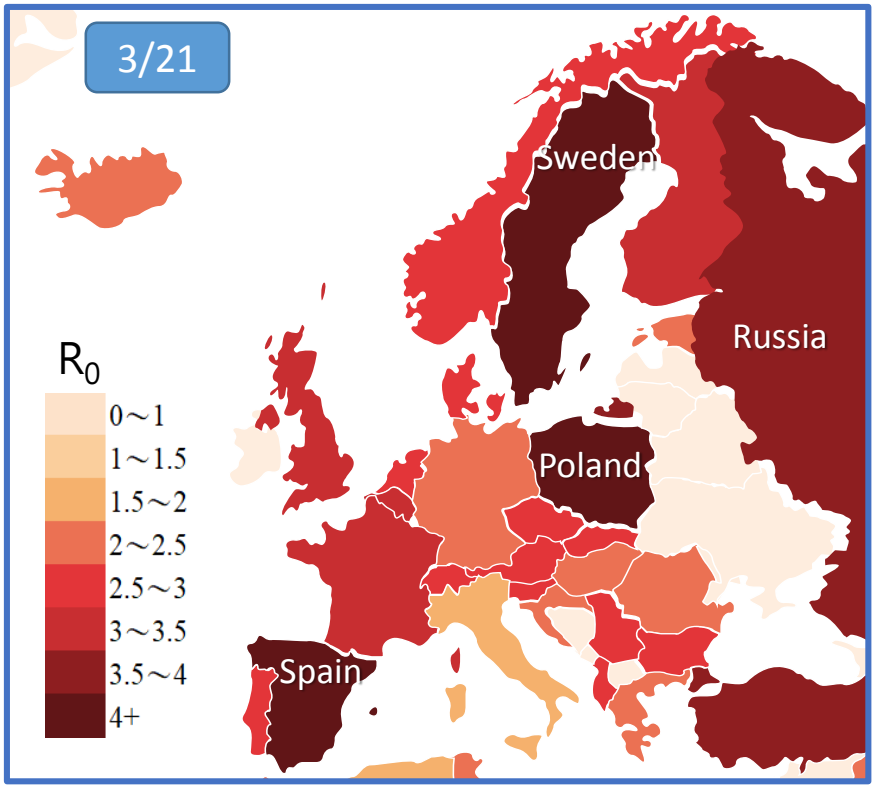
European, USA, and Canada

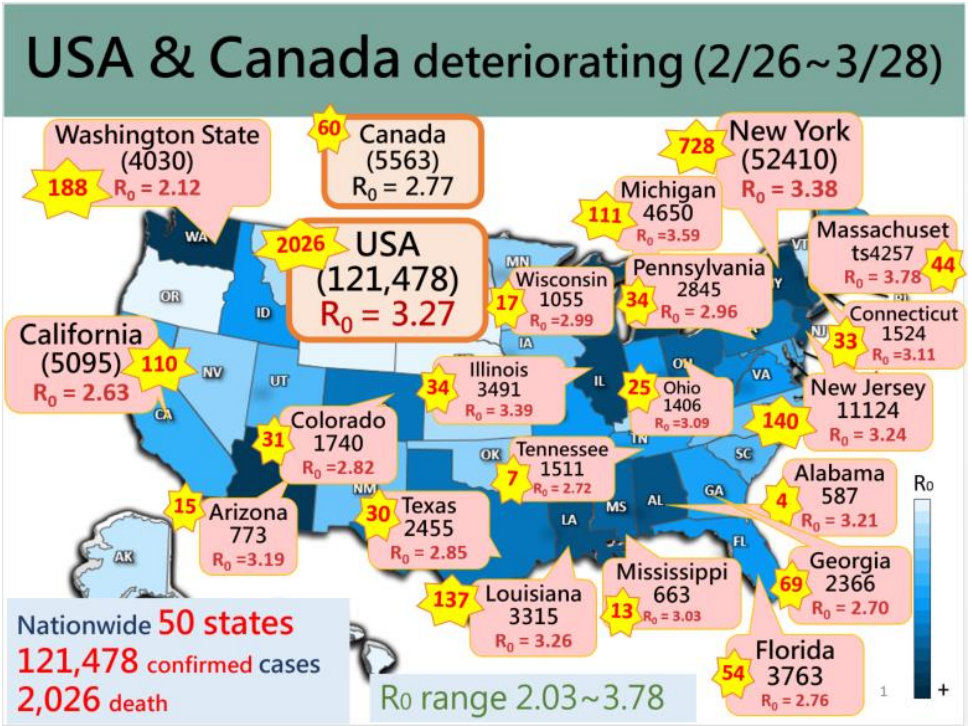










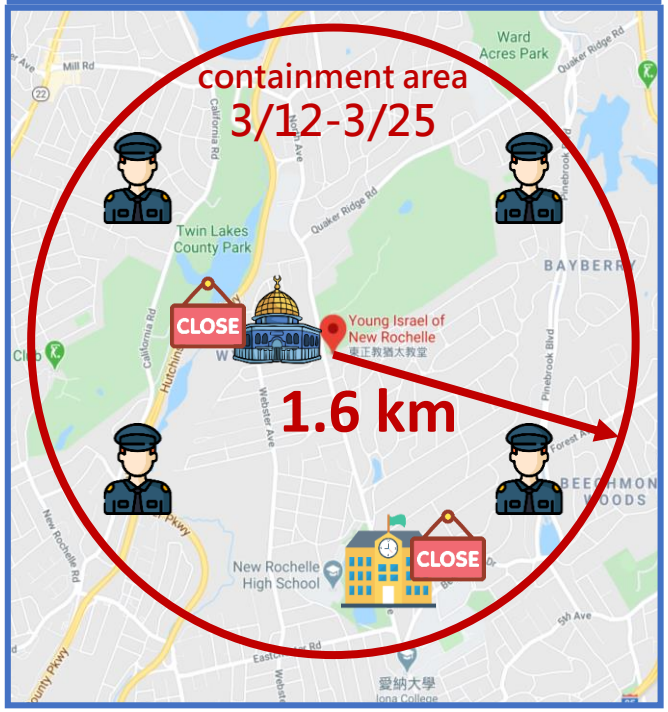


Containment Policy

USA and Taiwan

On 10 Mar. 2020, New York government creates a "containment area" around a community in New Rochelle. The containment area extends for a 1-mile radius. The governor is calling on the National Guard to help support the containment area. Schools and large gathering places inside the containment area will be closed for two weeks and officials will use that time to clean the schools.

New Rochelle, State of New York, USA



Taiwan Infectious Disease Control Act

第 37 條　地方主管機關於傳染病發生或有發生之虞時，應視實際需要，會同有關機關（構），採行下列措施：

一、管制上課、集會、宴會或其他團體活動。

二、管制特定場所之出入及容納人數。

三、管制特定區域之交通。

四、撤離特定場所或區域之人員。

五、限制或禁止傳染病或疑似傳染病病人搭乘大眾運輸工具或出入特定場所。

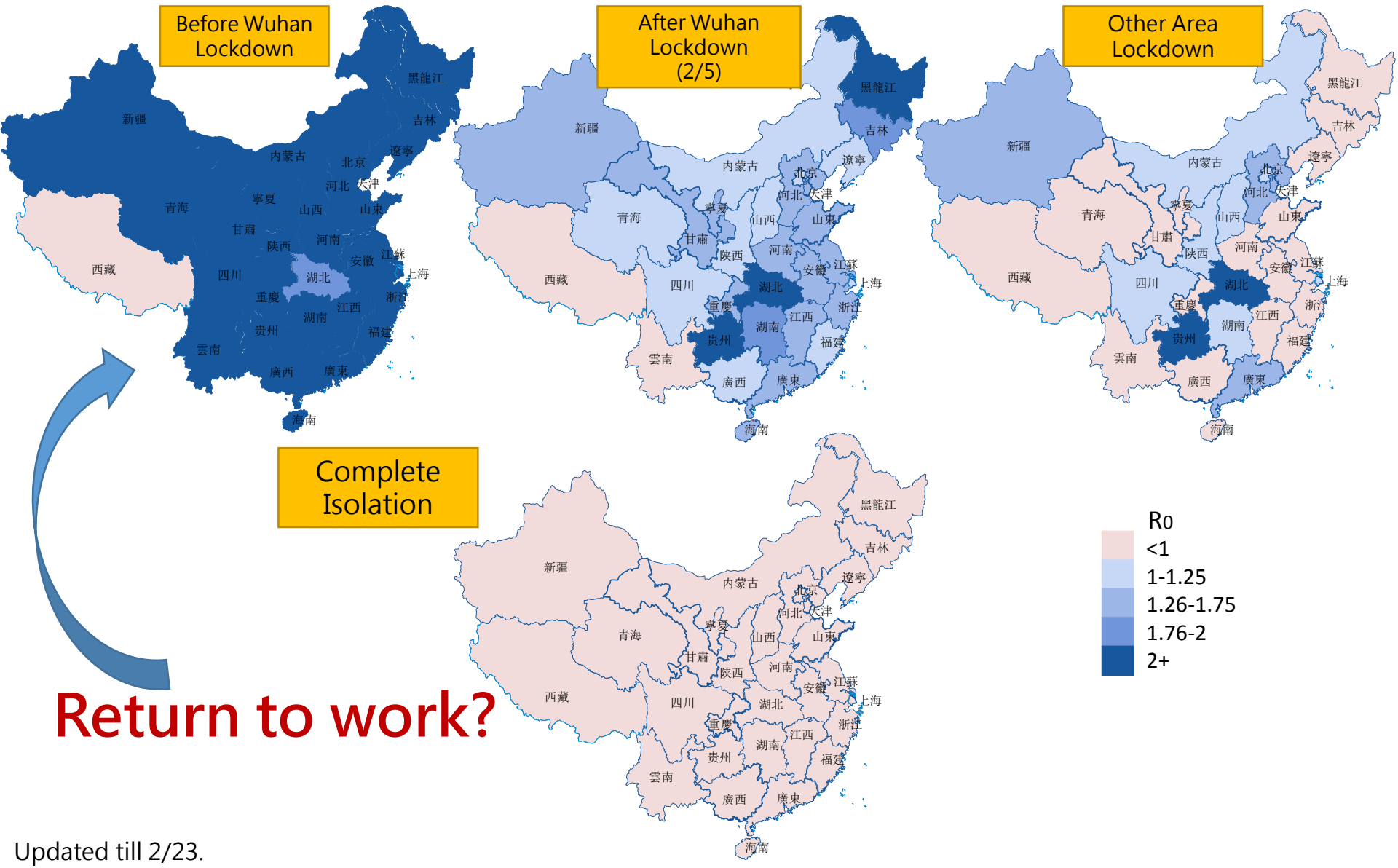
六、其他經各級政府機關公告之防疫措施。

各機關（構）、團體、事業及人員對於前項措施，不得拒絕、規避或妨礙。

第一項地方主管機關應採行之措施，於中央流行疫情指揮中心成立期間，應依指揮官之指示辦理。

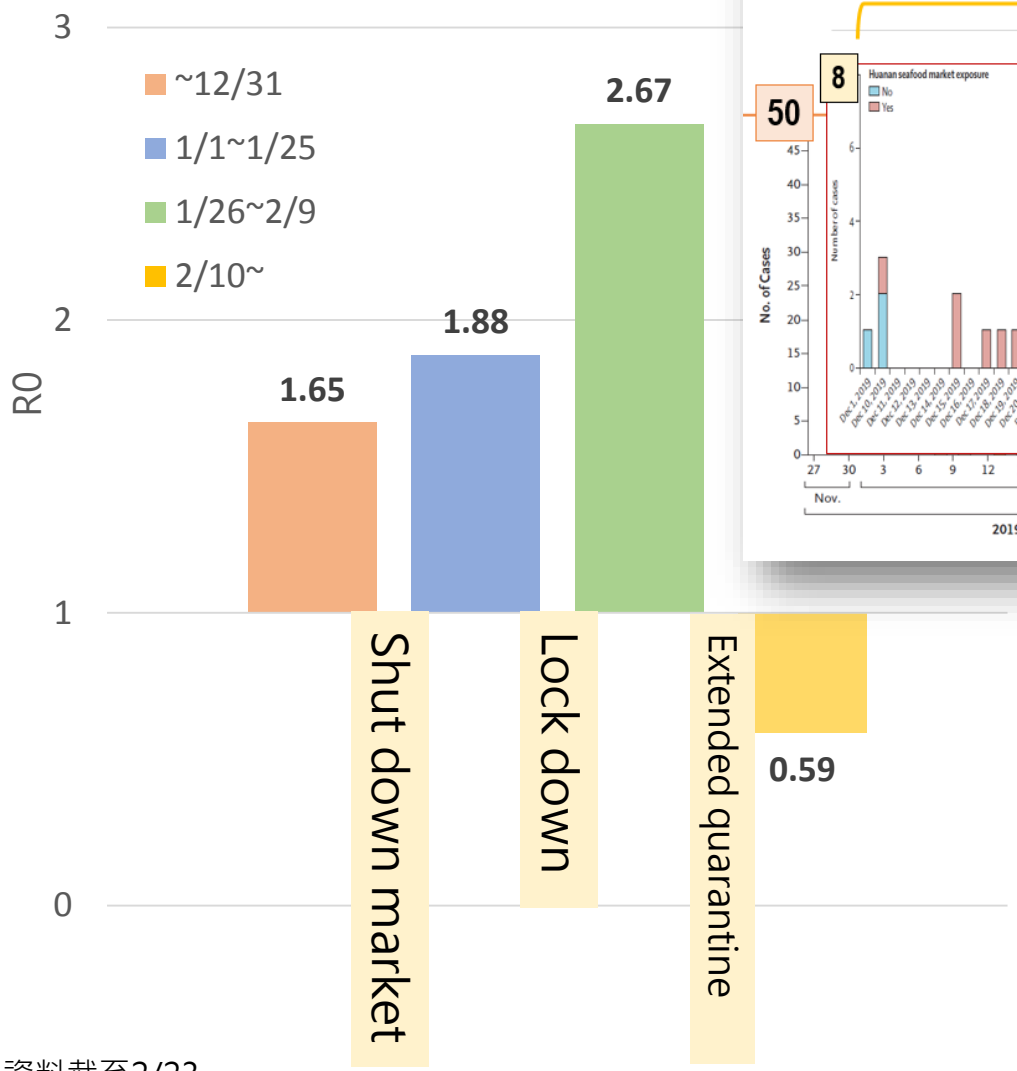
Alley Containment in Taipei, Taiwan(SARS)

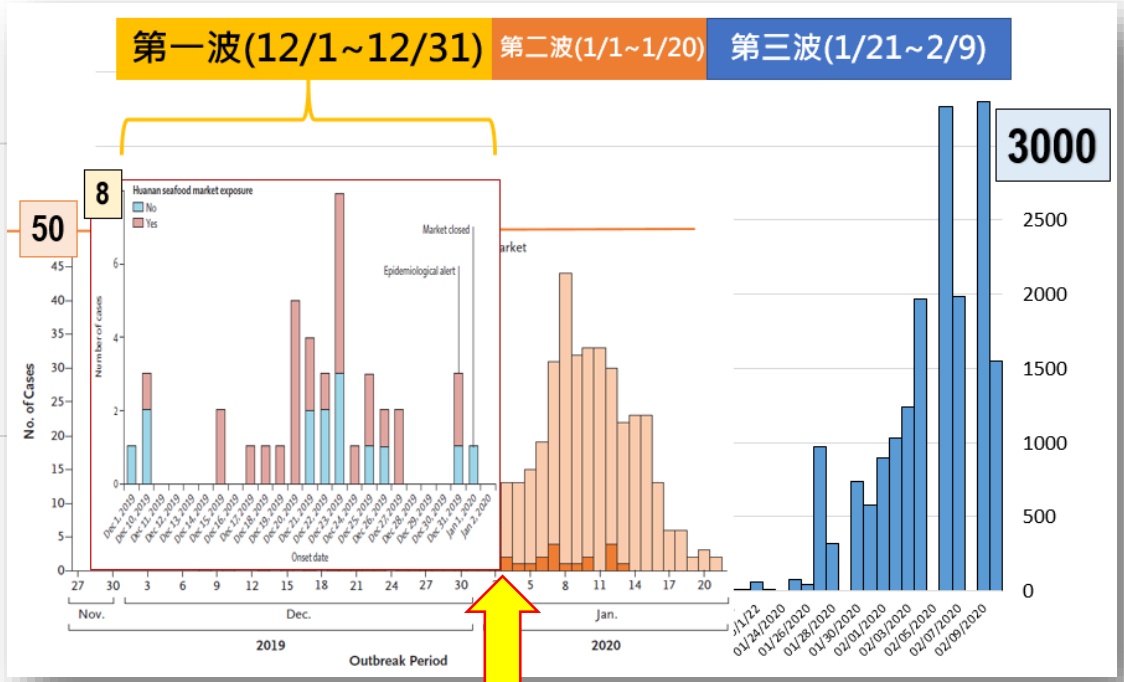
Epidemic evolution in mainland China after lockdown



Updated till 2/23.

COVID-19 Epidemic in China





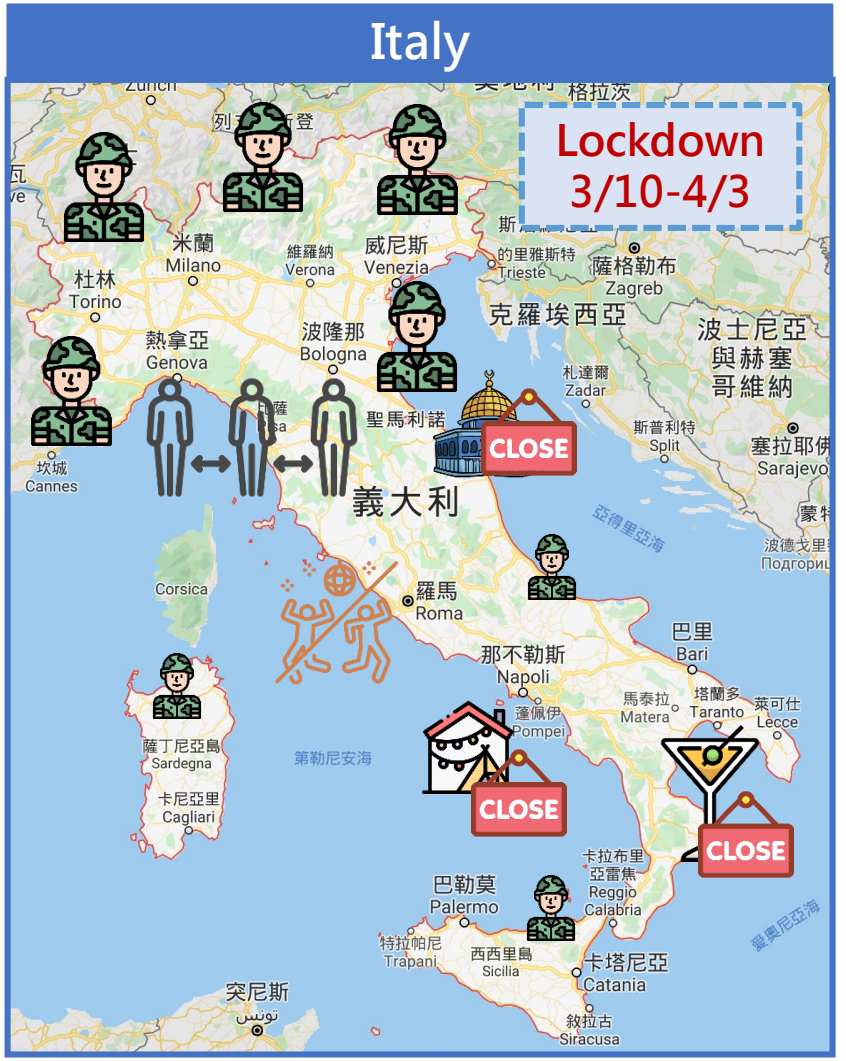
Best time to block beyond borders and reducing public gatherings

資料截至2/23

Lockdown Policy

Italy

On 9 Mar. 2020, Italian Prime Minister announced the emergency measures were expanded to the entire country, restricting travel from, to or within the affected areas, banning funerals and cultural events, and requiring people to keep at least one meter of distance from one another in public locations such as restaurants, churches and supermarkets. People would still be able to use trains and planes to and from the region for "proven work needs, emergencies, or health reasons".



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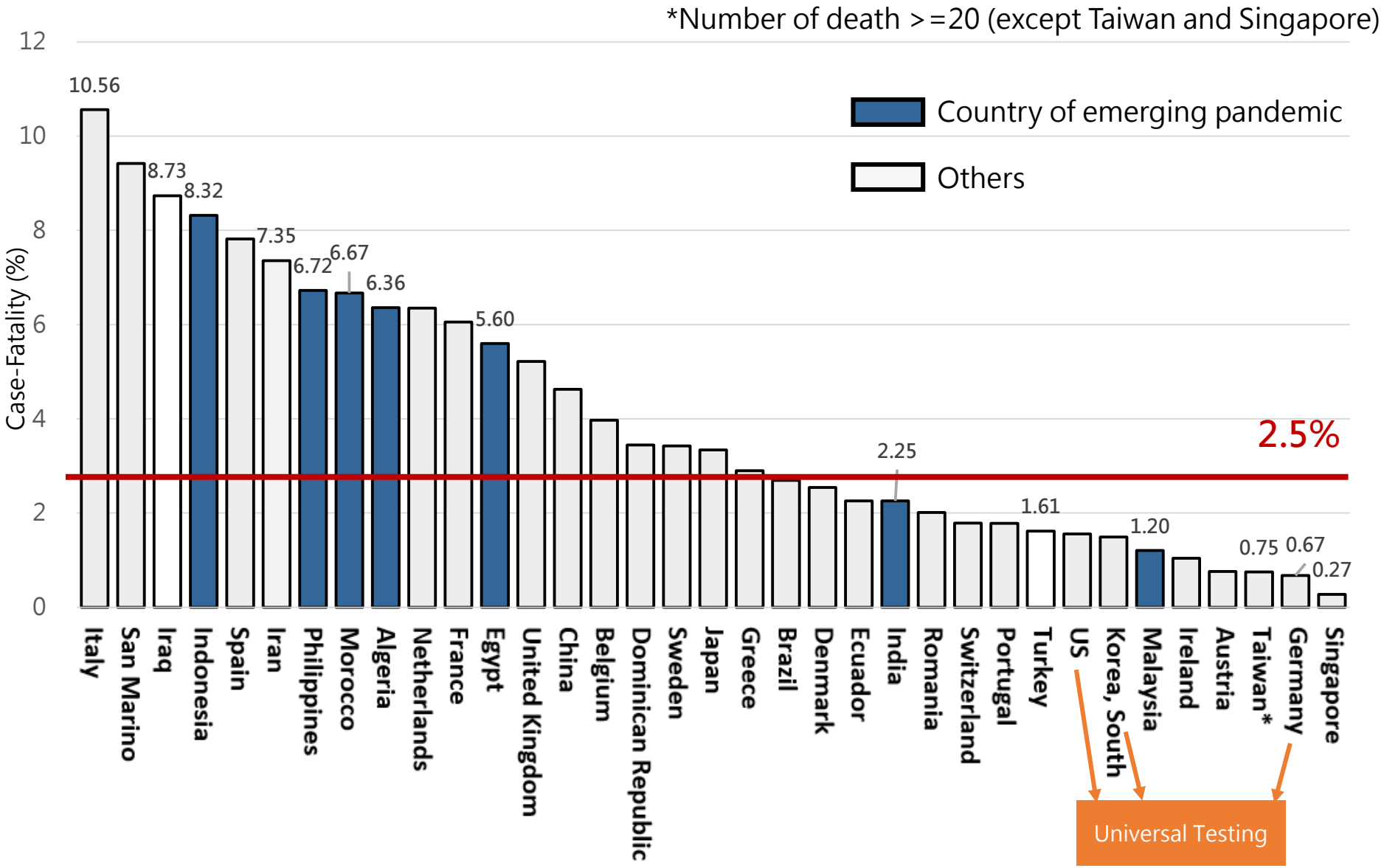
Case-Fatality of COVID-19



Impact of Quarantine and Isolation:

How to prevent the second wave of Italy

Partial quarantine and quarantine

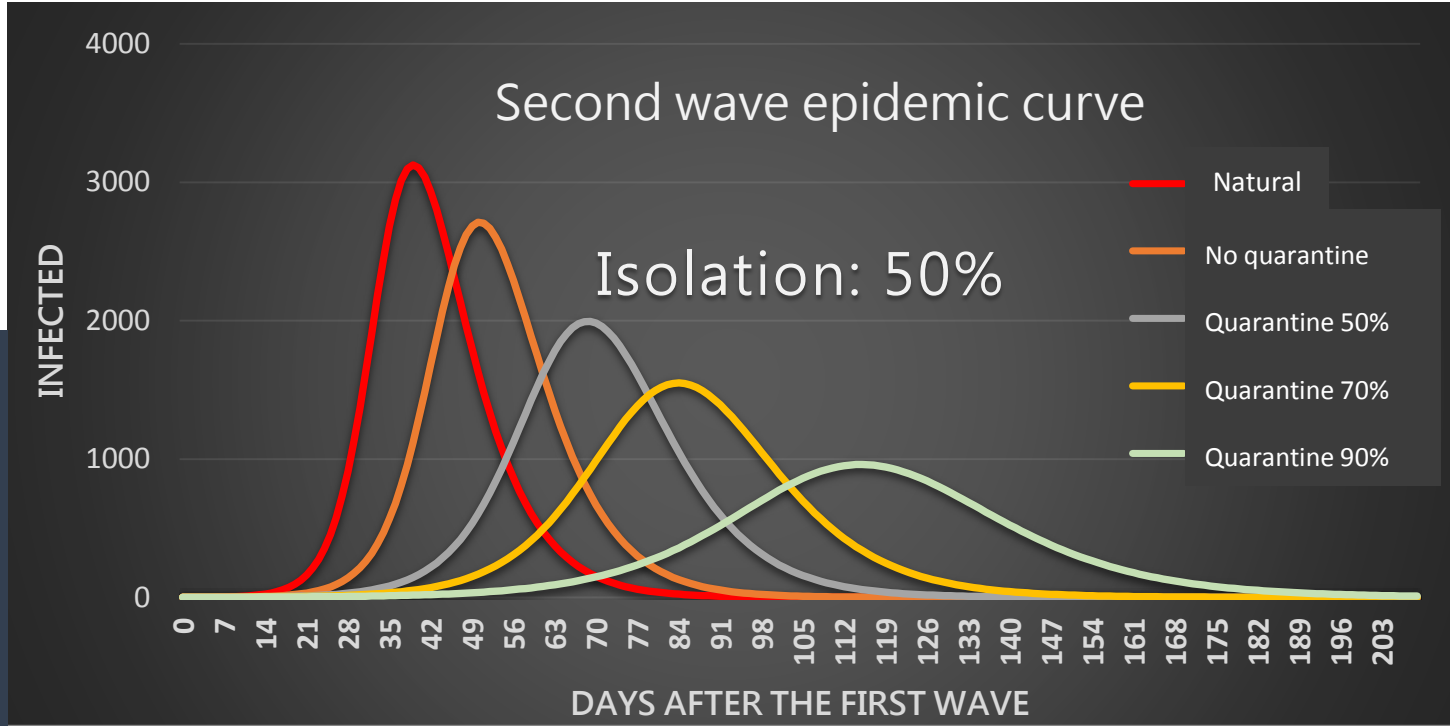
Delayed second wave of infection:

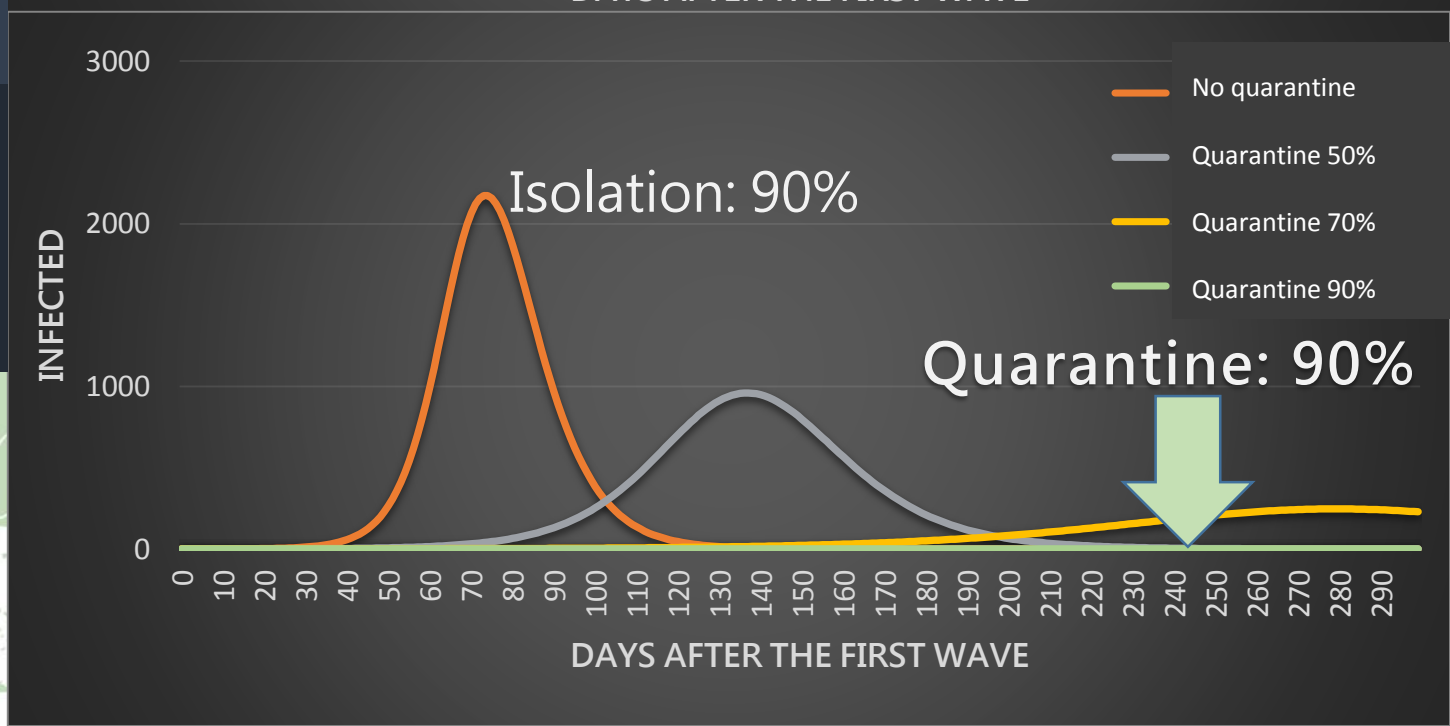
Allows for early deployment of uninfected harm reduction programs and improved personal protection

Total quarantine and isolation:

Block the second wave of infection

NuclearVacuum - File:Location European nation states.svg





Conventional Social Distancing with Finnish Contact

Social Distancing

"Distance is polite", line up at least 1 m apart

https://kknews.cc/world/4n35bb3.html

South Korea of COVID-19 Cluster Infection

Epidemiological estimation

Assume 22 people may enter the country on 20th Jan.

After two waves of epidemics, there shall be

76 initial cases

2000 people

809 positive cases

Estimation of the 1st wave of cases (2/5 ~ 2/12)

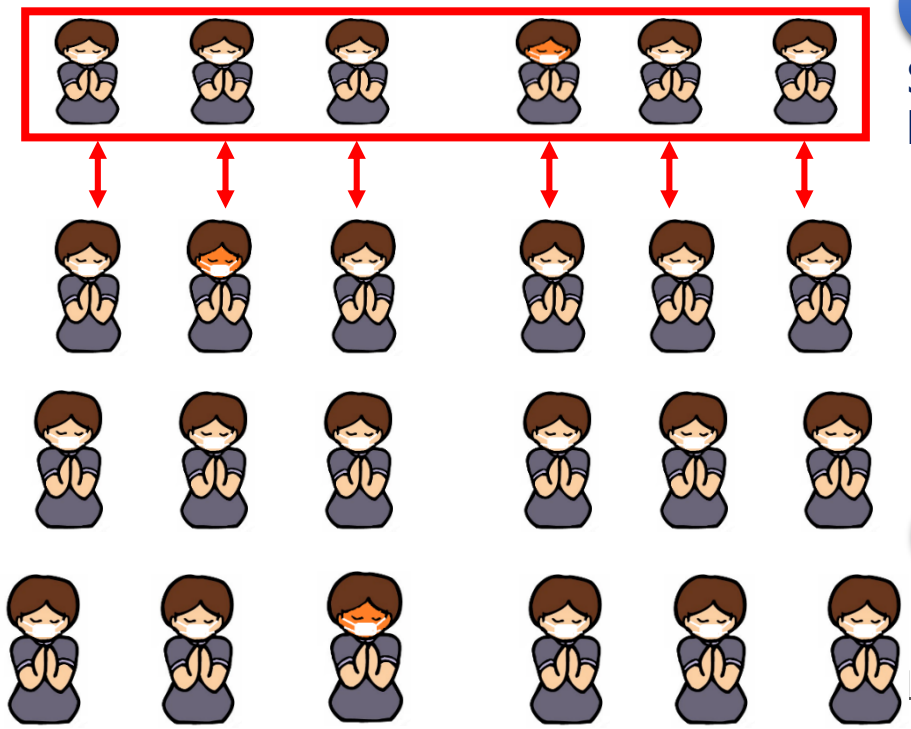
231 cases been infected (R_0 = 6.0)

Estimation of the 2nd wave of cases (2/13~2/20)

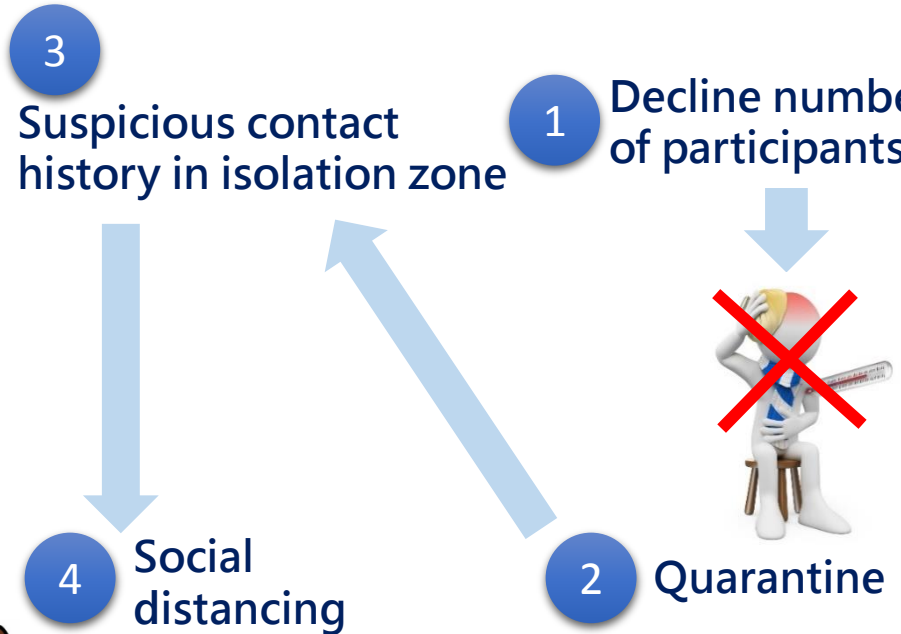
578 cases been infected (R_0 =2.5)

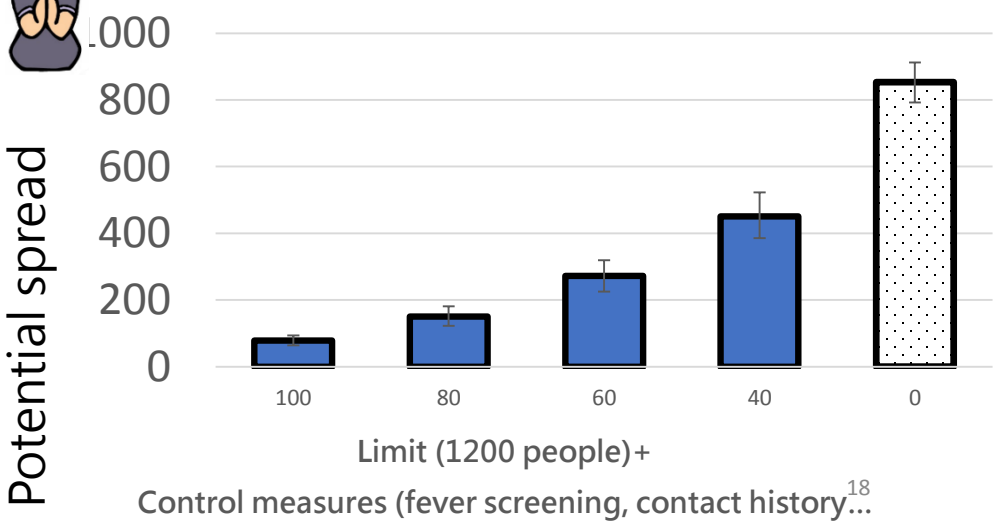
Group transmission rate : 19%/day

COVID-19 containment



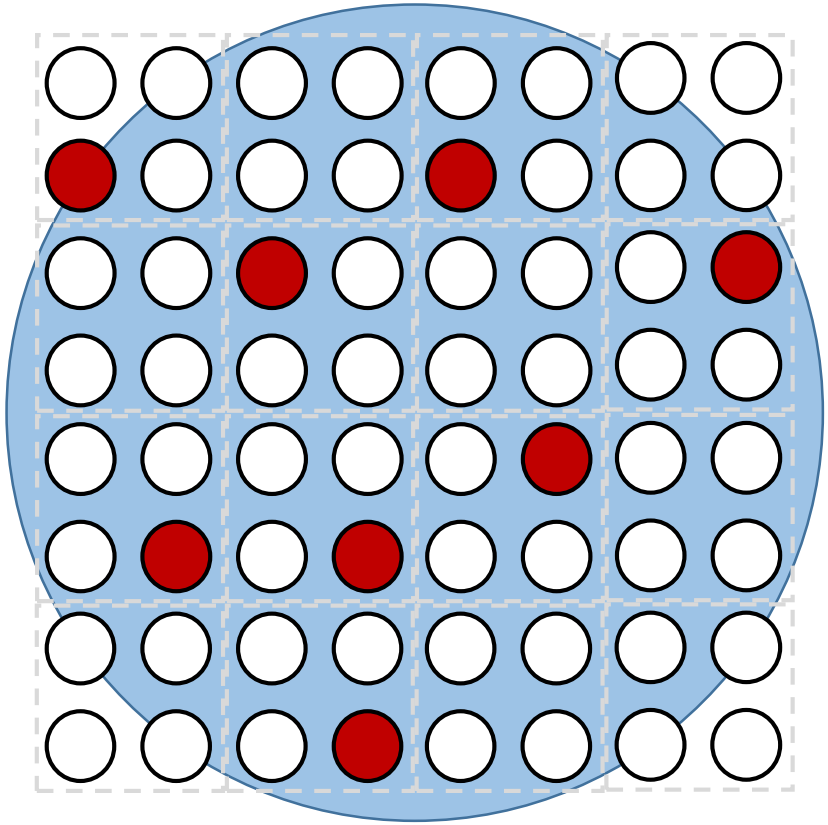
5. Wear a mask & wash your hands frequently

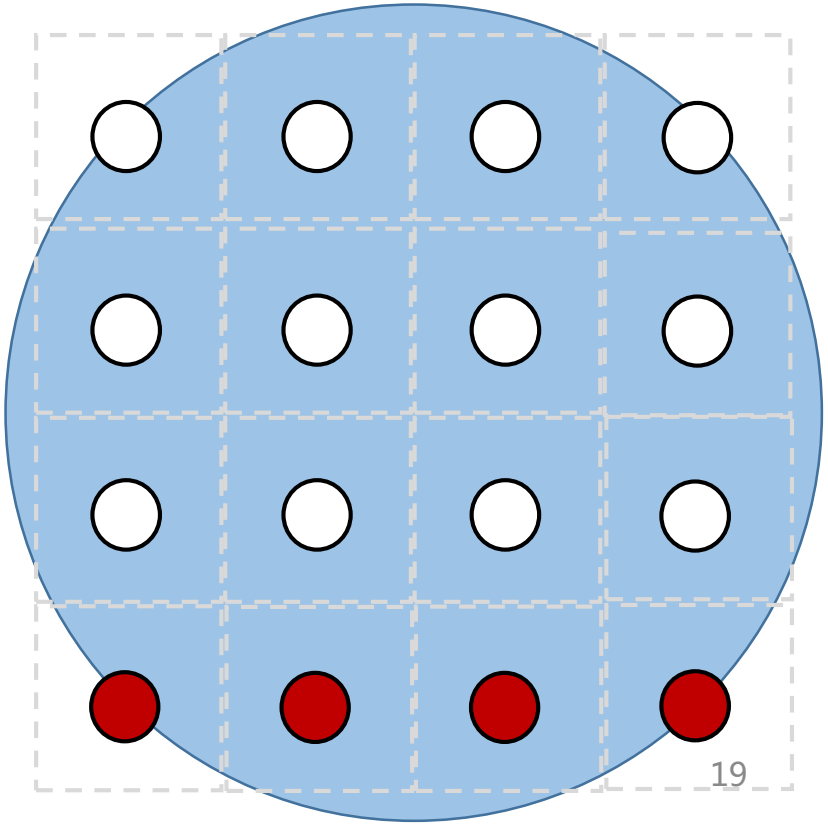




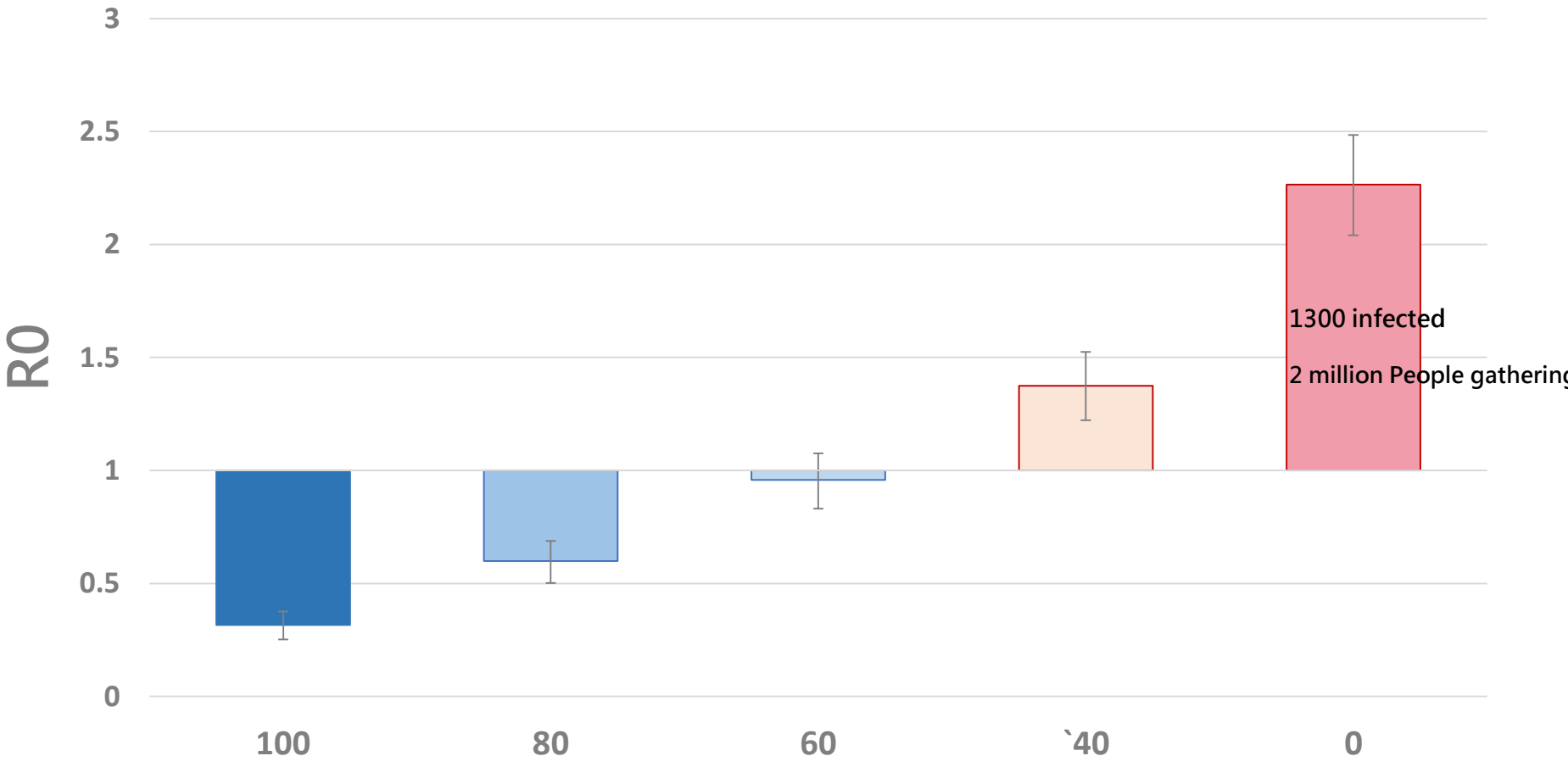
Large-scale public gathering

1. Fever Screening
2. Contact History Survey
3. Increase contact distance



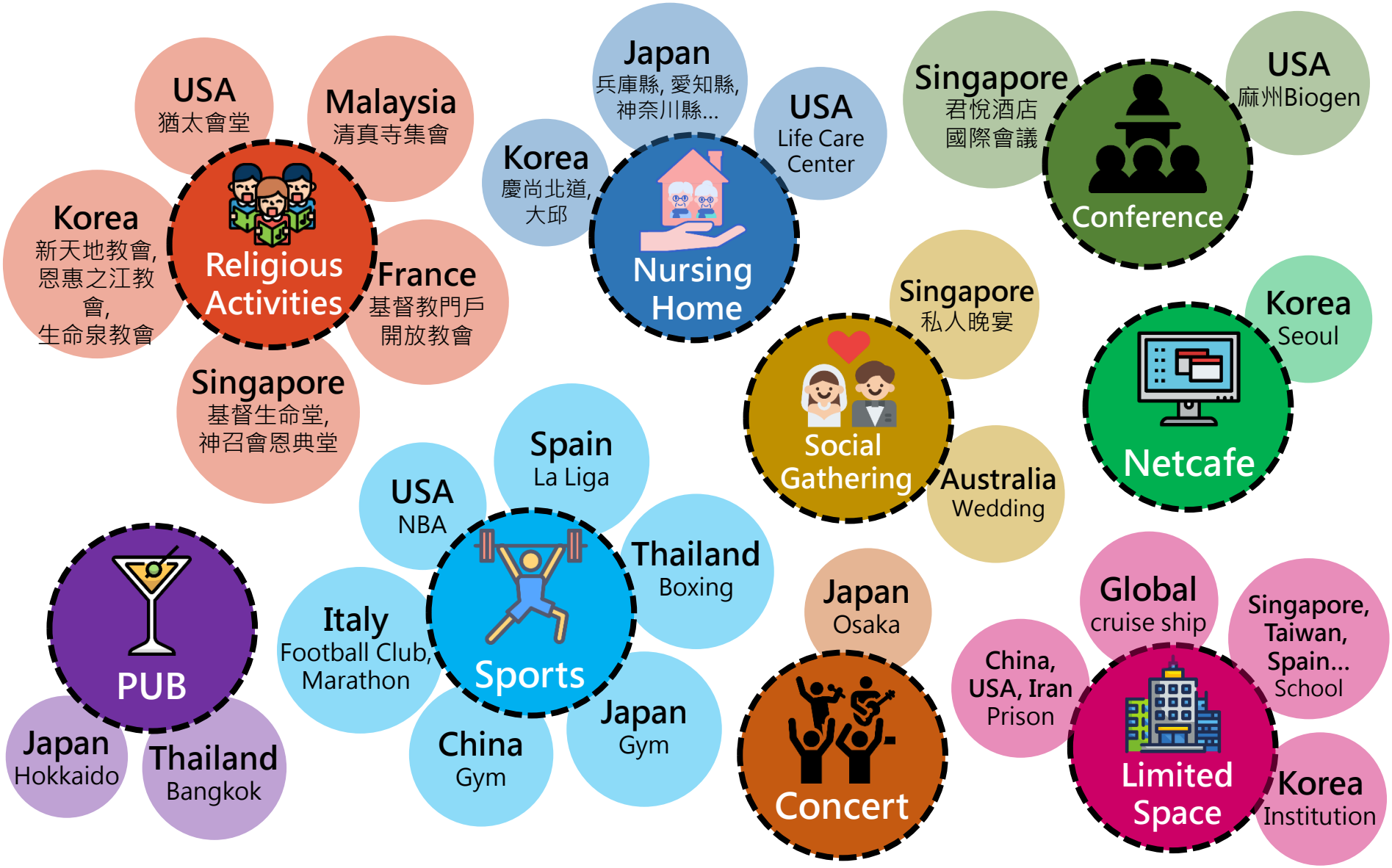


Risk assessment of large-scale public gathering and containment



INCREASE CROWD DISTANCE + CONTROL MEASURES (FEVER SCREENING, CONTACT HISTORY ISOLATION, WEARING A MASK AND WASHING HANDS)%

COVID-19 Public Gathering in Global

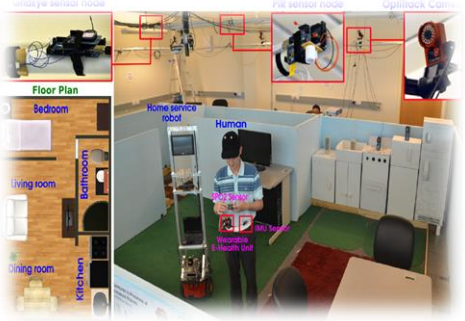


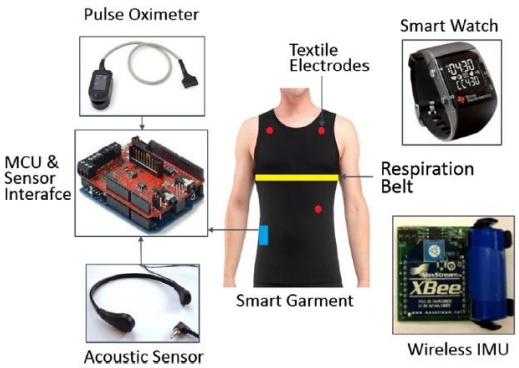
COVID-19 Disability-adjusted life year

COVID-19 costs around 4.9 billion US dollars

Possible Application of IOT on COVID-19 Prevention and Health Care

Quarantine and isolation at home





Cloud

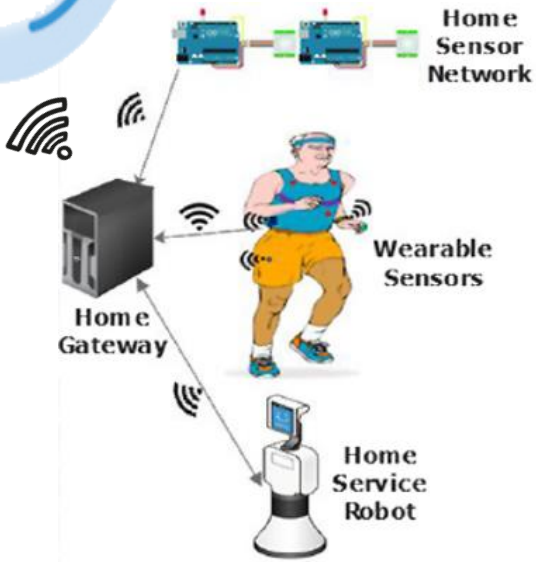
Cloud Storage → Data preprocessing → Attribute extraction

Diagnosis Knowledge base → Health diagnosis system

Mobile devices

Physicians &Health workers

Ambulance



Thank you