Game System in the game
Simulator: Fighting Against Novel Coronavirus

Jingru Chen & Shano Liang
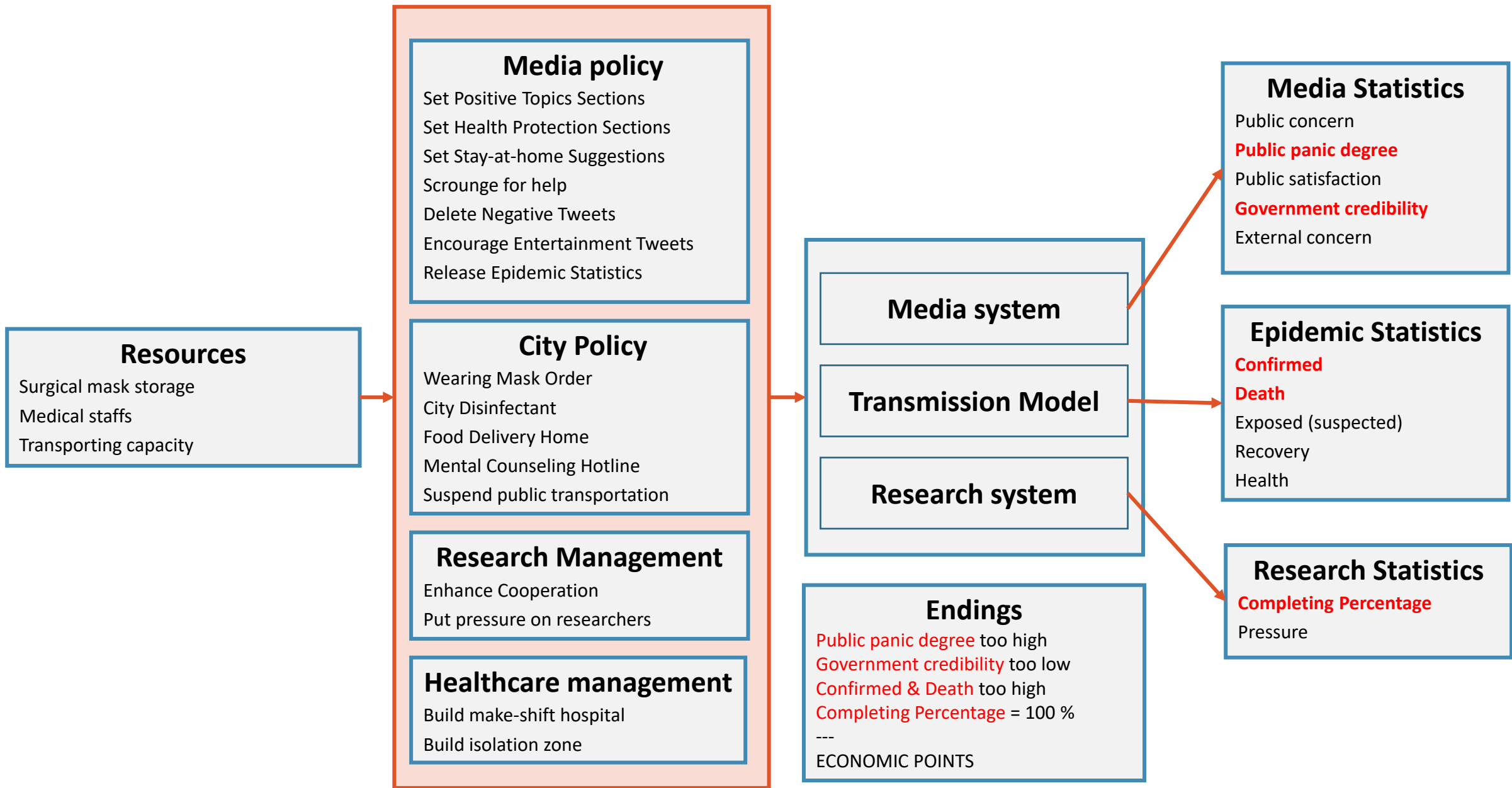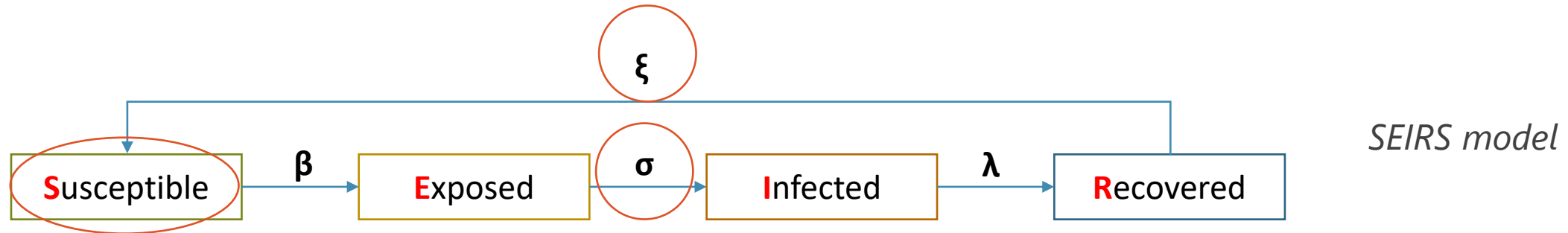
IMGD

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Simulator: Fighting Against Novel Coronavirus

- Simulation of the disease transmission
  - Modified SEIR Model considering policies taken
  - Scaled visualization of the transmission

- Policies and choices that affect the transmission
  - Scientific research
  - City policy
  - Healthcare
  - Media management

- Game Features
  - Parameters in transmission model are obtained from official health organizations and scientific journals.
  - News pieces in the game are rewrote version of selected real news.
  - It is a serious game in which we see it as true world for players to discover, not just visually and thematically but in play as well. The core experience is, any careless choice taken in facing this deadly disease would end in a disaster.

Game System: Summary

Resources
Surgical mask storage
Medical staffs
Transporting capacity

Media policy
Set Positive Topics Sections
Set Health Protection Sections
Set Stay-at-home Suggestions
Scrounge for help
Delete Negative Tweets
Encourage Entertainment Tweets
Release Epidemic Statistics

City Policy
Wearing Mask Order
City Disinfectant
Food Delivery Home
Mental Counseling Hotline
Suspend public transportation

Research Management
Enhance Cooperation
Put pressure on researchers

Healthcare management
Build make-shift hospital
Build isolation zone

Media system

Transmission Model

Research system

Media Statistics
Public concern
Public panic degree
Public satisfaction
Government credibility
External concern

Epidemic Statistics
Confirmed
Death
Exposed (suspected)
Recovery
Health

Research Statistics
Completing Percentage
Pressure

Endings
Public panic degree too high
Government credibility too low
Confirmed & Death too high
Completing Percentage = 100 %

ECONOMIC POINTS

Game System: Transfmission

ξ

Susceptible → β → **E**xposed → σ → **I**nfected → λ → **R**ecovered

SEIRS model

β - infectious rate

σ - incubation rate

γ - recovery rate (= 1/D)

ξ - loss of immunity rate

Susceptible: healthy population, but may get infected

Exposed: people containing the virus. In COVID-19 case, they are also infectious

Infected: confirmed cases, infectious

Recovered: recovery from infected, but may loss immune to the virus. In the real COVID-19 case, some recovery cases are tested positive for some reason, which means ξ > 0. But in the game, to simplify the calculation, we define ξ = 0.

Notes:

β, σ, λ, and ξ are parameters that affect the transmission progress. They are used to re-calculate current epidemic situation for every day in the game.

Susceptible are defined as constant (= 9,000,000), because comparing to other variables, it is large enough to ignore the changes in susceptible.

σ is defined 1, and ξ is defined 0, to simplify the calculation.

Game System: Transmission
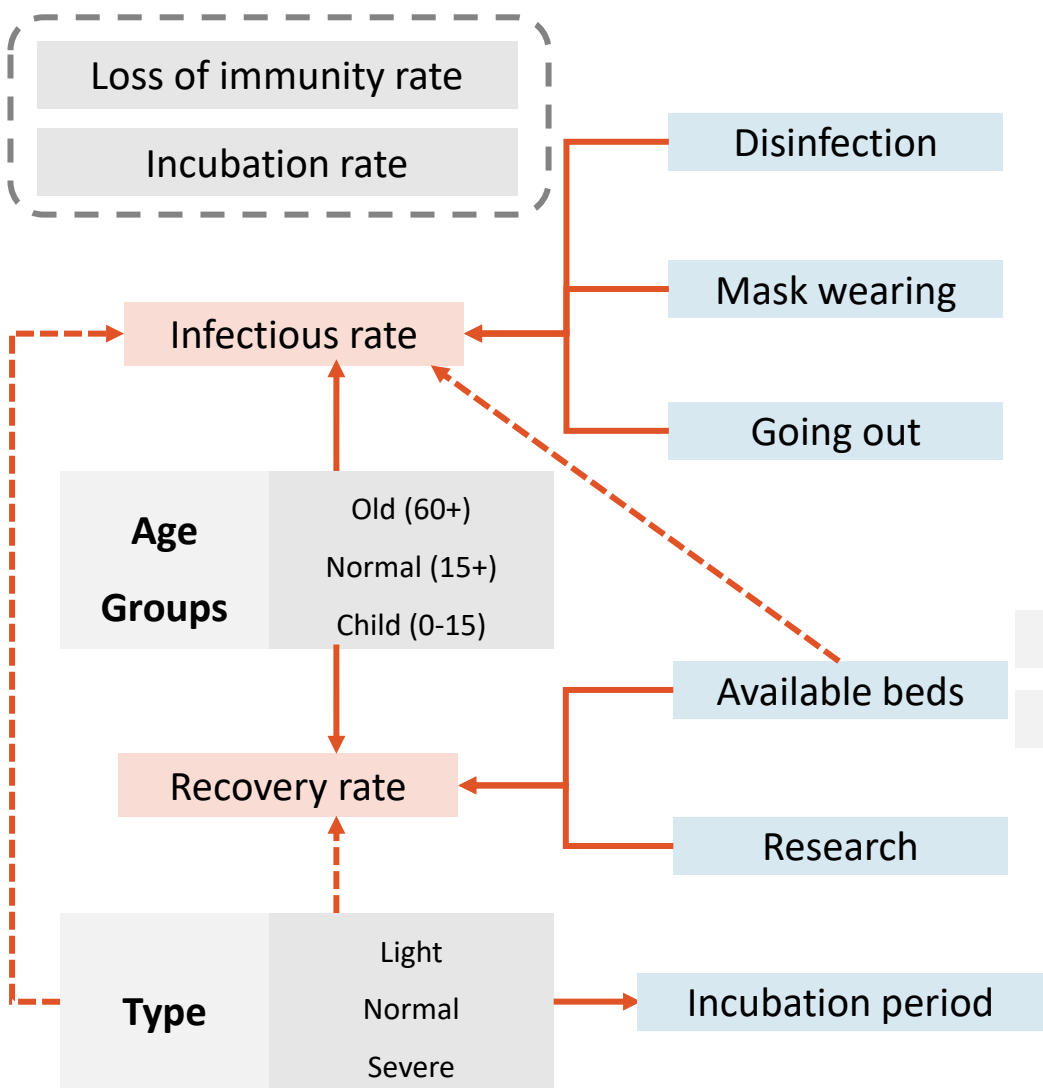
Infectious rate = (1-disinfection) × mask wearing × going out × age factor

If available beds > 0

$$\text{Recovery rate} = \text{ROUND} \left[\frac{research(\%) \times 100}{20}\right] \times 20$$

If available beds in hospitals = 0
(New severe cases) recovery rate = 0
(New severe cases) going out = 100%

If available beds in isolation zones = 0
(New severe cases) recovery rate = 0
(New all type cases) going out = 100%

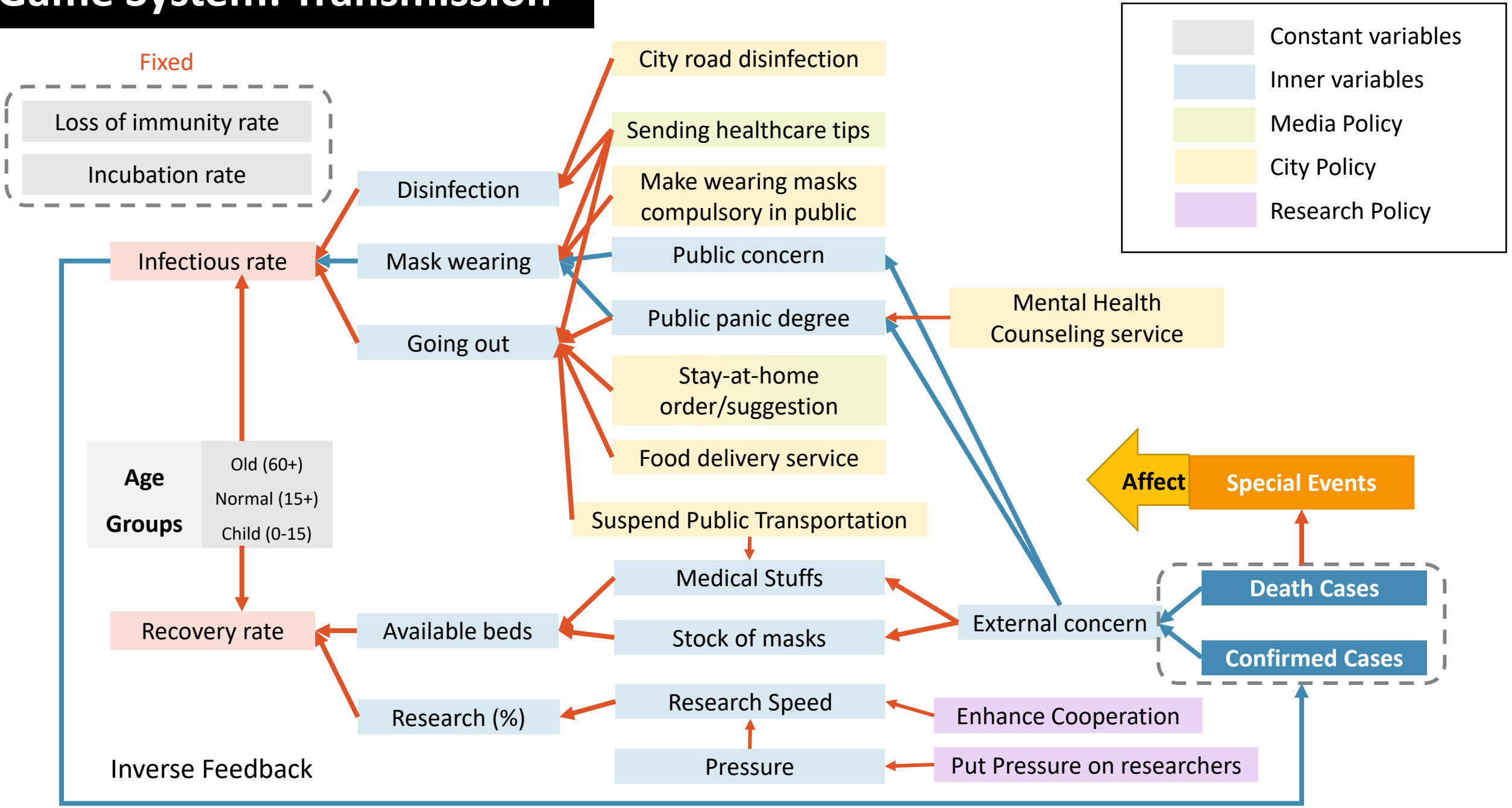Hospitals / Make-shift hospitals — Can receive light, normal, severe cases

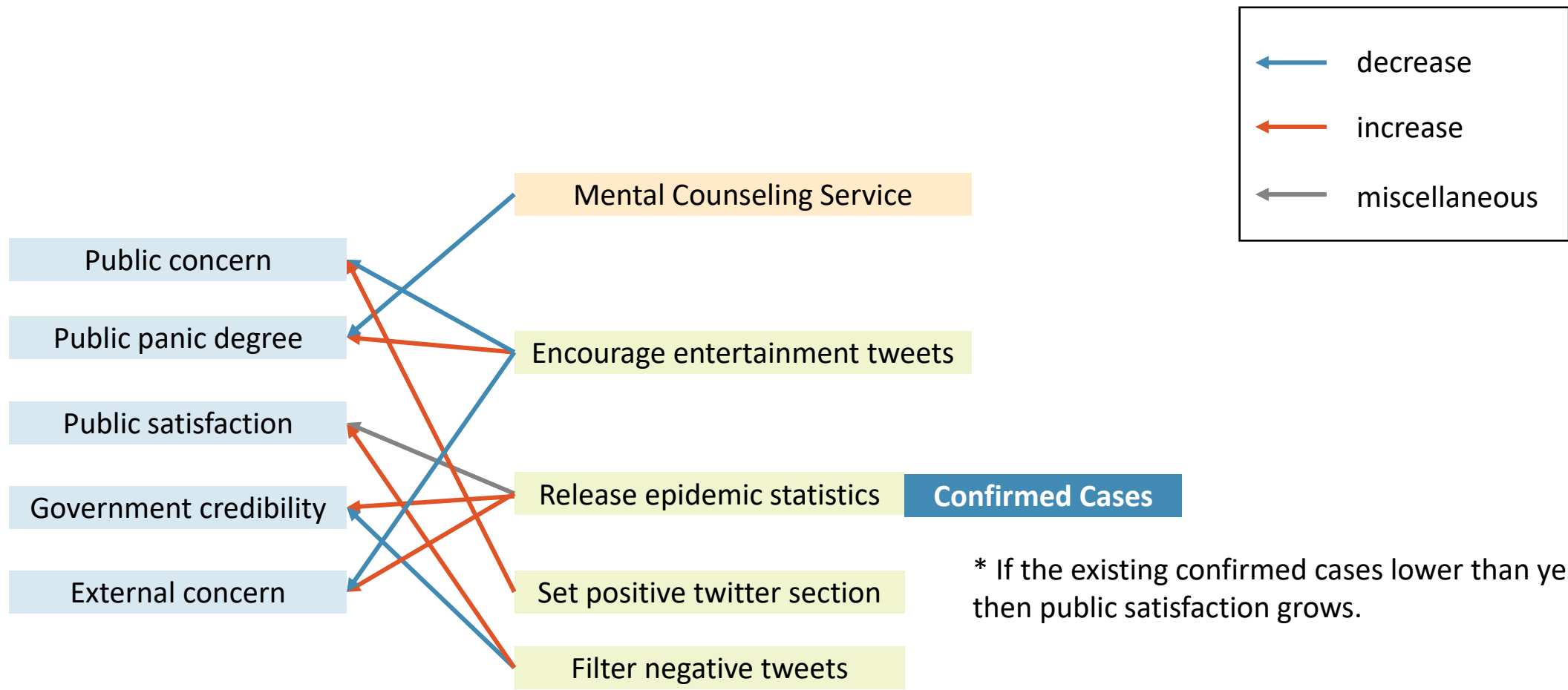Isolation zones / Quarantined Areas — Can receive light, normal cases

Note for why going out = 100%
Patients have to go to the hospitals or medical centers for taking injection treatment, and checking if there is available beds.
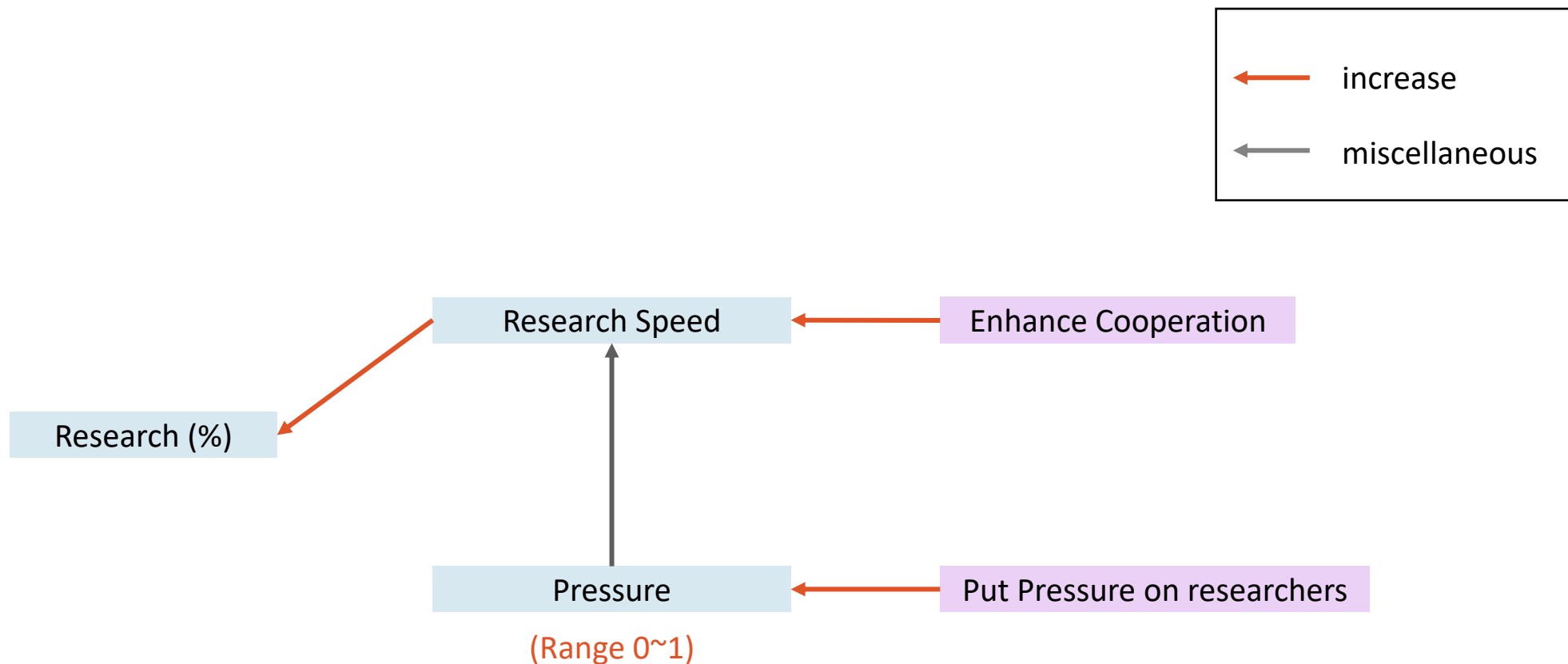
Diagram labels

Fixed
- Loss of immunity rate
- Incubation rate

Disinfection
Mask wearing
Going out
Infectious rate

Age Groups
- Old (60+)
- Normal (15+)
- Child (0-15)

Available beds
Recovery rate
Research

Type
- Light
- Normal
- Severe

Incubation period

Game System: Research

increase

miscellaneous

Research Speed ← Enhance Cooperation

Research (%)

Pressure ← Put Pressure on researchers

(Range 0~1)

Research speed = factor × *sin*(pressure)

* when you put pressure on researchers, they will work faster; but if there is too much pressure, then in the contrary, the research speed will drop.
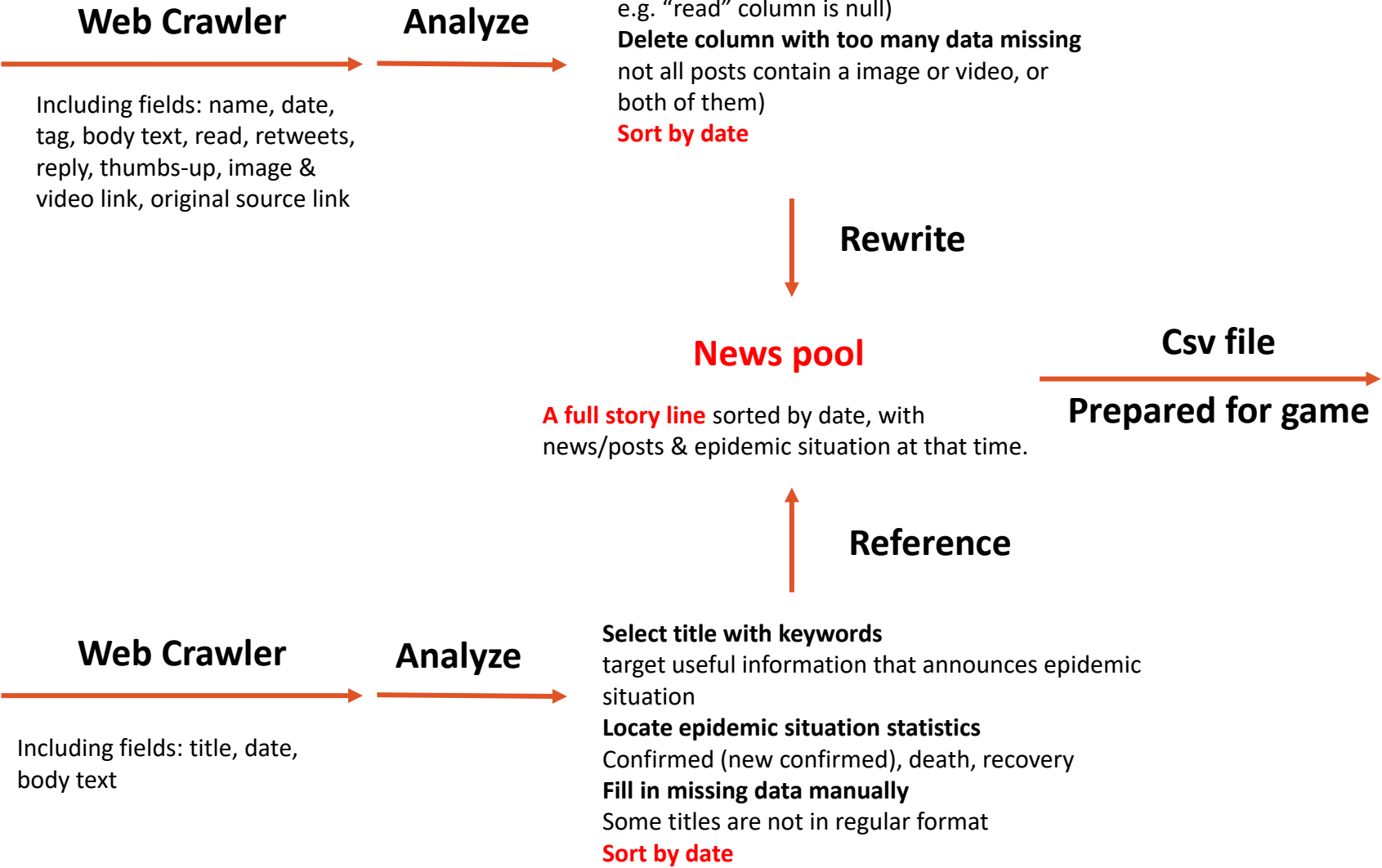
News Pool & science findings

Name

Date

Body text

Media

Retweet **Reply** **Thumbs-up**
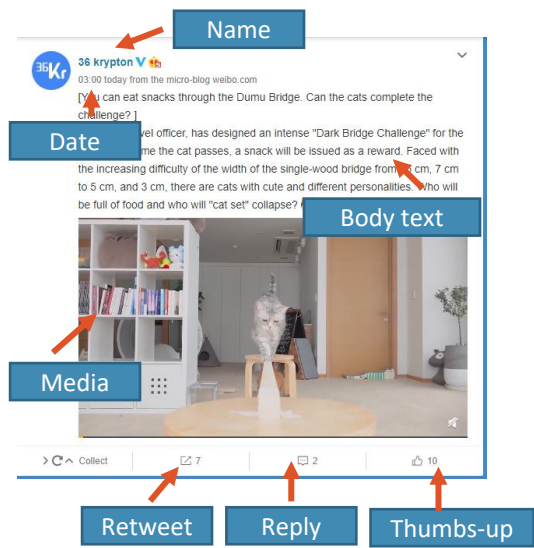
Weibo(Chinese Tweet), Social Media

Web Crawler → **Analyze**

Including fields: name, date, tag, body text, read, retweets, reply, thumbs-up, image & video link, original source link

Delete N/A values
e.g. "read" column is null)
Delete column with too many data missing
not all posts contain a image or video, or both of them)
Sort by date

Rewrite

News pool

A full story line sorted by date, with news/posts & epidemic situation at that time.

Csv file

Prepared for game

Reference

Health Commission of Hubei Province

Official Website

Web Crawler → **Analyze**

Including fields: title, date, body text

Select title with keywords
target useful information that announces epidemic situation
Locate epidemic situation statistics
Confirmed (new confirmed), death, recovery
Fill in missing data manually
Some titles are not in regular format
Sort by date

News Pool

criteria

Type	Event	Date	Confirmed	Death	Research	Beds	Med	New Confirmed	Tag	Tag/Keywords	Body Text
3			10						Recreation	# Zhang San is a professor and criminal law teacher of the University of Political Science and Law. How hot is he? He was invited to the C station, a network video platform. His first greeting video was played more than 5 million times.#	# Zhang San is a professor and criminal law teacher of the University of Political Science and Law. How hot is he? He was invited to the C station, a network video platform. His first greeting video was played more than 5 million times.
3			10						Recreation	# Foodie ordered takeout #	# Foodie ordered takeout # Foodie ordered takeout, and his request was very strange. After reading the boss's reply, I almost laughed to death! That was more strange!
1			44							#WHO: No travel or trade restrictions recommended against China #	#WHO: No travel or trade restrictions recommended against China # The World Health Organization issued an unexplained pneumonia in the city of W, "based on the information currently available, no travel or trade restrictions are recommended against China".
1			50							# City W Center for Disease Control and Prevention: Epidemic prevention is proceeding in an orderly manner #	# City W Center for Disease Control and Prevention: Epidemic prevention is proceeding in an orderly manner # Recently, in view of the situation of an unexplained viral pneumonia in our city, the reporter interviewed the CDC experts and the director of W city CDC on relevant issues of public concern, and was told that the prevention and control of unexplained viral pneumonia in our city is proceeding in an orderly manner.
1			100							#Three airports in America would screen passengers from W city. #	#Three airports in America would screen passengers from W city. #The Centers for Disease Control and Prevention (CDC) announced it was sending more than 100 employees to international airports in New York, Los Angeles, and San Francisco, to screen passengers from China. Inspectors would focus on people with symptoms like cough and dyspnea, and would check the temperature of each passenger through infrared thermometers.
3			100						Health	# Parents do not listen to the advice about prevention and control of pneumonia? In the face of the new pneumonia epidemic, many young netizens reported that their parents did not take it seriously: they did not wear masks, frequently went to crowded places, planned family dinners and visited relatives. In a short period of time, "behavior" is easier to change than "concept", so supervise and help them form healthy habits are more useful than persuade! For the sake of their health, please do more!#	# Parents do not listen to the advice about prevention and control of pneumonia? In the face of the new pneumonia epidemic, many young netizens reported that their parents did not take it seriously: they did not wear masks, frequently went to crowded places, planned family dinners and visited relatives. In a short period of time, "behavior" is easier to change than "concept", so supervise and help them form healthy habits are more useful than persuade! For the sake of their health, please do more!
3			100						Health	# Health Tips #	# Health Tips # Forward a reminder to wear a mask and reduce contact with dense groups!

Notes:

1. Date, confirmed cases, and death are three natural increase values. They can represent the progress of the disease.

2. In the game, news are randomly selected to present("happen") when all criteria are met. (If some of the criteria remain N/A, they are defined as met.)

Science findings

Notes:

1. Science findings can also be sorted by date. And date can be implied by "research completing percentage" in the game.

A	B	C	D	E
I	10	Establishment of NCP epidemic related scientific research group	The survey found that patients with unknown causes of new respiratory diseases were mainly aquatic market operators and purchasers.	**Diagnosis:** According to the clinical manifestations and epidemiological history, the patients can be detected an unknown new respiratory disease (NCP) diagnosis.**Treatment:** anti-infective drugs, including linezolid glucose injection, acamicin sulfate injection, moxifloxacin hydrochloride injection.
I	20	Establishment of NCP epidemic related scientific research group	The virus was isolated from a positive patient. It presented typical coronavirus morphology under electron microscope.	**Diagnosis:** According to the patient's clinical manifestations and epidemiological history, the patient can be detected coronavirus pneumonia (NCP) diagnosis.**Treatment:** anti-infective drugs, including linezolid glucose injection, acamicin sulfate injection, moxifloxacin hydrochloride injection.
I	50	Establishment of NCP epidemic related scientific research group	Using high-throughput sequencing technology, the first batch of samples were sequenced and the full genome sequence of the virus was obtained. The comparison determined that it was a new virus. The NCP virus is up to 96% genetically similar to a bat virus.	**Diagnosis:** According to the clinical manifestations and epidemiological history, patients can be detected coronavirus pneumonia (NCP) diagnosis.**Treatment:** to take clinical conventional treatment, symptomatic treatment. Prevention of organ dysfunction by active treatment of complications;At the same time, support treatment should be strengthened to enhance the immunity of the body.
III	225	Develop of antibody kits; Further study pathogenic mechanism and virus traceability.	Scientists from many countries jointly published a paper predicting that the actual number of infected people far exceeded the reported number. The paper predicts that by January 28 the actual number of NCP infected people has reached 26701. The Institute has successfully isolated the NCP strain, which means that we have entered the stage of developing vaccines.	Diagnosis: Nucleic acid test kits can provide evidence of etiological testing. Treatment: take bed rest, antiviral treatment (α-interferon aerosol inhalation, lopinavir, ritonavir), evidence of secondary bacterial infection when the application of antimicrobial drugs, active prevention and treatment of complications, if necessary, to give respiratory support.
III	250	Develop antibody kits; Further study pathogenic mechanism and virus traceability. Further study pathogenic mechanism and virus traceability.	The national research team used computer simulation screening, in vitro enzyme activity testing and other methods to screen more than 70000 drugs or compounds, selected 5000 potentially effective candidate drugs, screened at the cellular level, and then selected about 100 drugs to carry out in vivo activity experiments.	Diagnosis: Nucleic acid test kits can provide evidence of etiological testing. Treatment: Take bed rest, antiviral treatment (α-interferon aerosol inhalation, lopinavir, ritonavir), evidence of secondary bacterial infection when the application of antimicrobial drugs, active prevention and treatment of complications, if necessary, to give respiratory support.