

Facts – thanks for sharing his experience Dr. Nanshan Zhong – a wake-up call for the world

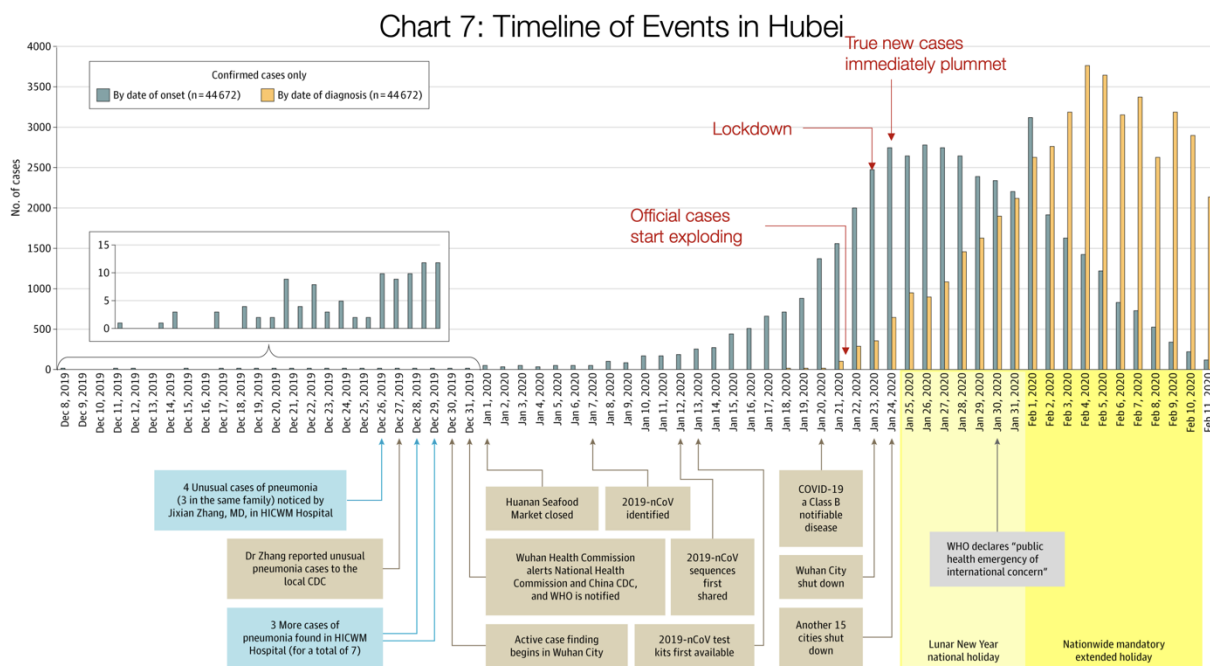
March 20, 2020

Facts why a **complete lockdown** is the only way to tackle the crisis and avoid total breakdown of healthcare systems and mass fatality:

- Proximity “guarantees” high infection rates (almost 20% infections on cruise ship Diamond Princess)
- Asymptomatic transmission (30% of patients are asymptomatic, another 56% have only mild symptoms) as the major cause (especially by children and young adults): 2.5 contagions on average per infected person...
- Basic reproductive number about 3 people and much higher than seasonal influenza or cold; much higher mortality rate as well
- Why? Because the virus load is much higher in upper airway at early stage of onset (see above – asymptomatic, but super contagious especially in first 5 days)
- Quick reaction necessary: early prevention, early detection, early diagnosis, early isolation
- Every country follows the same pathway and curve – **the flattening of the curve depends on early lockdown**

Why is this so difficult to understand?

#stayathome #flattenthecurve #COVID19 #timeiscriticalnow



<https://medium.com/@tomaspueyo/coronavirus-act-today-or-people-will-die-f4d3d9cd99ca>

Zoom Meeting ID: 962-741-624

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1 Transmission Features

- Transmission Route
- Transmission dynamics
- Asymptomatic patient (virus carrier)

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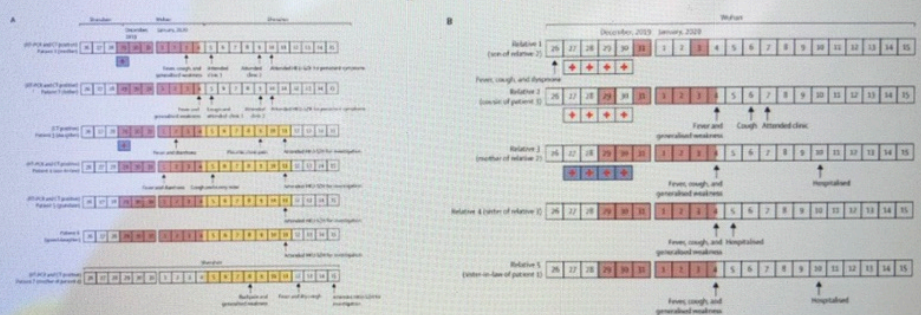
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A familial cluster of 2019-nCoV associated pneumonia indicating person-to-person transmission

The 1st case developed symptoms on Jan 10th



Chronology of symptom onset of the Shenzhen family cluster and their contacts in Wuhan. Dates filled in red are the dates on which patients 1–6 had close contacts with their relatives (relatives 1–5). Dates filled in yellow are the dates on which patients 3–6 stayed with patient 7. The boxes with an internal red cross are the dates on which patients 1 and 3 or relatives 1, 2, and 3 had stayed overnight (white boxes) at or had visited (blue boxes) the hospital in which relative 1 was admitted for febrile pneumonia. The information of relatives 1–5 was provided by patient 3. No virological data were available.

Chan et al. *Lancet* 2020; 395: 514–23

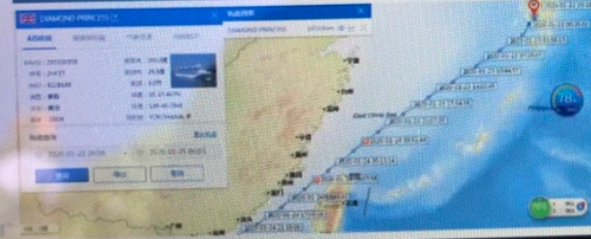
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COVID-19 outbreak in Diamond Princess



Up to 29th Feb, totally 712 patients
(712/3711, 19.1%) infected on Diamond Princess

- 3711 passengers : 2666 passengers / 1045 crew members
- More than half of the passengers are over 60 years old and come from about 30 countries and regions around the world

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Asymptomatic Transmission

No symptoms



Timeline of Exposure to Index Patient with Asymptomatic 2019-CoV Infection in Germany

Rothe C., et al. N Engl J Med. 2020.

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Basic reproductive number

Median R_0 : ~3.0 for SARS-CoV-2 among published reports

Basic reproductive number estimated from different studies

Comparison of the R_0 among different viruses

Clinical characteristics	SARS-CoV	MERS-CoV	Seasonal influenza*
Basic reproductive number	2.0-3.0	<1.0	1.5

Li Q, et al. *N Engl J Med.* 2020; Zhao et al. *Int J Infect Dis.* 2020; Zhou T, et al. *J Evid Based Med.* 2020; Jung SM, et al. *J Clin Med.* 2020; Zumla A, et al. *Lancet.* 2015

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- Virus load much higher in upper airway at the early stage of onset (More contagious in early stage)
- Decreases remarkably one week later

Lirong Zou, et al. *NEJM*, February 19, 2020.

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Attention

- High basic reproduction number (R_0) ≈ 3
- High mortality (0.7%-7.0%, $\pm 4\%$) compared with influenza
- Transmission to human by asymptomatic virus carrier
- The earlier stage of patients' onset, the higher the infectivity (Alert for infected importer)
- Keep unobstructed of the sewer and exhausted tube

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5 China strategy in controlling further spreading





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Timeline of SARS-CoV-2 outbreak


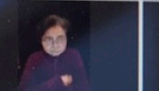


On January 20th, 2020, we had announced definite human-to-human transmission and also confirmed that medical staff had been infected.


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China's strategy in controlling COVID-19 spreading

- Lockdown Wuhan on 23rd Jan : "Don't go to Wuhan, Don't leave Wuhan".
- Realtime announcement of the number of diagnosed, suspected patients everyday in each city national wide
- Interagency mechanism launched (early prevention, early detection, early diagnosis and early isolation)
- Quarantine and RT-PCR test imperative in close contactors


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January 23, 2020. Blocking the Wuhan city



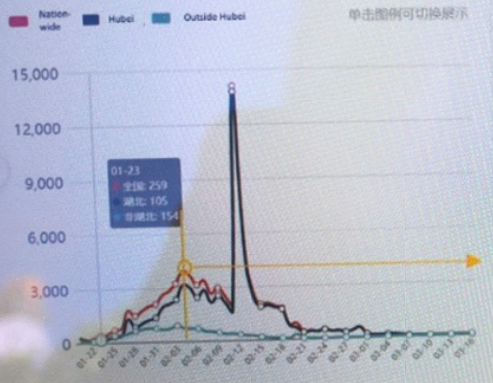
Masking in public

- Restricting people movement and home isolation
- Isolate suspected cases
- Extend spring festival holidays
- Delayed school opening,
- Closing live poultry trading market,
- Information disclosure
- et al.

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Lock down Wuhan, Interagency Mechanism (Four Early) national-wide



- Two weeks (23rd Jan. to 4th Feb.) reaching peak (patients number)
- Four weeks under basic control

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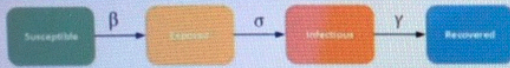
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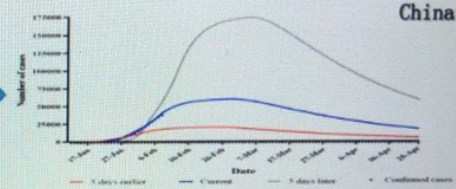
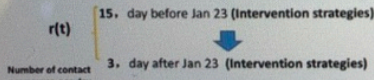
Predict the real-world situation considering public intervention and migration



Estimation of model parameters

SEIR (classic)	SEIR (modified)
Transmissibility β	Transmissibility β
Incubation rate σ	Incubation rate σ
Probability of recovery or death γ	Probability of recovery or death γ
Additional parameters	Diversity of transmission k
	Government management $r(t)$
	Migration rate S_{in} and S_{out}

k1: S→I k2: S→E



If interventions introduced 5d delay

- Peak: **On March 4**, the cumulative number of infections: about **170,000**

Interventions on January 23

- Peak: **February 28**, the cumulative number of infections: about **60,000**
- End: **the end of April**

If interventions introduced 5d earlier

- Peak: **On February 23**, the cumulative number of infections: about **20,000**

中国科学院 (CAS)

Yang Zifeng, ..., Jianxing He, et al. JTD. 2020, Feb