因應新型冠狀病毒
之
醫院動線管制

SARS-CoV-2 vs Traffic Control -2

顏慕庸

National Yang-Ming University

Taipei City Hospital

Outline

- **SARS and Traffic Control Bundling (TCB)**
- Fomite transmission
- SARS 2.0 vs TCB 2.0 (ETCB)
- Implication in future Responsiveness

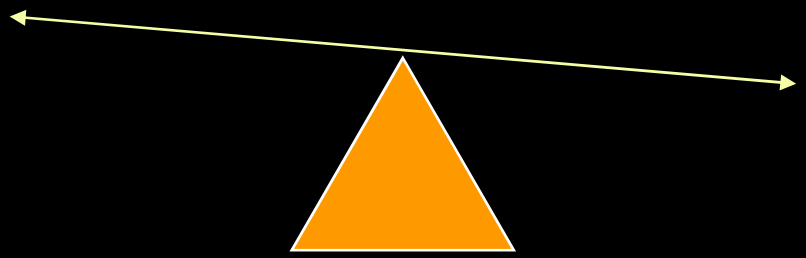
2003 SARS epidemic of Taiwan

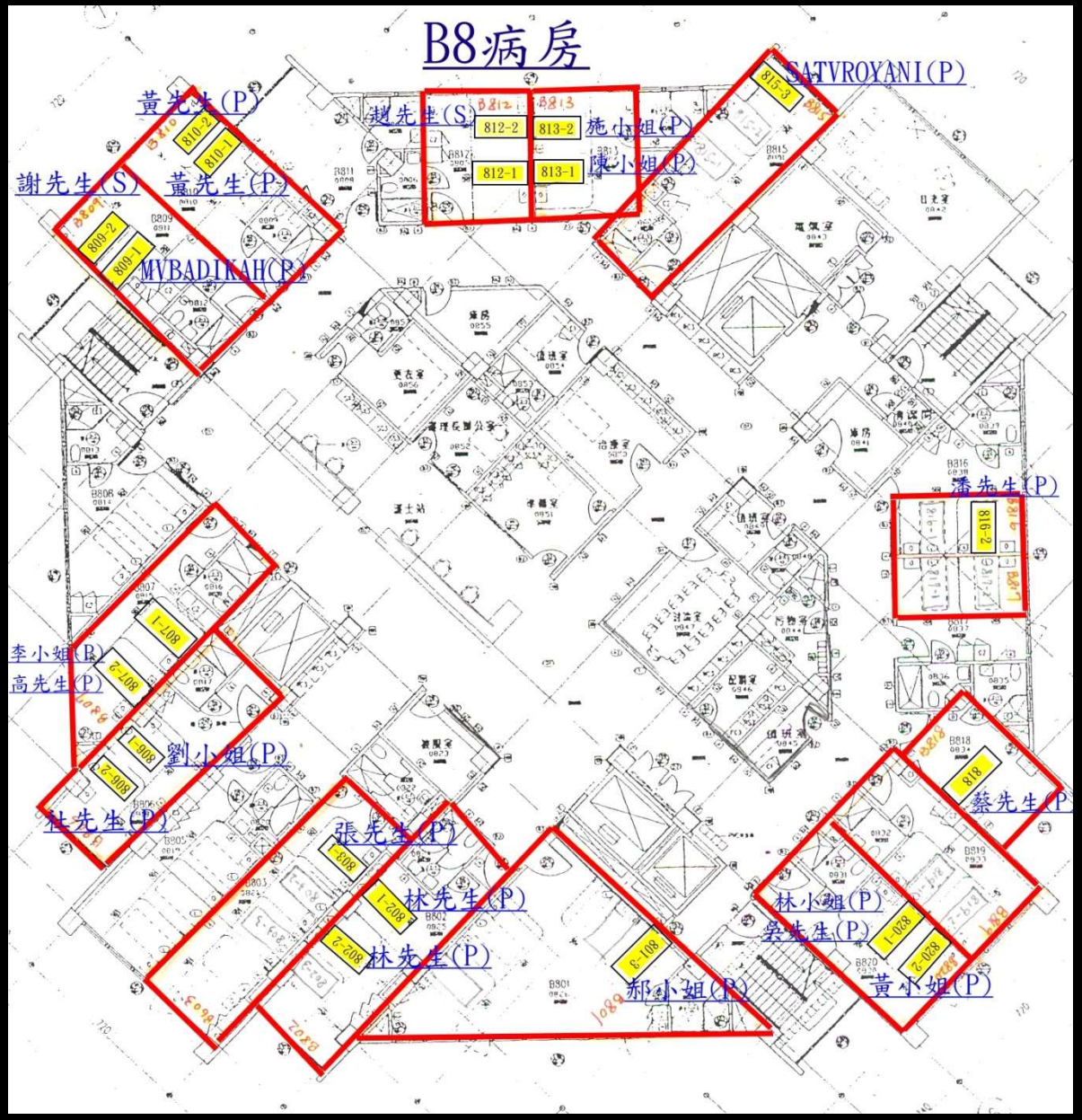
Respiratory Droplet,

NPIR, N95

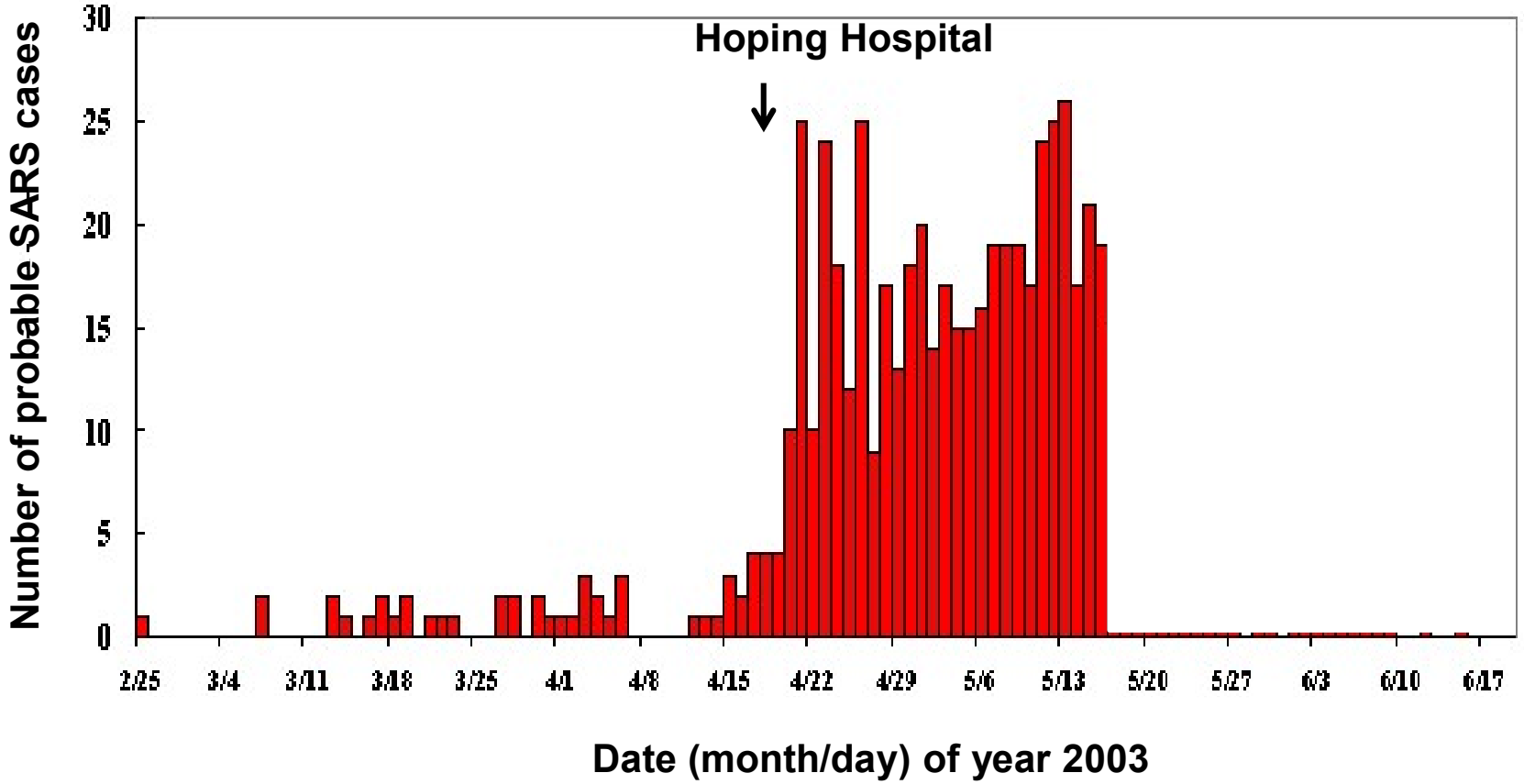
contact

PPE, SOP




B8病房
黃先生(P)
謝先生(S)
黃先生(P)
MVBADIKAH(P)
趙先生(S)
812-2
813-2
施小姐(P)
812-1
813-1
陳小姐(P)
SATVROYANI(P)
潘先生(P)
李小姐(P)
高先生(P)
劉小姐(P)
杜先生(P)
張先生(P)
林先生(P)
林先生(P)
郝小姐(P)
林小姐(P)
吳先生(P)
黃小姐(P)
蔡先生(P)

SARS epidemic 2003, Taiwan



A Brand New World for SARS Infection Control

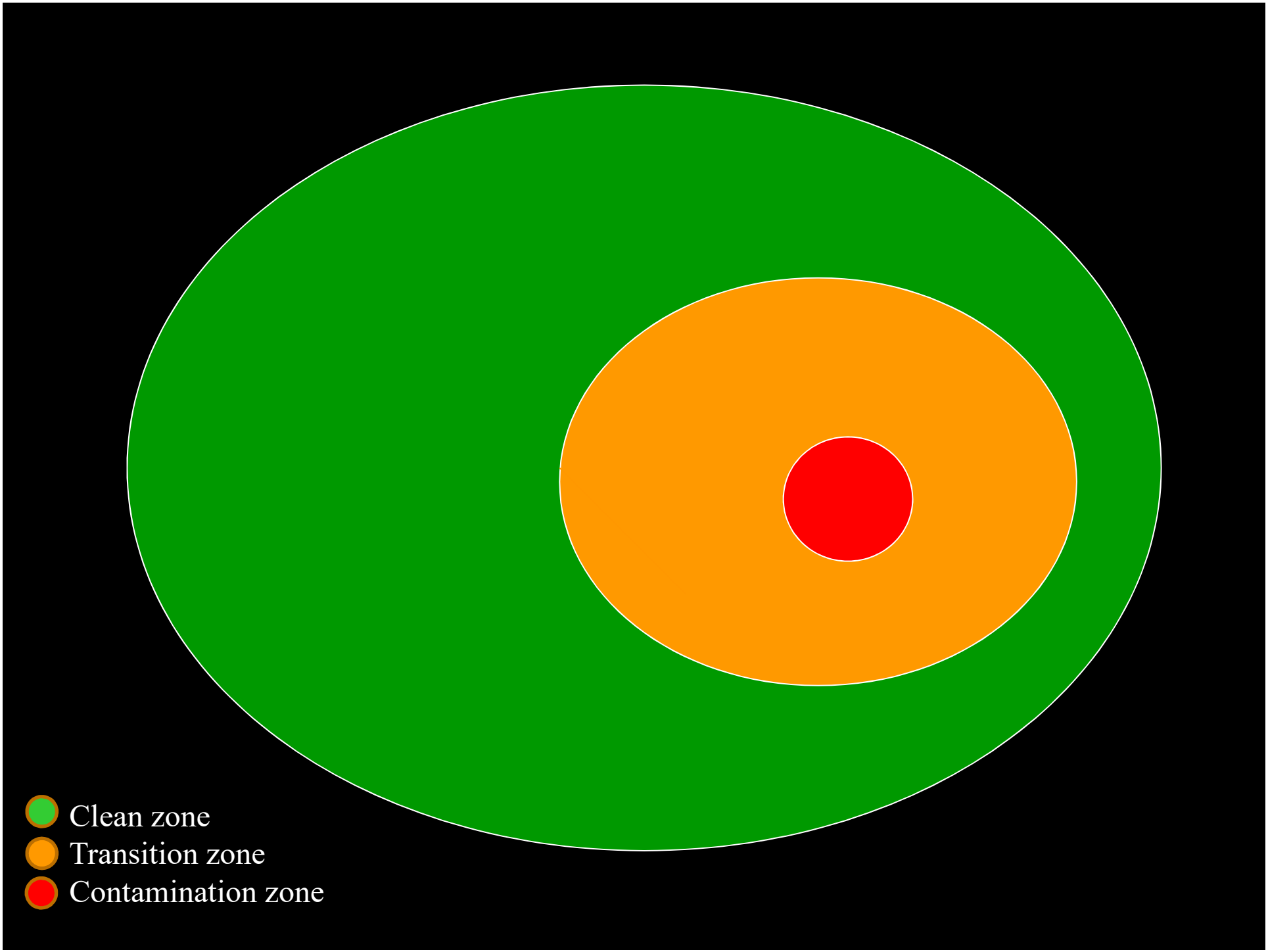
顏慕庸

李建賢

Task Force of SARS Control Committee
in Sung Shan Hospital, DOH

2003/May/03

第九病房
外
國軍松山醫院啟
自動化停車設備
(入口)·請減速慢行


Clean zone
Transition zone
Contamination zone

MAY 8 2003

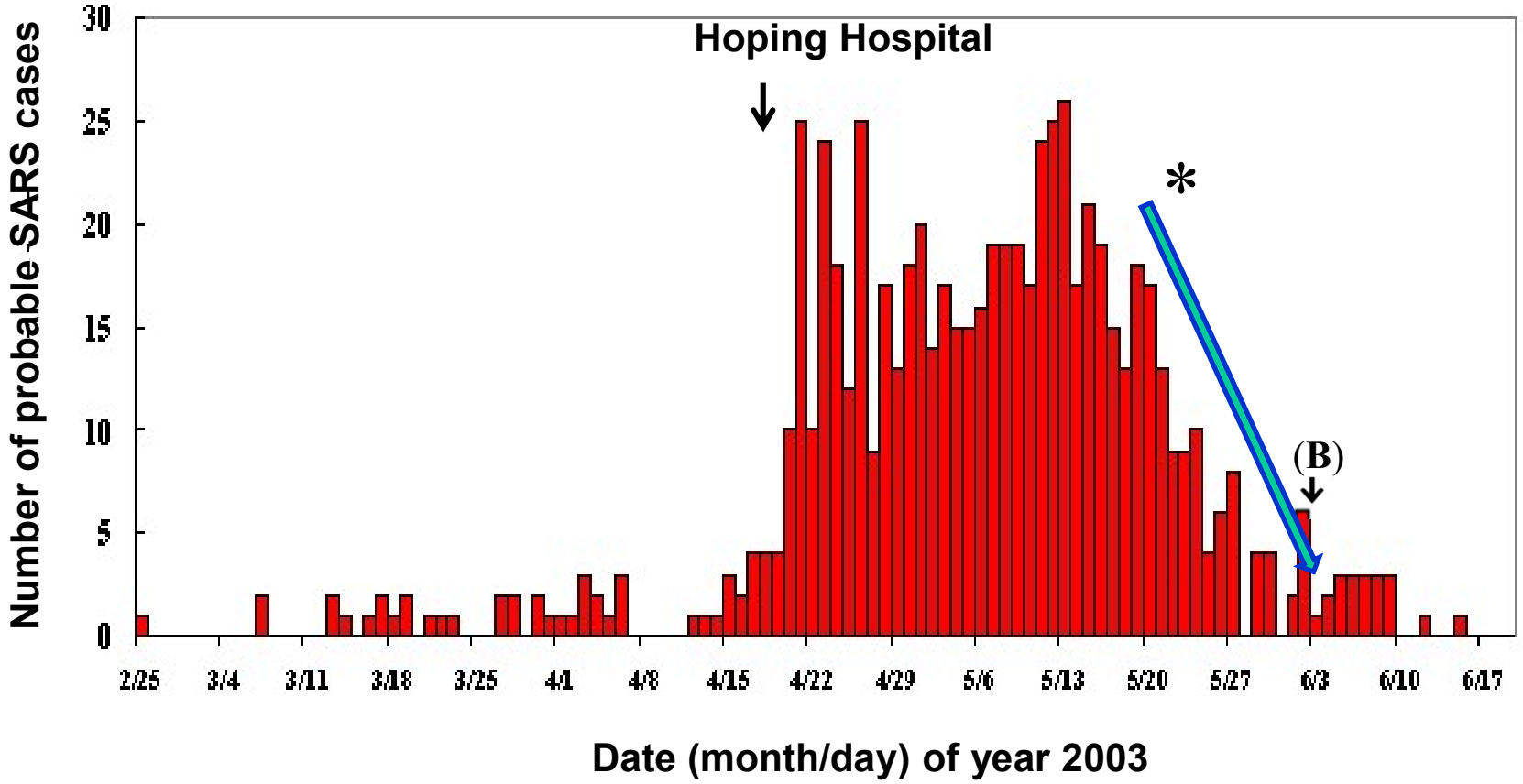
動線管制
Traffic control bundle

- An integrated infection control strategic bundle which includes (核生化規格)

  - **triage of patients into hospital** 到院前分流
  - **zones of risks** 汙染分區
  - **installation of alcohol dispensers at checkpoint hand disinfection** 節點洗手

- Yen MY, et al. JHI ,2006.2,62:2:195
- Yen MY, et al. *Scand J Inf Dis*, 2010,
- Yen MY, et al. JHI, 2011, 2014

SARS epidemic 2003, Taiwan



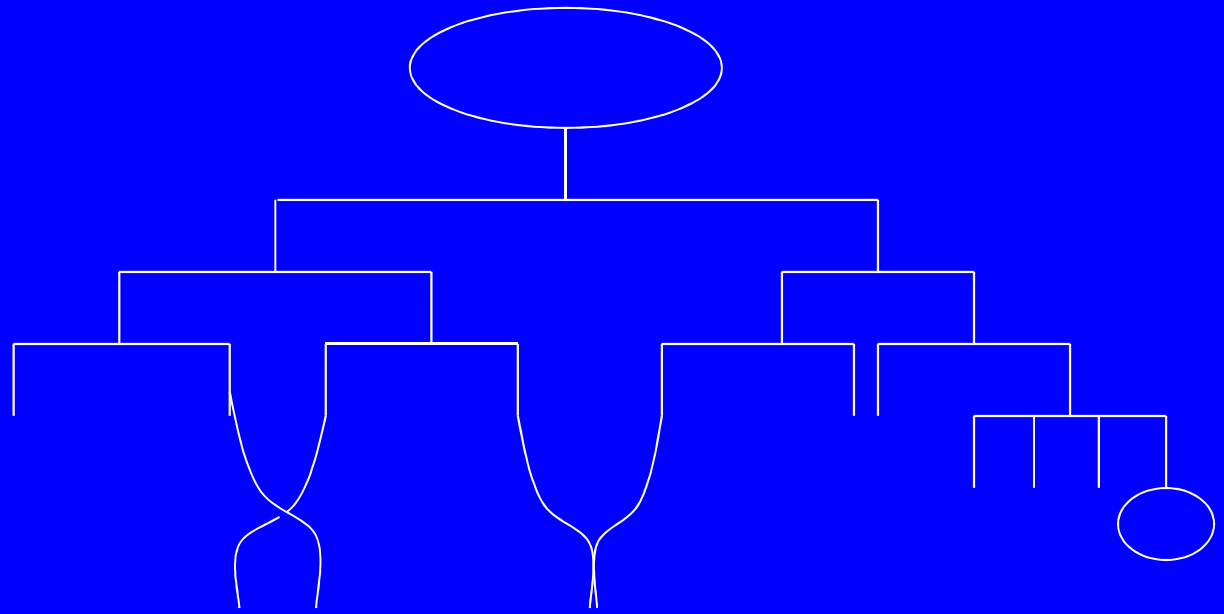
Yen MY, et al. CID, 2015; August 3, doi: 10.1093/cid/civ648

Sources of vulnerability

- Atypical presentation 第一現場 診斷不明

- the unwarranted assumption among HCWs that existing barrier precautions and PPE provided sufficient protection and
- obviated the need for hand disinfection.

- casual contact with contaminated environments.



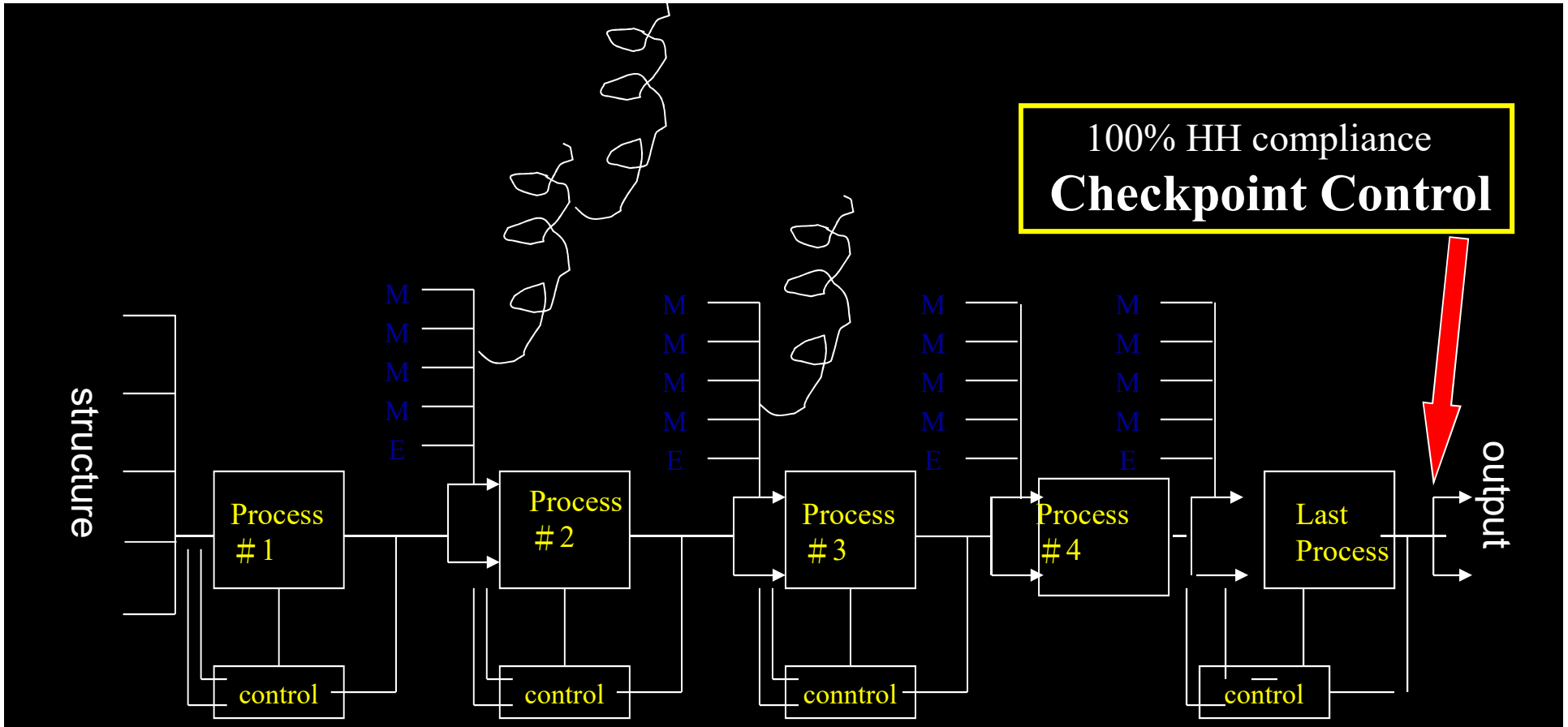
吹毛求疵　抽絲剝繭

Nothing is particularly hard if you divide it into small jobs.

Henry Ford

Reductionism 化約論

2·38·5·19



6 sigma 流程/分流管理

越分越細 越好管理

Yen MY, et al. *J Hosp Infect* 2014; 87:185-93

醫護第一 病人次之

動線管制: SARS有效保護HCW

- 2003年SARS 台灣發展之抗煞措施
  - 50家收治SARS 病人醫院分析保護HCW因子
  - 戶外篩檢站，發燒/SARS病人分流，醫病分流， 廣設酒精洗手點。 (univariate analysis; P< 0.05). 再以多重回歸分析

	OR	95% CI	P
Set up fever screen station outside of ED			
Ineffective	Reference	–	–
Effective	0.051	(0.004–0.692)	0.025
Set up alcohol dispensers at checkpoint for glove-on hand rubbing between zones of risk			
Ineffective	Reference	–	–
Effective	0.043	(0.003–0.627)	0.021

  - 到院前分流 (戶外疫病篩檢站)
  - 汙染分區 (醫院: 清潔、緩衝、汙染分區)
  - 節點洗手 (出入各區之間設置酒精洗手點， 縱使戴手套亦以酒精除汙)

- 統合性感控策略有效保護HCWs零感染，同時並保護病人(2: 203)

- 動線管制以其六標準差的策略管理，可以作為未來新興傳染病防疫的有效運用機制。

Yen MY, et al. J Hosp Infect 2011DOI: 10.1016/j.jhin.2010.12.002

Health e Galaxy™
Health News and Information for Your World
WELCOME MEDICAL PROF
Home Medical Radio Medical News FDA & Industry News Financial News
What Makes Us Different Choose Your Avatar Free CME Featured Programs Clinical Tools & Mobile App
Your ZIP Code Current Weather Conditions In Beverly Hills, CA (90210) Clear, and 55 ° F. | Doppler Radar | Pollen
Home » Medical News

Yen MY et al, 2014. Clin Infect Dis (2015) 60 (5): 823-825

"Traffic control" needed to control Ebola, SARS experts say

By Lorraine L. Janeczko

NEW YORK (Reuters Health) - Traffic control bundling (TCB) can protect healthcare workers from Ebola and other highly contagious diseases, according to a paper from Taiwan.

The authors speak from experience, having dealt with the 2003 SARS (severe acute respiratory syndrome) epidemic there.

"TCB is a powerful, convenient, and economical tool for protecting (healthcare workers) against highly contagious diseases. We recommend that it be implemented as part of

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Tweet
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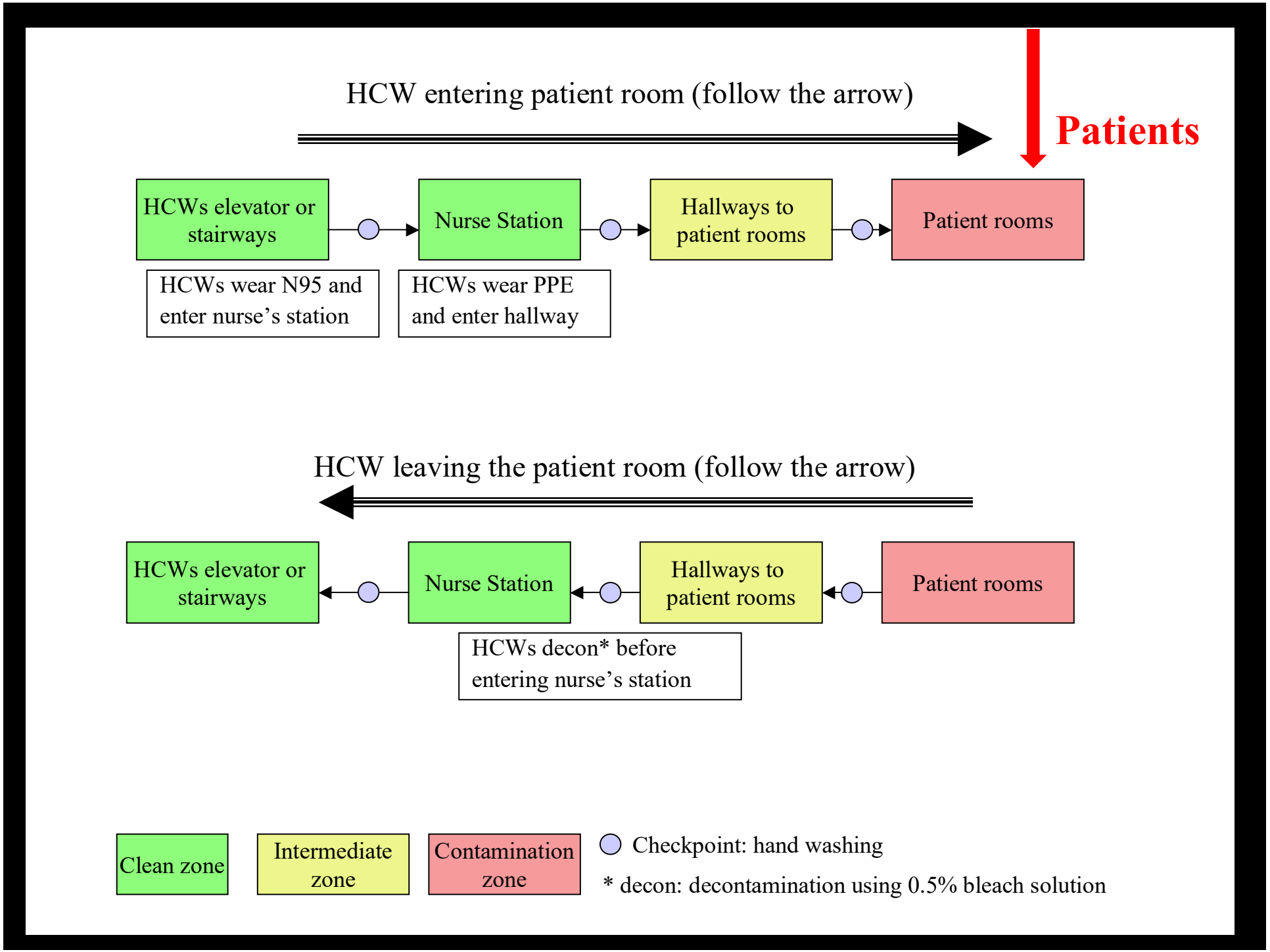
g+1


HCW entering patient room (follow the arrow)
Patients
HCWs elevator or stairways
Nurse Station
Hallways to patient rooms
Patient rooms
HCWs wear N95 and enter nurse's station
HCWs wear PPE and enter hallway
HCW leaving the patient room (follow the arrow)
HCWs elevator or stairways
Nurse Station
Hallways to patient rooms
Patient rooms
HCWs decon* before entering nurse's station
Clean zone
Intermediate zone
Contamination zone
Checkpoint: hand washing
* decon: decontamination using 0.5% bleach solution

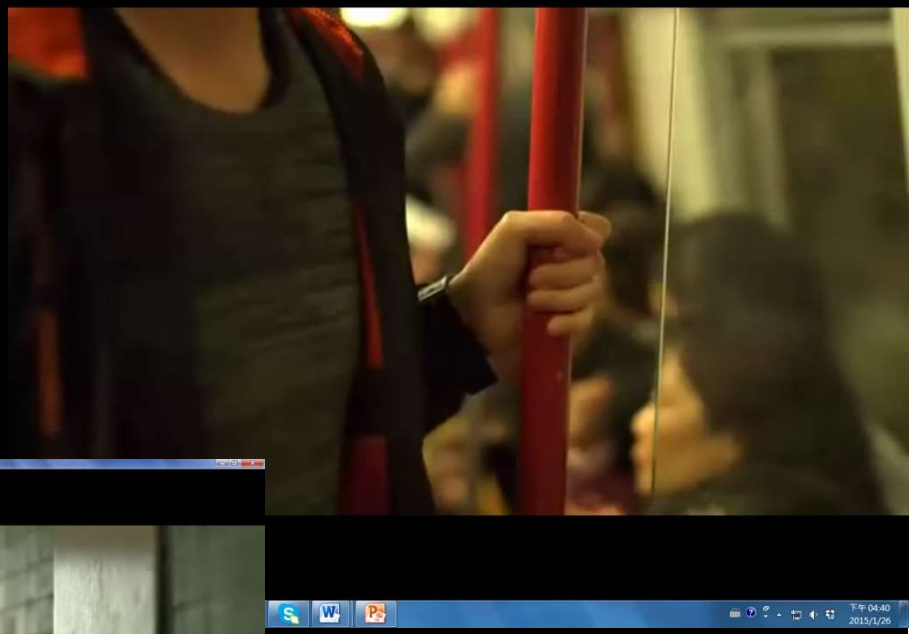
Outline

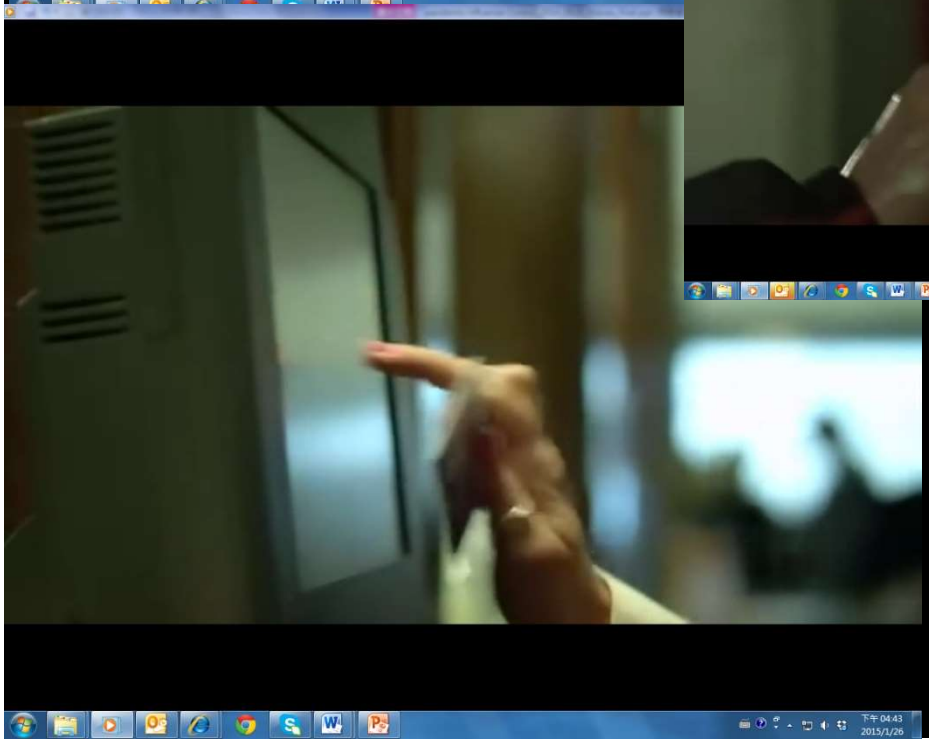
- SARS and Traffic Control Bundling (TCB)
- **Fomite Transmission**
- SARS 2.0 vs TCB 2.0 (ETCB)
- Application of future assessment

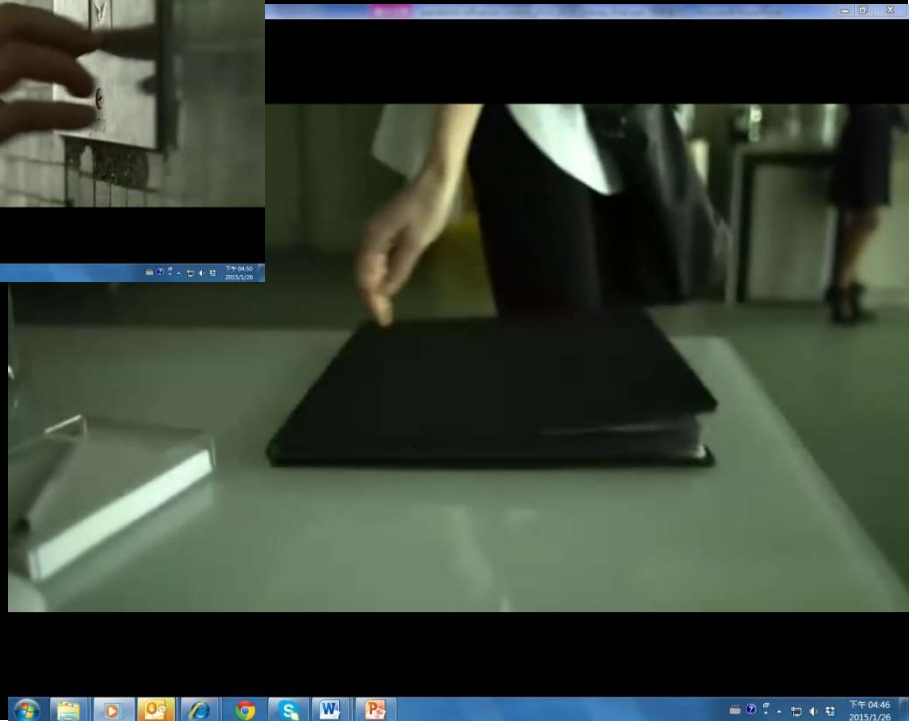
MARION COTILLARD
MATT DAMON
LAURENCE FISHBURNE
JUDE LAW
GWYNETH PALTROW
KATE WINSLET
NOTHING SPREADS LIKE FEAR
CONTAGION
participant MEDIA
imagenation
WARNER BROS. PICTURES

fomite

請拿好您的登機證

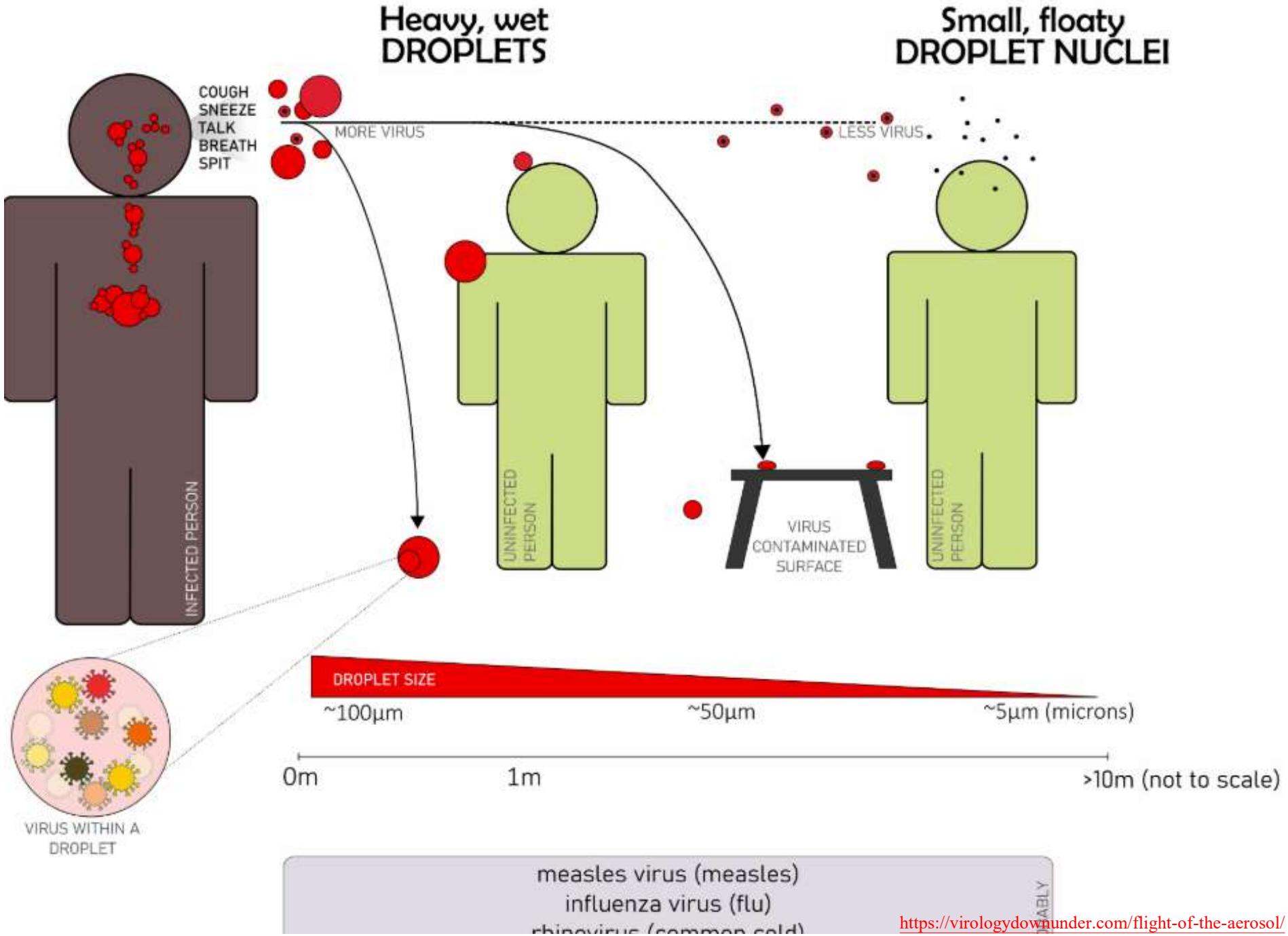






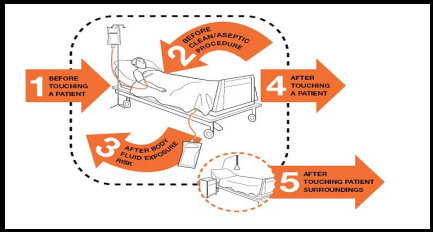
Beware of Fomites 環媒

- An inanimate object
  - as a SIM, dish, toy, book, doorknob, or clothing, etc.
- that may be contaminated with infectious organisms
- serve in their transmission



https://virologydownunder.com/flight-of-the-aerosol/

Definition of Contact:
2 hours
2 meters



- MERS, Korera 2015/May 20

casual contact with fomites through contaminated environments.

What we learned (II)

The current WHO definition of close contact did not work for hospital outbreak control

전염을 통한 **메르스 환자 발생** 흐름

6월15일 오후 3시 현재

0 남자 0 여자 0 퇴원 0 사망

첫 감염자 | 2차 감염 | 3차 감염 | 4차 감염

확진 150명
사망 16명
퇴원 14명
격리자 5,216명
치사율 10.67%

1 → 27명 2 3 4 6 7 9 10 11 12 13 14 15 16 17 18 19 20 21 22 25 26 27 29 32 33 34 51

5명 93 94 108 117 144 한림대동탄성심병원

9명 23 24 31 36 45 82 83 95 105 건양대병원 → 1명 148

14명 30 38 54 84 85 86 87 107 127 128 129 130 143 149 대청병원

2명 88 여의도성모병원 92 서울아산병원

9명 28 37 39 40 42 43 44 52 53 평택성모병원
(2차감염자로 인한 의료기관내 감염)

70명 35 41 46 47 48 49 50 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 89 90 91 96 97 98 99 100 101 102 103 104 105 109 110 111 112 113 114 116 120 122 123 124 125 131 132 134 135 136 137 138 139 140 142 146 삼성서울병원
→ 1명 150 건국대병원
→ 2명 133 145 운전자 동승자 6월 5, 6일 76번 환자 이송한 민간구급대
→ 1명 147 송태의내과
→ 2명 115 외래 내원 141 외래 내원

3명 118 121 126 평택굿모닝병원

1명 119 ? 평택박애병원

자료/ 보건복지부 중앙메르스관리대책본부

박영석.김토일 기자 / 20150615

페이스북 tuney.kr/LeYN1, 트위터 @yonhap_graphics

Yen MY, etal. CID, 2015; August 3, doi: 10.1093/cid/civ648

Correspondence

Controlling Middle East Respiratory Syndrome: Lessons Learned From Severe Acute Respiratory Syndrome

To the Editor—First identifie
2012, Middle East respiratory
(MERS) usually derives from i
in close contact with camels.
tion may then spread to close
including healthcare workers
who are exposed to the patien
droplet and contact transmi
date, no other transmission m
been definitively identified [1].
evidence exists that a number o
fected by South Korea's index

ospital,
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Ws sig-
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03) [4],
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s imme-
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via fomites [4]. Shortly after the index SARS case entered Hoping Hospital in Taipei, a nosocomial SARS outbreak occurred. Similar to the South Korean MERS

contributors to nosocomial infection and spread of emerging infectious diseases, such as SARS and potentially MERS. As we have illustrated, it seems that fomite transmission is a common microbiological niche adapted to human behavior [3, 9, 10]. The SARS and, potentially, MERS

環媒fomite傳播是微生物繁衍共有的機制

addressing fomite transmission spread of emerging infectious diseases. Given the evidence that TCB effectively limits

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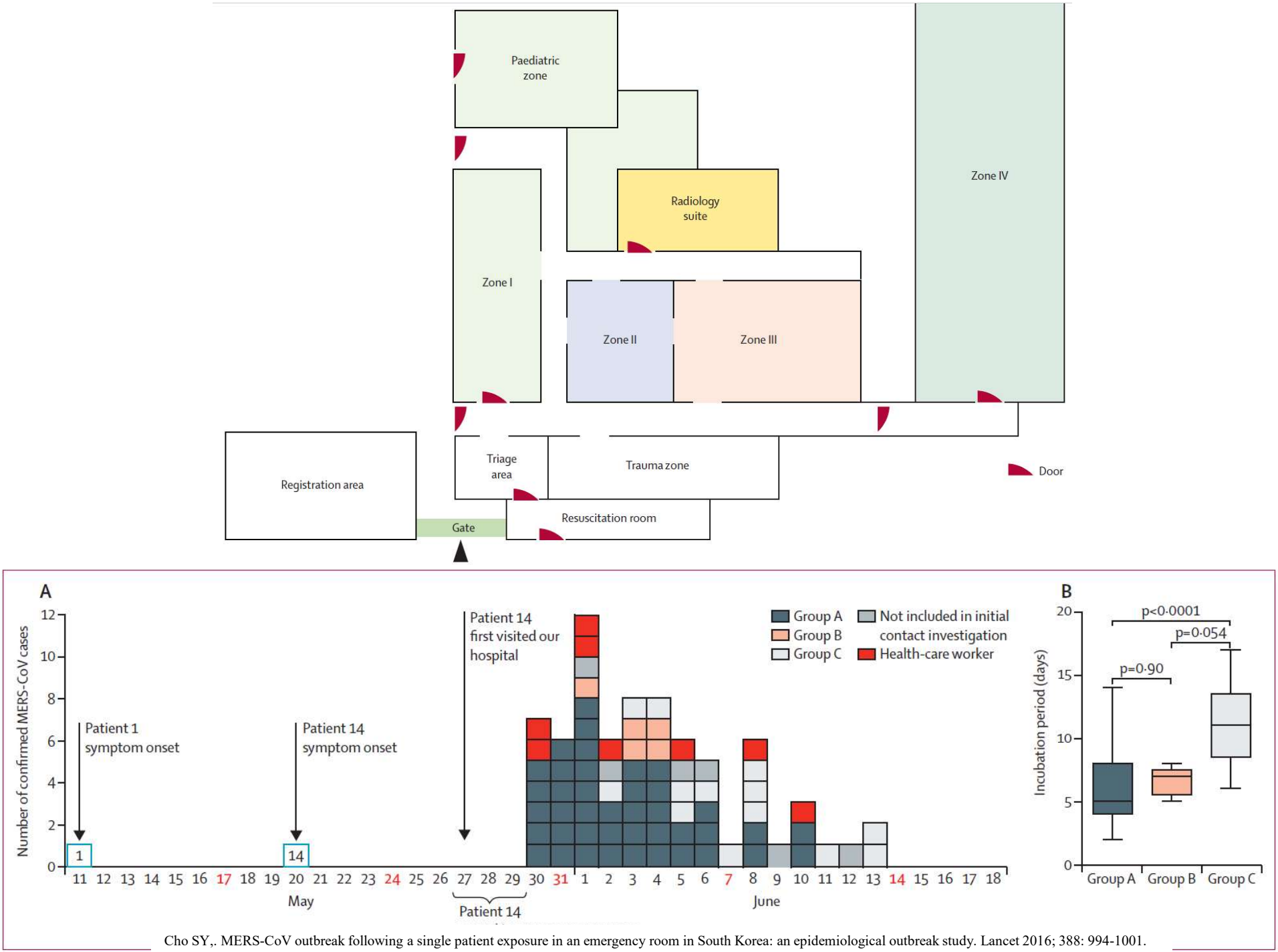
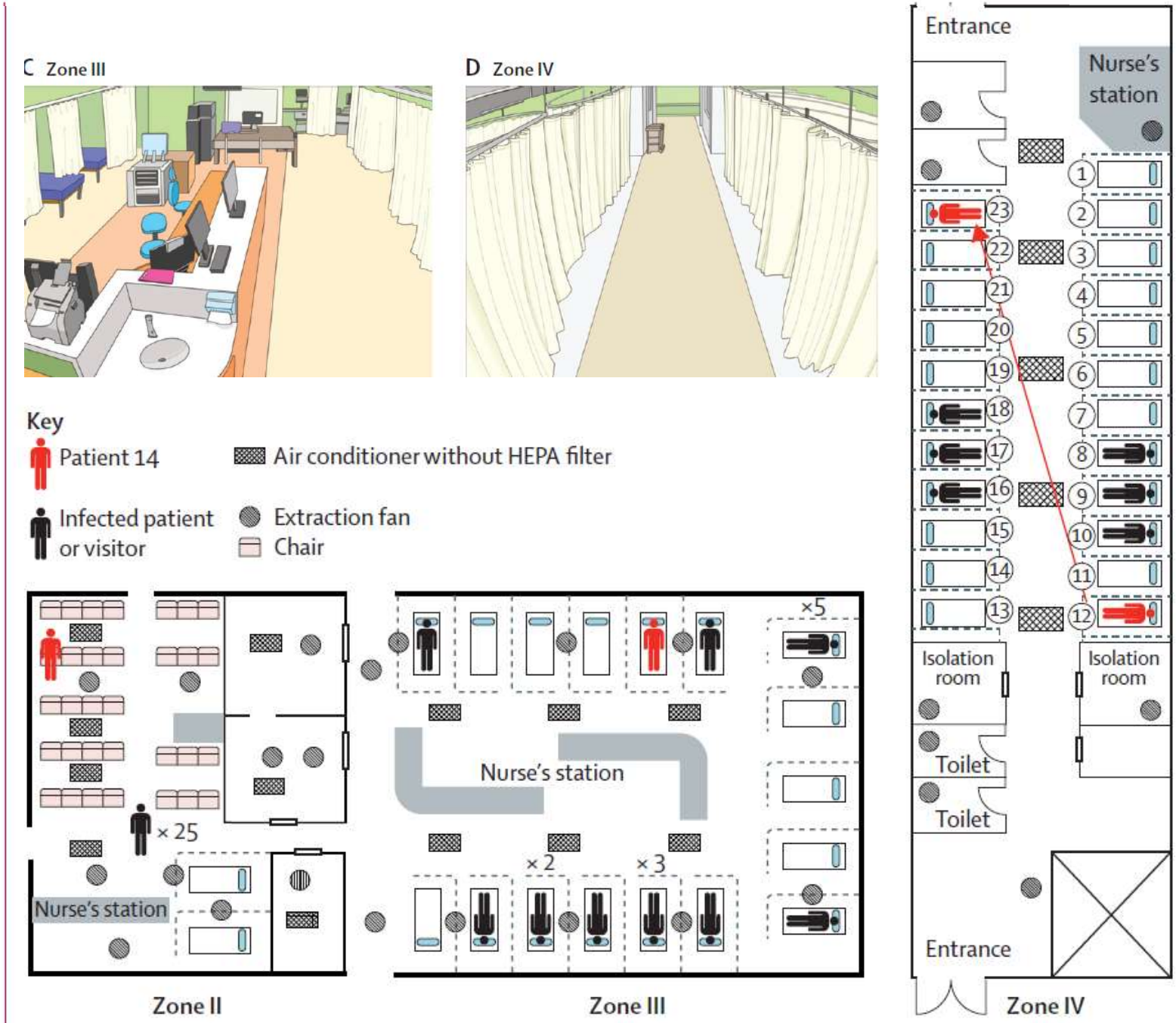


Cho SY,. MERS-CoV outbreak following a single patient exposure in an emergency room in South Korea: an epidemiological outbreak study. Lancet 2016; 388: 994-1001.

Cho SY,. MERS-CoV outbreak following a single patient exposure in an emergency room in South Korea: an epidemiological outbreak study. Lancet 2016; 388: 994-1001.



om in a tertiary-care
record information
duration of exposure,
g of exposed contacts.
ntact as being within
e same room or care
were difficult to apply
high patient volumes,
ncy room and to and
e numbers of visitors
red all patients who
the stay of Patients 1
ped criteria for close
efinitions of the US
evention (CDC),[12] and
groups. Therefore, we
l incubation periods
eak. In close contacts
ncubation period was
r than patients who
ly, in zones III and IV,
ney were separated by

locations, those who overlapped with Patient 14 at the radiology suite or registration area had higher attack rates (5%) than the rest of the patients (1%), suggesting that transmission might occur by even brief exposures to recently contaminated objects or encounters with individuals carrying a super-spreader.

Comparisons of environmental exposure and patient exposure also revealed unique findings. No patient developed MERS-CoV infection after exposure on May 29 only to the environment that had been potentially contaminated on May 27 (zone II) and May 28 (zone III) while Patient 14 was confined to zone IV on May 29. It is plausible that even if the environment was heavily contaminated by a super-spreader, the virus might not persist long enough in the environment to be capable of causing any new infection. Although patient exposure is clearly the most important factor in the spread of MERS-CoV, more research is needed to address the potential of environmental spread.[14]

Increased viral load and larger amounts of respiratory secretions have been suggested as the factors for SARS-CoV super-spreaders.[15,16] In this MERS outbreak,

Mode of transmission in MERS Samsung medical center, S. Korea

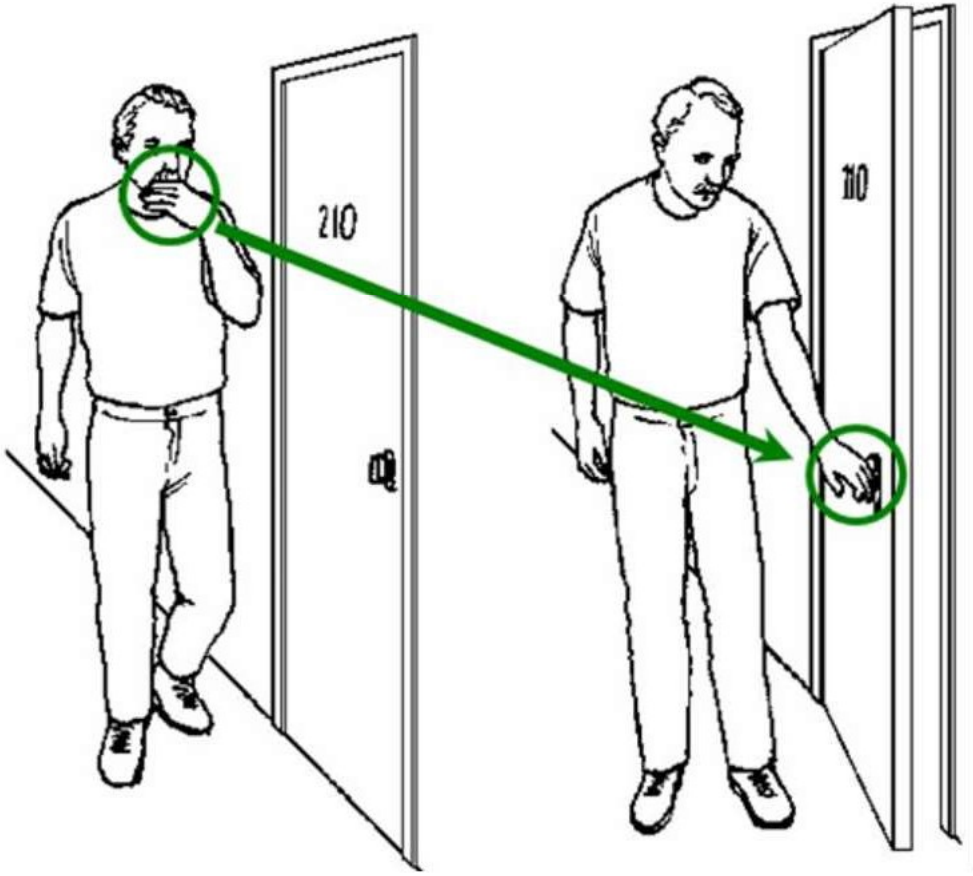
- Walking pneumonia with diarrhea of index case and infected other 70 cases in the emergency department.
- Bed curtains/Rest room (door knob, faucet of toilet, etc) as the common fomite reservoir.

study in the University of Arizona office

80 coworkers with 1 colleague carrying a virus mimicking flu. Within 4 hours, > 50 % of surfaces and hands with virus.

surfaces that are commonly touched but maybe rarely disinfected —
computer mouse/keyboard, the desktop in front of an individual's workspace.

doorknobs, faucets in the bathrooms, coffee pot, refrigerator handle, copy machine .



https://uanews.arizona.edu/story/germs-spread-fast-at-work-study-finds

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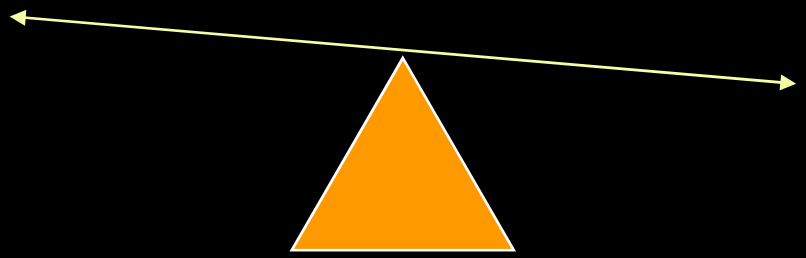
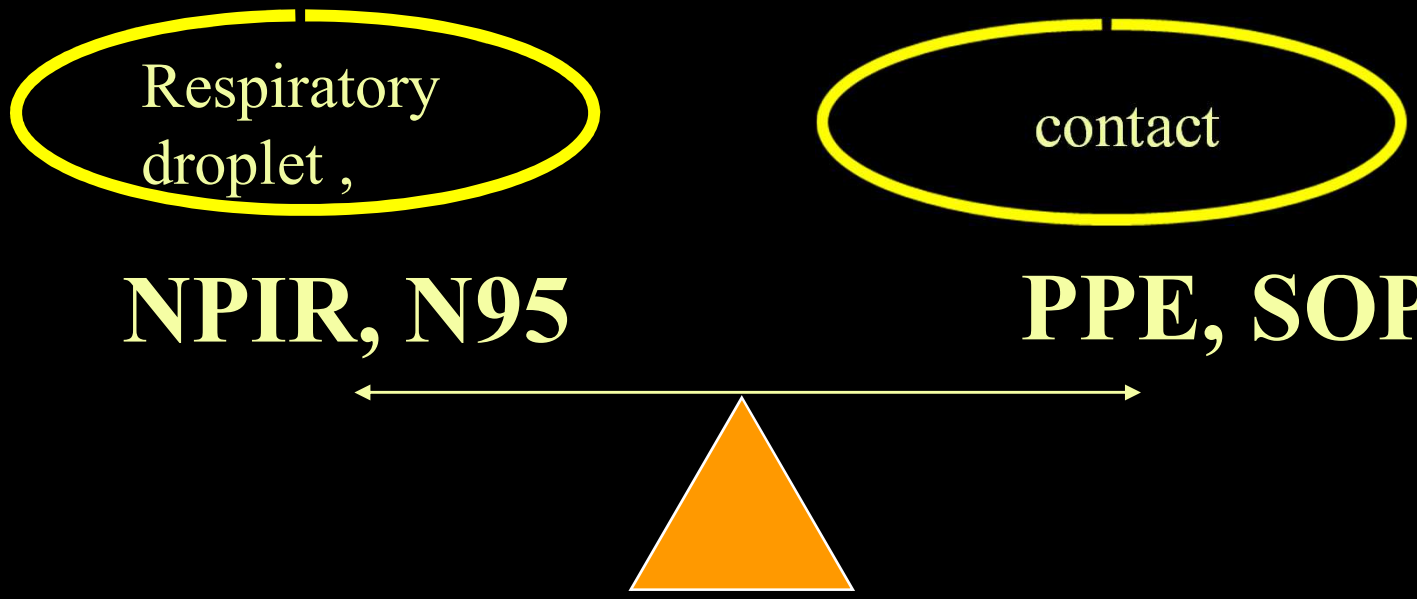


2003 SARS epidemic of Taiwan
2014 EVD episodes of USA
2015 MERS epidemic of Korea



fomite

Traffic Control

100% compliance of HH

Outline

- SARS and Traffic Control Bundling (TCB)
- Fomite transmission
- **SARS 2.0 vs TCB 2.0** (ETCB)
- Application of future assessment

东部战区总院呼吸科权威专家宋勇的回答㊙ 新冠病毒科学问答

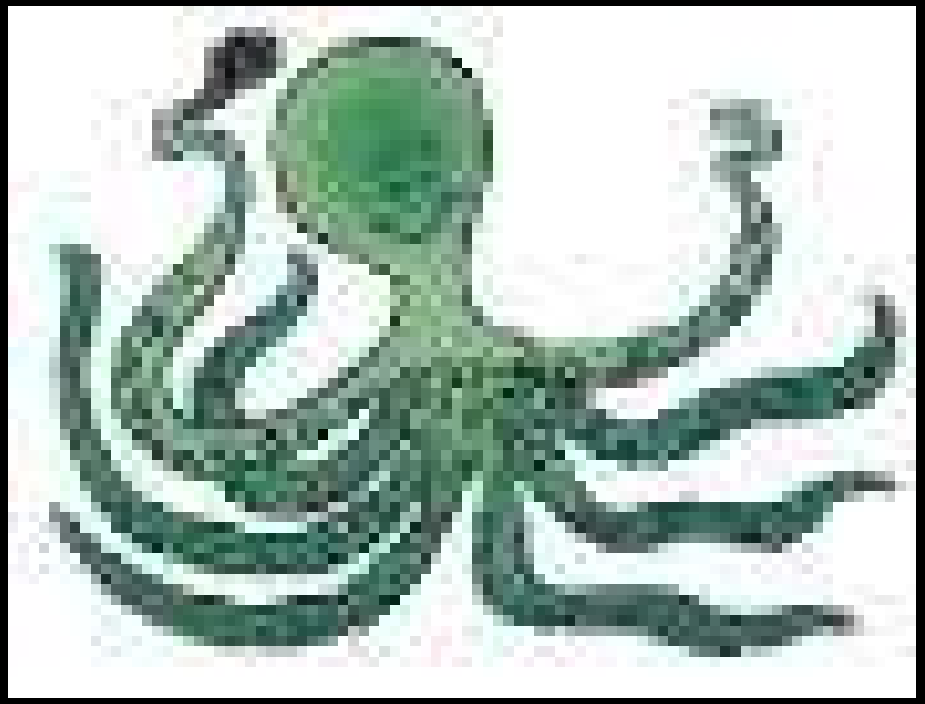
- ○ 1.新冠状病毒在普通环境中能存活多久？
- ✓ 答：病毒只能存活于生物体细胞内，室温情况下基本不能存活。 Q&A 16s. 2020/0203

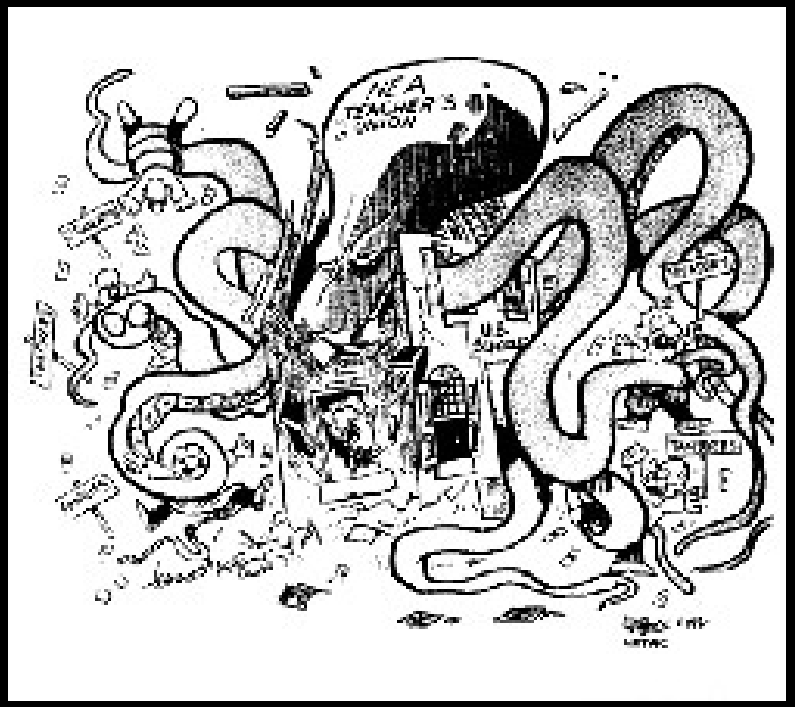
- 第1 題就錯了

- 顏慕庸 在環境中可以存活幾天，這也是他之所以會一直擴大傳染的最重要的原因
- 黃XX: 不是近距離方會傳染嗎！?否則天下不早就大亂了
- 顏慕庸 天下就是因為這樣才亂的，從2003年2014年2015年到2020年都是這樣子

@协和小医DO先森

No crossing or overlapping of the moving line





Casual contact of contaminated environment (fomites)
Lack of hand hygiene due to fully geared PPE

World Health Organization

Novel coronavirus press conference at United Nations of Geneva

29 January 2020

Speaker Key:

TA Tarik Jasarevic

00:49:19

MK So what we understand about transmission is that this is being transmitted through the respiratory route. So that is droplets and that also can have transmission through direct physical contact between people but also the possibility of fomites, which is when you have virus on an inanimate surface which could survive for a short period of time. So there's respiratory routes and that's based on all of the evidence that we have to date. The second question about mild cases is, as surveillance improves, as detection improves, we will see people identified on the more mild end of the spectrum. Typically in outbreaks we tend to focus on the severe cases because those are the individuals who seek care, so we pick those up first. So we may see more individuals on the mild end of the spectrum.

WHO finally declare PHEIC

- The UN's World Health Organization on 2020/0130 declared
- the deadly new coronavirus outbreak a global emergency that the epidemic of the new coronavirus which has appeared in China, and which has spread to several regions of the world, constitutes an international emergency, calling however not to limit traveling.

- and revealed that **the disease can spread more easily** than previously thought.

- https://nypost.com/2020/01/30/coronavirus-can-spread-on-contaminated-surfaces-experts-warn

NEWS

Coronavirus can spread on contaminated surfaces, exp warn

By Jackie Salo and Tamar Lapin

January 30, 2020 |

廣州確診病例 門把測出武漢肺炎病毒

13:00 2020/02/03 | 中時電子報 | 李慈音

108年12月13日起
愛心櫃檯
請抽號碼牌
請觸控螢幕
取號碼牌
取號機
掛號/批價
愛心櫃檯
提醒您：過號請重抽號碼牌
SENOR

聯合新聞網

願景工程 買東西 uD 有設計 售票網 有行旅

即時 要聞 娛樂 運動 全球 社會 專題 產經 股市 房市 健康 生活 文教 訊

快訊 新冠肺炎本土病例超越境外移入 指揮中心：社區傳播警訊 19:07

udn / 要聞 / 陸新冠肺炎疫情

香港佛堂二代傳播！經書、跪墊驗出病毒

2020-02-26 15:08 世界日報 / 香港新聞組／香港26電

+ 香港

熱門

首頁 > 新聞 > 國際要聞 > 正文

韓國大邱現超級傳播者 教會128人染武漢肺炎

日千葉縣1家健身房出現3名感染者 600人被鎖定追蹤

19:28 2020/02/25 | 中時電子報 | 黃菁菁

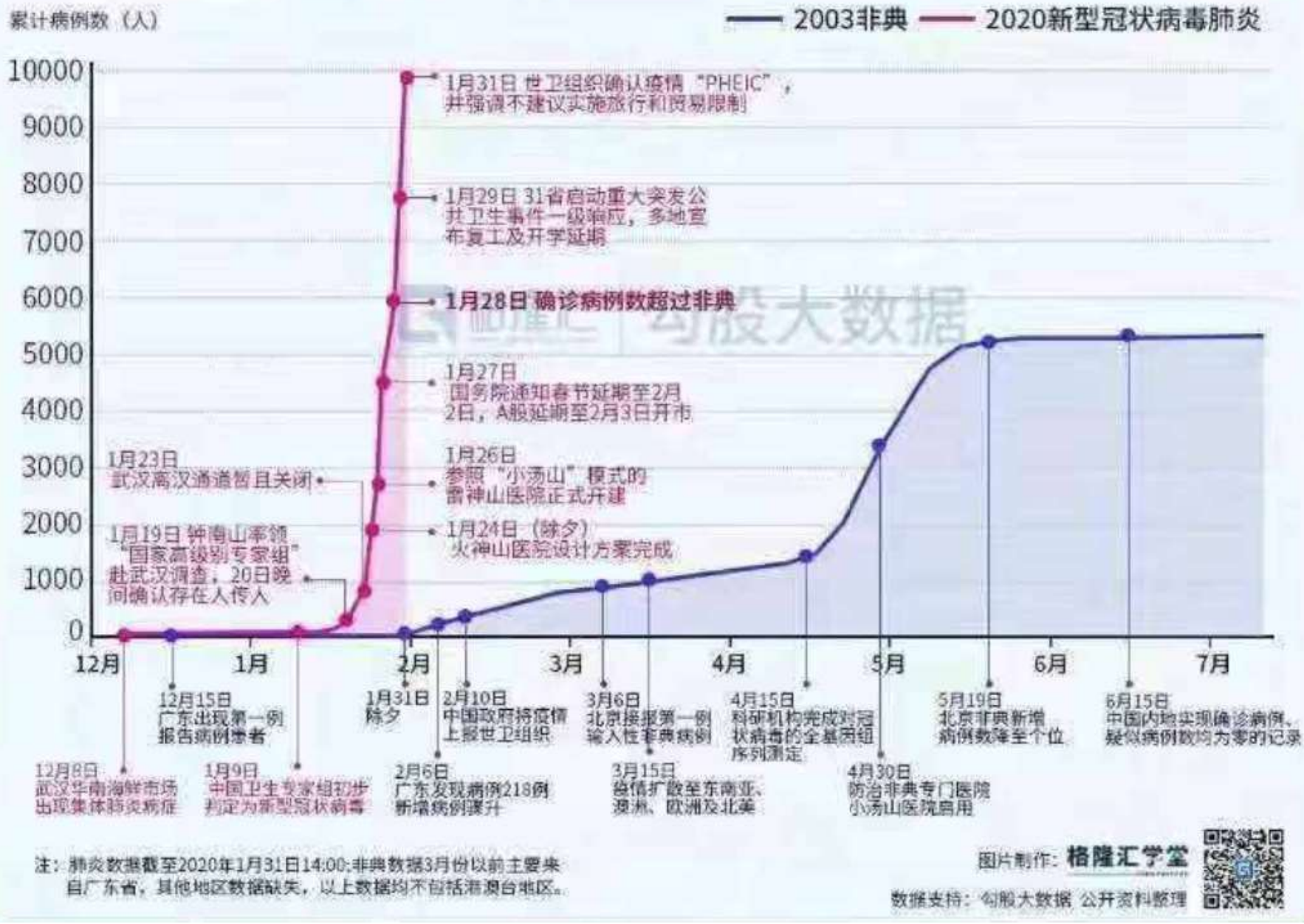
中天電視
HD 高畫質頻道
新聞ING
LIVE BROADCAST CH52

國際熱門新聞

1 土耳其不擋了 數千難民湧歐洲 - 國際大事 - 中國時報

2 韓專家怒批WHO不可信！預估南韓3月

SARS及新冠病毒肺炎疫情发展时间线对比



2020 SARS.2 COVID of Taiwan

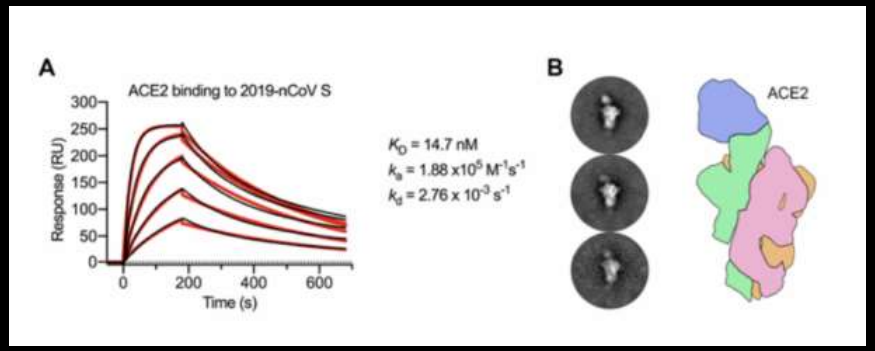
2019-nCoV S ectodomain is 10- to 20-fold higher affinity than ACE2 binding to SARS-CoV

Respiratory
Droplet,

NPIR, N95

contact

PPE, SOP



fomite

https://www.biorxiv.org/content/10.1101/2020.02.11.944462v1.full.pdf

Invisible fomite transmission

- SARS/MERS/Ebola/COVID ?
  - A (mostly) ignored mechanism in EID
  - A common microbiological niche adapted to human behavior.

- Super-spreader
- Break point in epidemiological linkage
- Weakness in training/education/resources
- Airborne transmission?

Asymptomatic ??!!

- 其他症狀來就醫: quarantine ward 檢疫病房
- 無症狀，沒發燒/輕微症狀， 傳染人?
  - 發燒(37.3-38C ?)， 咳嗽、 倦怠、腹瀉
  - high titers of virus in the oropharynx early in the course of disease concern about increased infectivity during minimal symptoms.
- 無症狀， 檢測出病毒？
  - ~1 %， close contact with family cluster mostly
  - NIH Fauci: in the history of respiratory-borne illnesses of any type, asymptomatic has never been the driver of outbreaks.

1st super-spreader
to 14 HCWs nosocomial

【2020. 1. 22 中國】

攔截「超級傳播者」：更多湖北醫護人員院內感染「武漢肺炎」

「武漢政府為何不早點讓公眾知情？」以中國湖北省武漢市為主要傳染軸心的「武漢新型冠狀病毒疫情」，目前正進入通報病例快速增加的威脅上升期。根據中國國務院
例（不含台灣），其中至少9人死亡。目前在湖北省，已
染武漢肺炎的14名醫護人員，也被武漢市長出面證實「
生？中國政府有無提供前線醫護足夠的隔離支援？這是
待的防疫關鍵。

▌前情提要：〈鏡頭背後／武漢的武漢肺炎防

台灣疾病管制署防疫提醒：春節旅遊旺季已經到來，如
所疑慮，建議盡快撥打「1922」防疫專線，以利衛生局
流感症狀」（無論是否服用退燒藥、止咳藥），應主動
旅遊史、職業別、接觸史及群聚情形以供醫師及時診斷

武漢肺炎》武漢大型醫院爆群聚感染！80醫護、病患確診

讚

2020/01/12-26

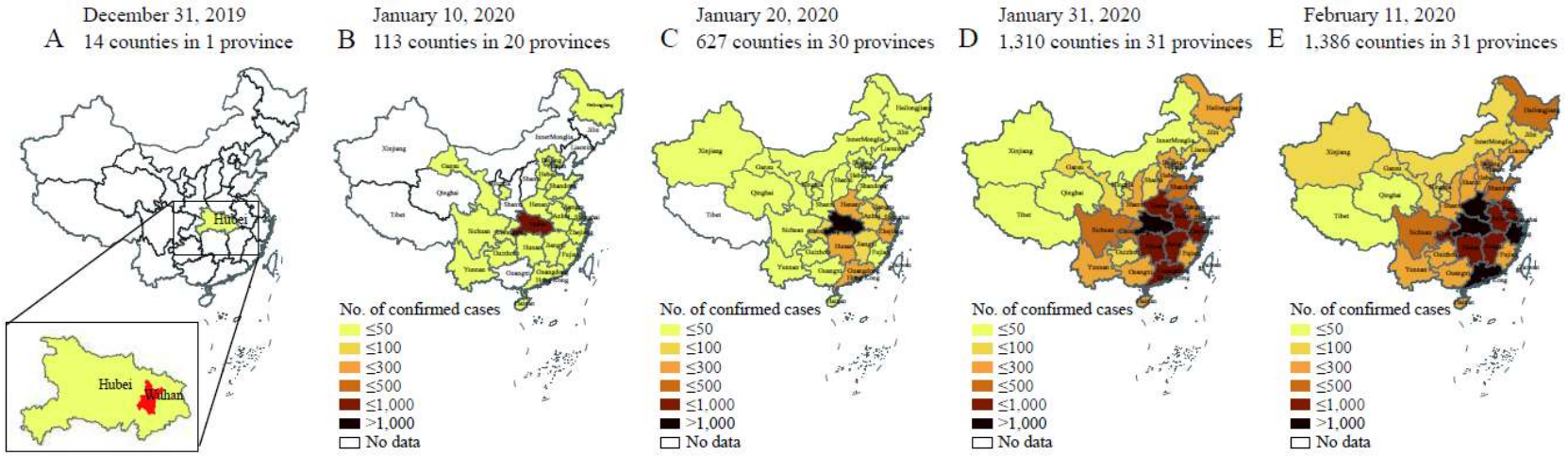


FIGURE 2. Geo-temporal spread of COVID-19 in China through February 11, 2020. (A) a total of 14 county-level administrative areas (hereafter counties) in Hubei Province only (inset) had reported cases as of December 31, 2019; (B) by January 10, 2020, 113 counties in 20 PLADs had reported cases with the highest prevalence still in Hubei Province; (C) nine days later, on January 20, 627 counties in 30 PLADs had reported cases and PLADs neighboring Hubei Province observed increasing prevalence; (D) by the end of January 31, 1,310 counties across all 31 PLADs were affected and prevalence in the central, south, and south-central regions had risen dramatically; (E) by the end of February 11, 1,386 counties nationwide were affected and prevalence in the south-central PLADs had risen to the level of Hubei.

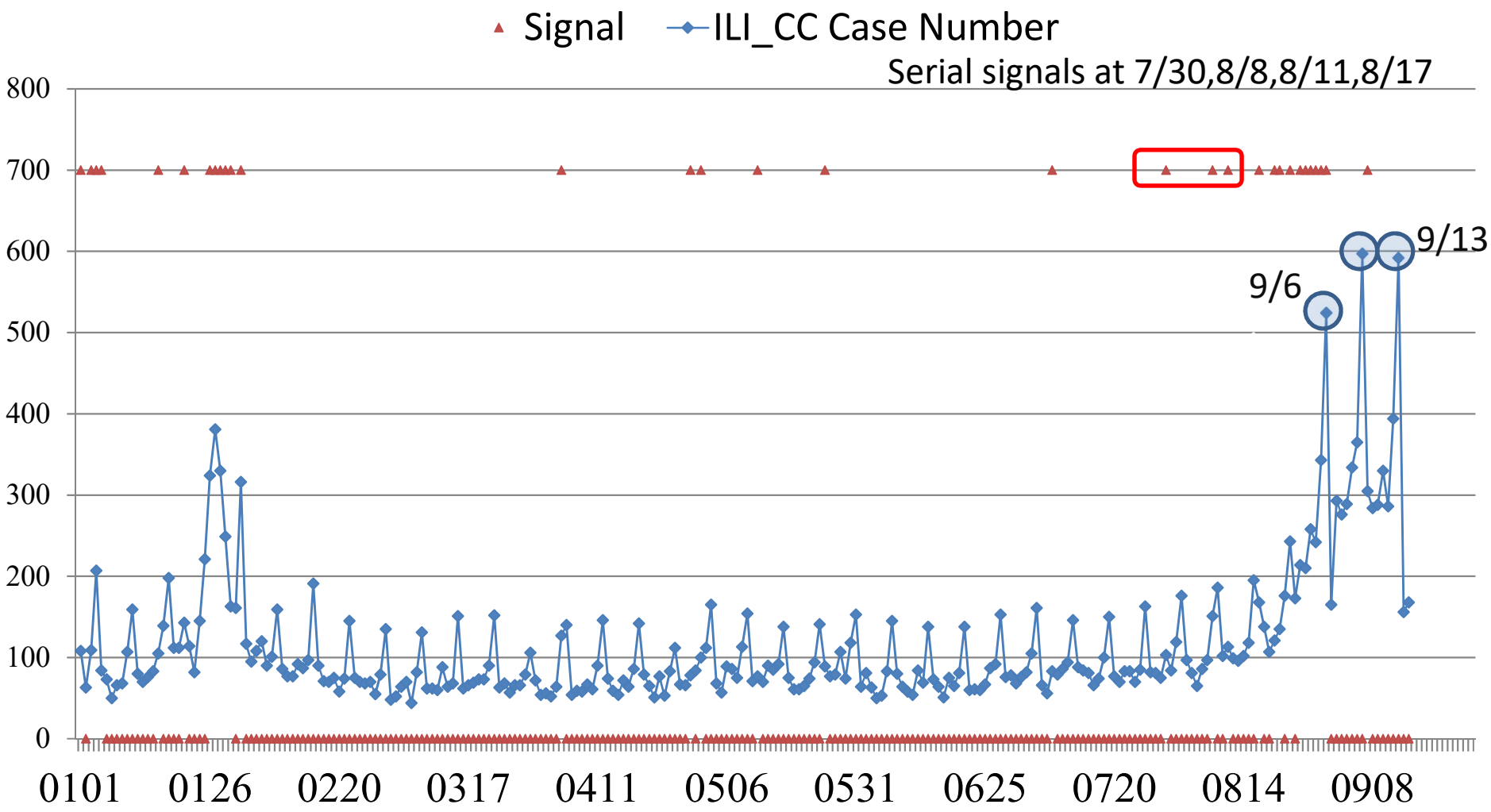
武漢肺炎》北京醫院爆群聚感染 5醫護4患者中鏢

- 從2009年 H1N1 的研究 there appeared the first hospital outbreak (cluster) which may be viewed as signs of approaching community saturation and peaking of epidemic soon followed.在武漢已經看到這樣的現象， 北京要多小心

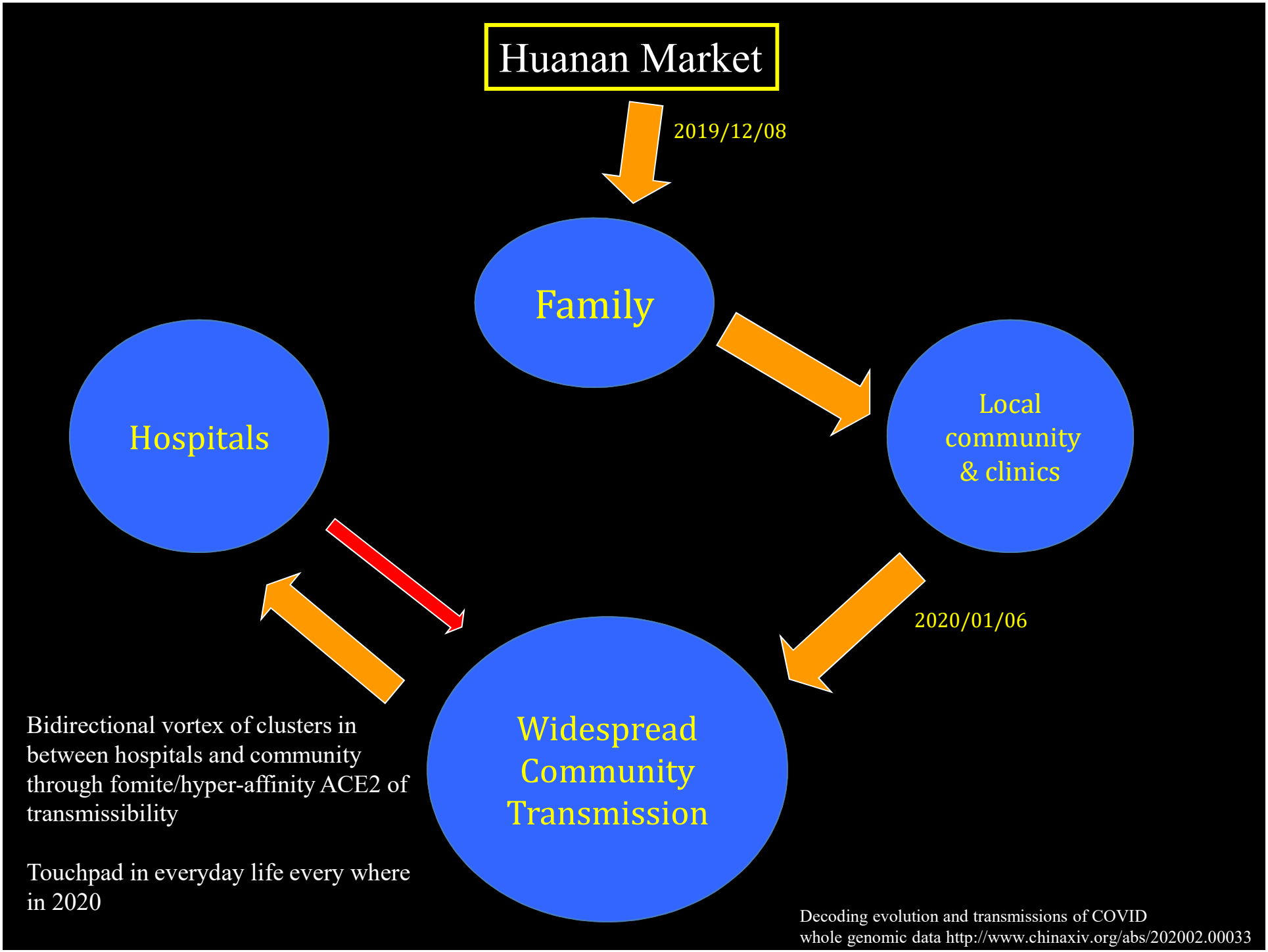
2020/0131-2010 lockdown

A few hospital outbreak as early warning sign of approaching community saturation

The first few bubbles popping up before the boiling water boils

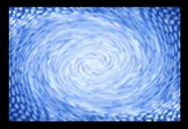


Yen MY et al. *J Hosp Inf 2014*


Huanan Market
2019/12/08
Family
Local community & clinics
2020/01/06
Widespread Community Transmission
Hospitals
Bidirectional vortex of clusters in between hospitals and community through fomite/hyper-affinity ACE2 of transmissibility
Touchpad in everyday life every where in 2020
Decoding evolution and transmissions of COVID whole genomic data http://www.chinaxiv.org/abs/202002.00033

Vicious cascade

Market – **Hospital** – Community



Community – **Hospital** – Society

in the later phase of community saturation,

focus on both droplet and more of ***fomite*** transmission.

nationwide - lockdown/air flight - Pandemic

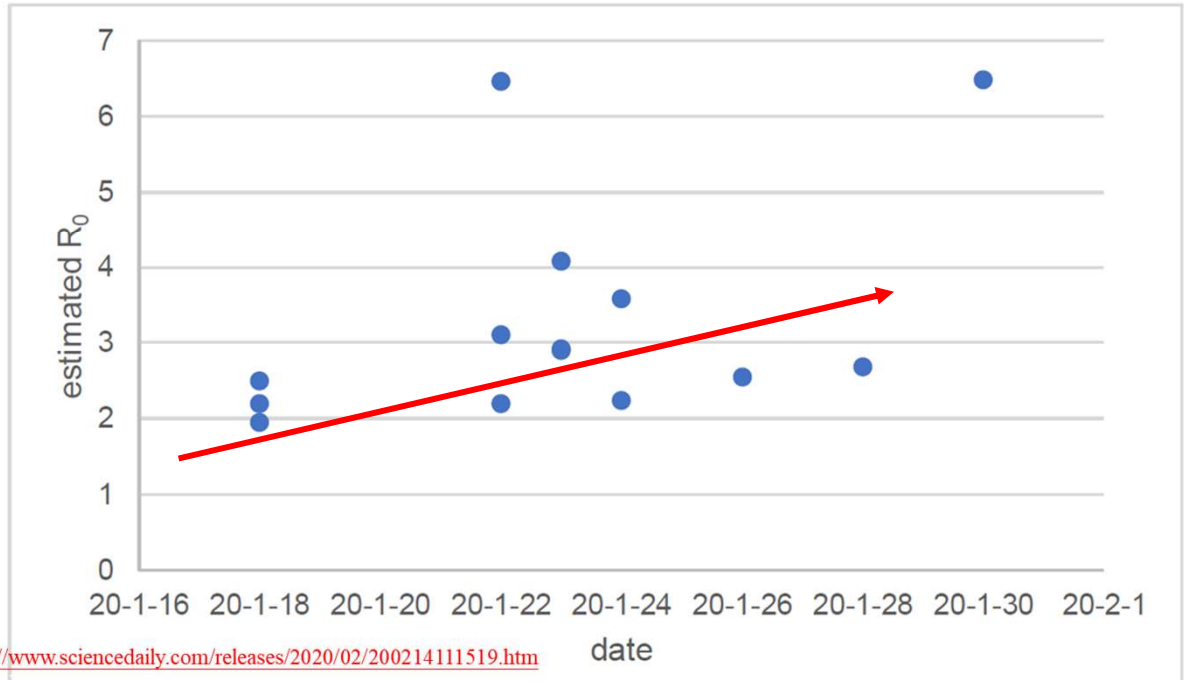
R0 Up

Bidirectional vortex of clusters in between hospitals and community through similar mechanisms of fomite and hyper-transmissibility of ACE2

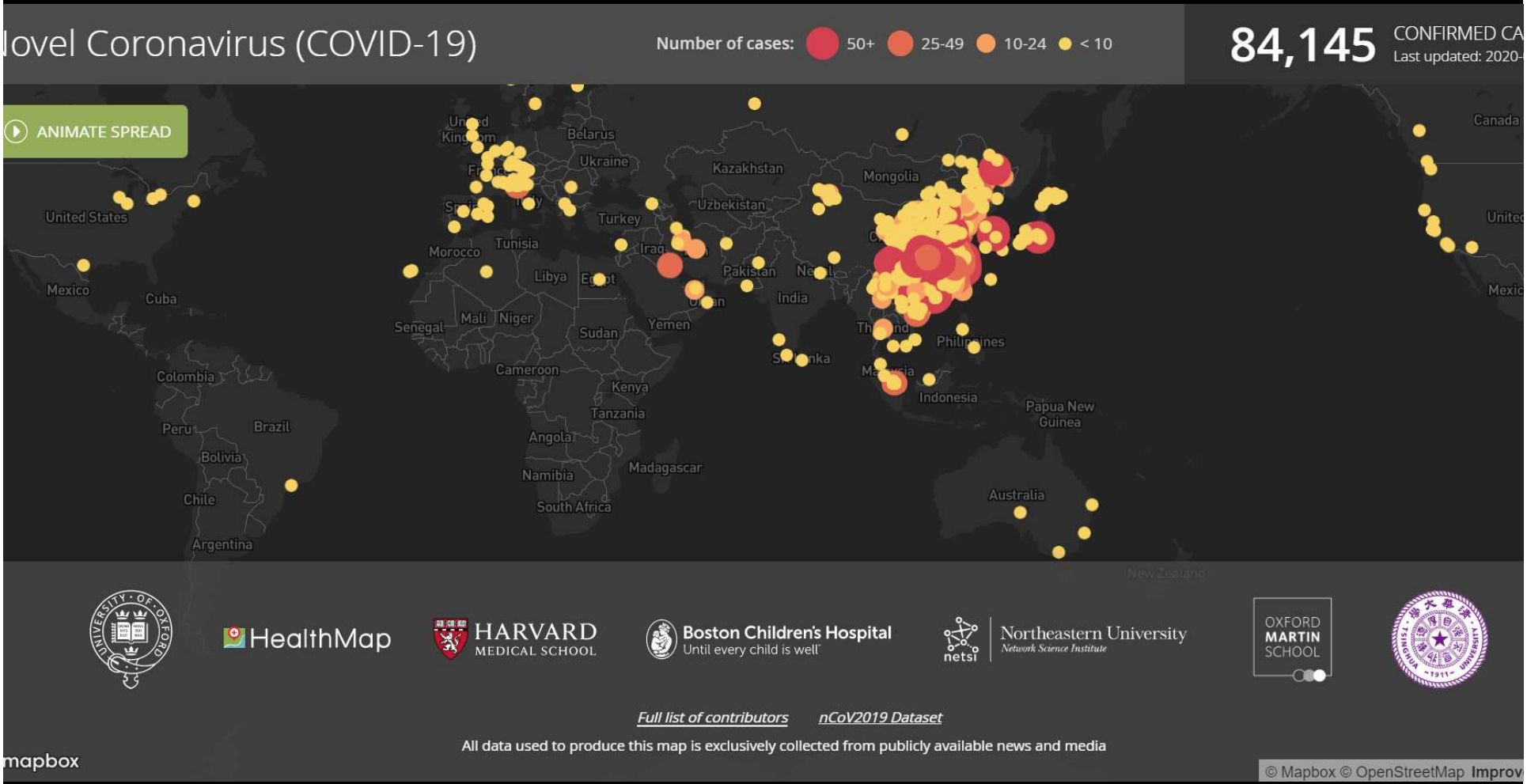
COVID-19 > SARS-CoV

- R0 summed up to a mean of 3.28, and a median of 2.79,
- significantly higher than WHO's estimation of 1.4-2.5.

from China and overseas. Table 1 shows that the estimates ranged from 1.4 to 6.49, with a mean of 3.28, a median of 2.79 and IQR of 1.16.



https://www.sciencedaily.com/releases/2020/02/200214111519.htm


ovel Coronavirus (COVID-19)
Number of cases: 50+ 25-49 10-24 < 10
84,145
CONFIRMED CA
Last updated: 2020-
ANIMATE SPREAD
United States
Mexico
Cuba
Colombia
Peru
Brazil
Bolivia
Chile
Argentina
Belarus
Ukraine
Kazakhstan
Mongolia
Uzbekistan
Turkey
Tunisia
Morocco
Libya
Pakistan
India
Senegal
Mali
Niger
Sudan
Yemen
Cameroon
Kenya
Tanzania
Angola
Namibia
Madagascar
South Africa
Indonesia
Papua New Guinea
Australia
New Zealand
Canada
HealthMap
HARVARD MEDICAL SCHOOL
Boston Children's Hospital
Until every child is well
netsi
Northeastern University
Network Science Institute
OXFORD MARTIN SCHOOL
Full list of contributors
nCoV2019 Dataset
All data used to produce this map is exclusively collected from publicly available news and media
mapbox
© Mapbox © OpenStreetMap Improv

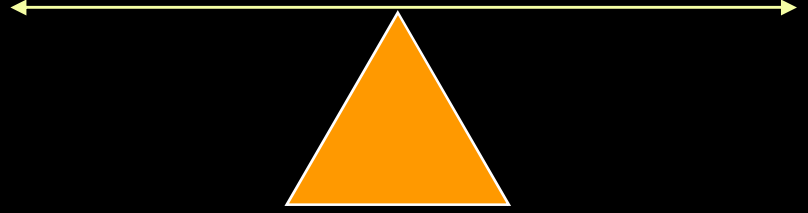
SARS-CoV-2 covid pandemic

Respiratory droplet ,

contact

NPIR, N95

PPE, SOP



fomite/ asymptomatics

Traffic Control-2 (ETCB)

Yen MY et al, CID, in revision

Chelsea Naval Hospital, Boston. 1918, mid-Sep

- Detachment arrived Phil.with a well-planned, concerted effort to contain it.
- 4 days later, 19 ills.
- Immediate isolation and everyone with whom they had had contact.
- 87 hospitalized the next days.
- Immediate isolation and everyone with whom they had had contact.
- 600 hospitalized 2 days later.

The Great Influenza 1918

https://flutrackers.com/forum/forum/welcome-to-the-scientific-library/-1918-pandemic-data-stories-history/30797-the-great-influenza-of-1918

鑽石公主號無症狀患者 4人安置後疑肺炎送醫

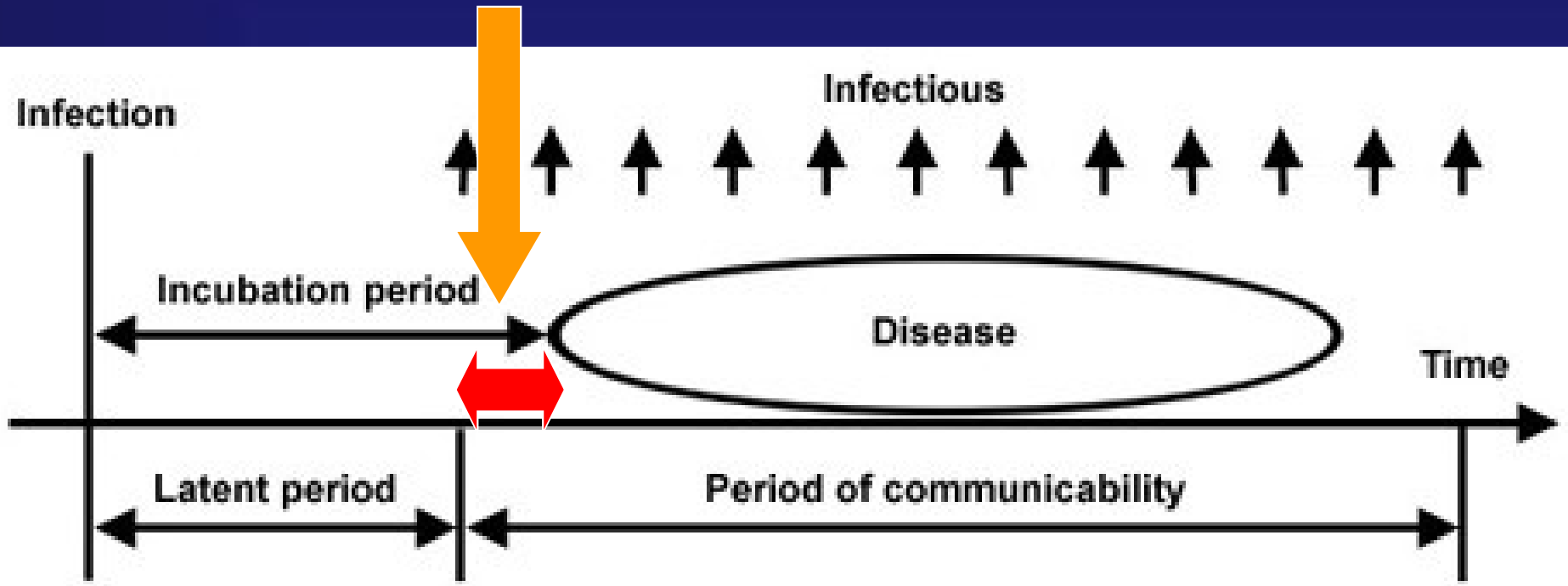
020-02-19 11:22 中央社 / 東京19日綜合外電報導

+ 鑽石公主號

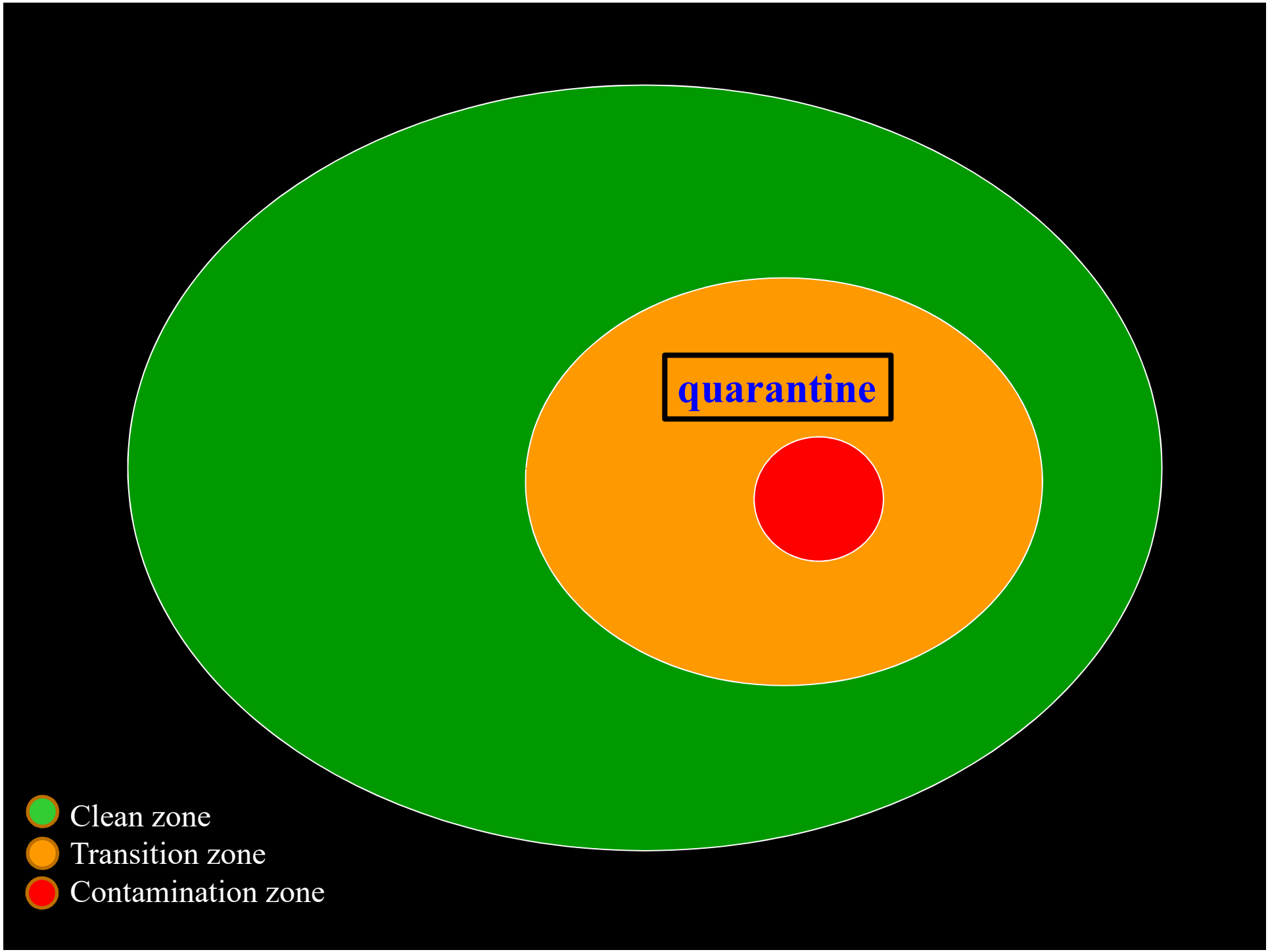
不是人傳人， 是船傳人

Loyalwise 他恐怕是被”船”感染，而不是被”人”感染
顏慕庸 Yes! Fomite transmission!

Detention, quarantine



- **Latent Period (latency)** – The time from initial infection until the start of infectiousness.
- **Incubation Period** – The time from the initial infection until the onset of clinical symptoms.
- **Period of communicability** – The period during which an individual is infectious and can spread to other hosts.


quarantine
Clean zone
Transition zone
Contamination zone

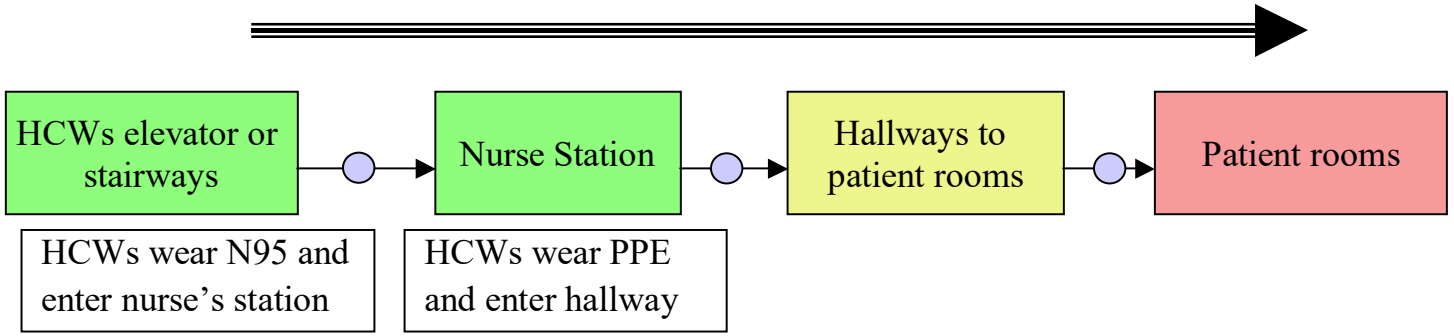
Dubrovnik， 世界第一座針對黑死病檢疫 **quarantine** 的城市

緩衝區 檢疫病房

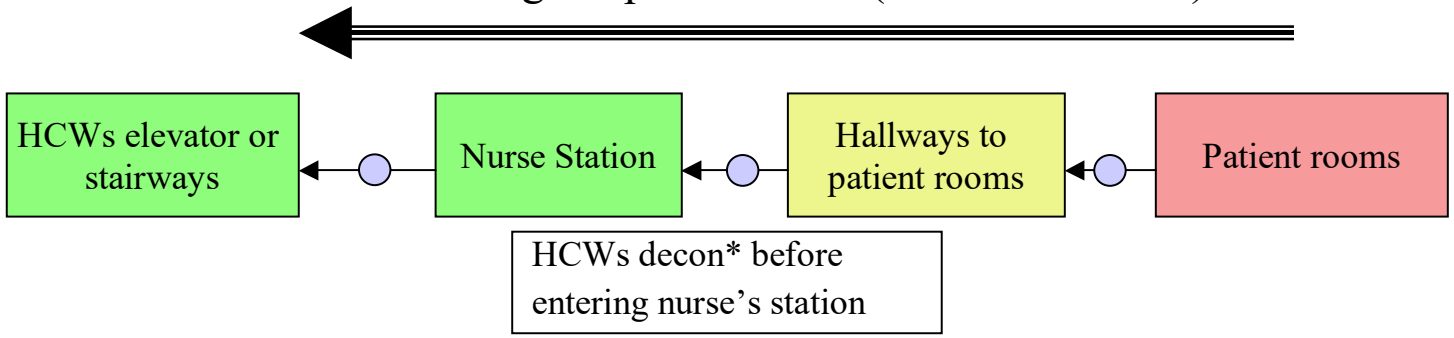
Detention Ward

The Great Influenza 1918

HCW entering patient room (follow the arrow)



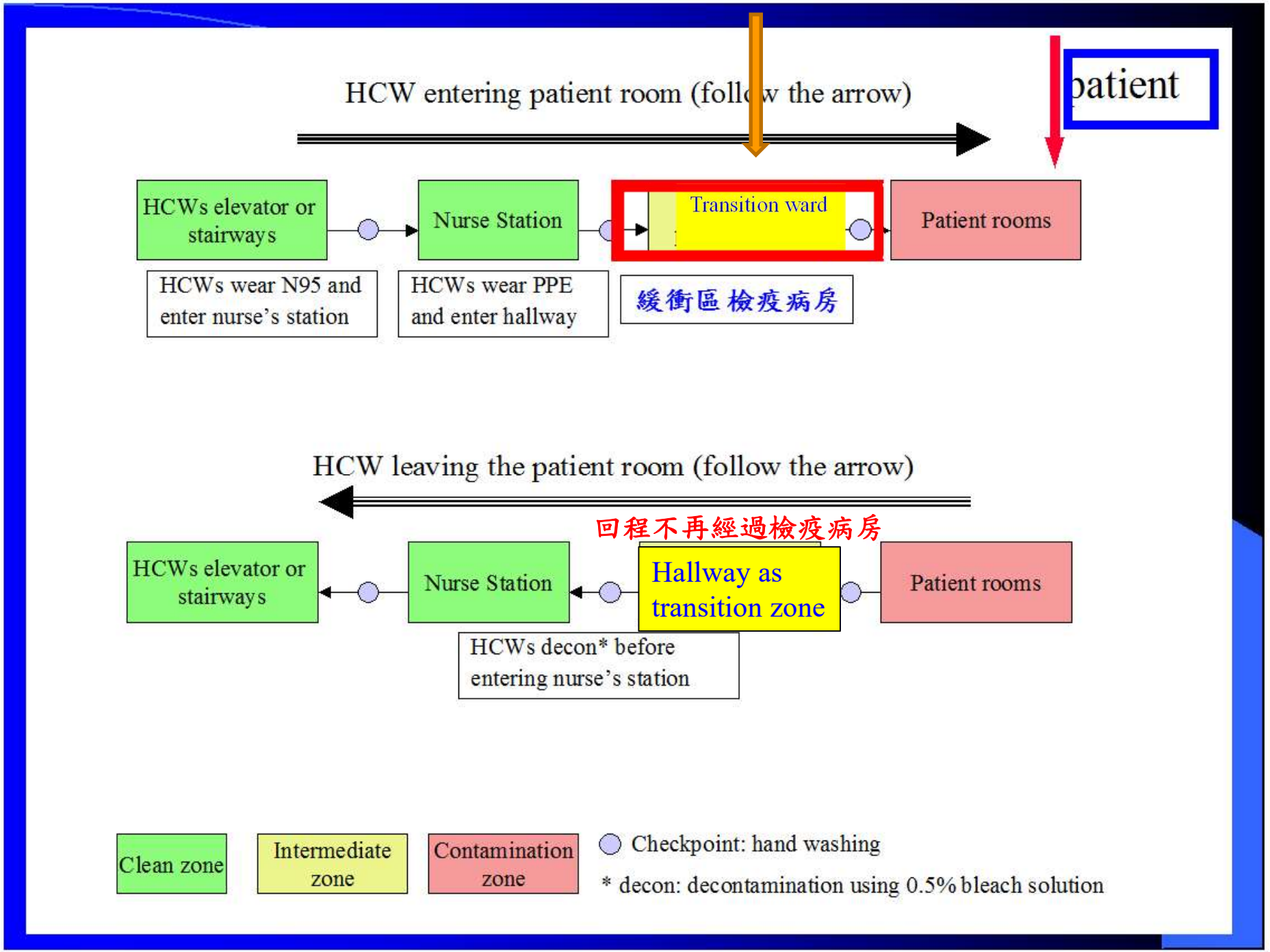
HCW leaving the patient room (follow the arrow)



Clean zone | Intermediate zone | Contamination zone

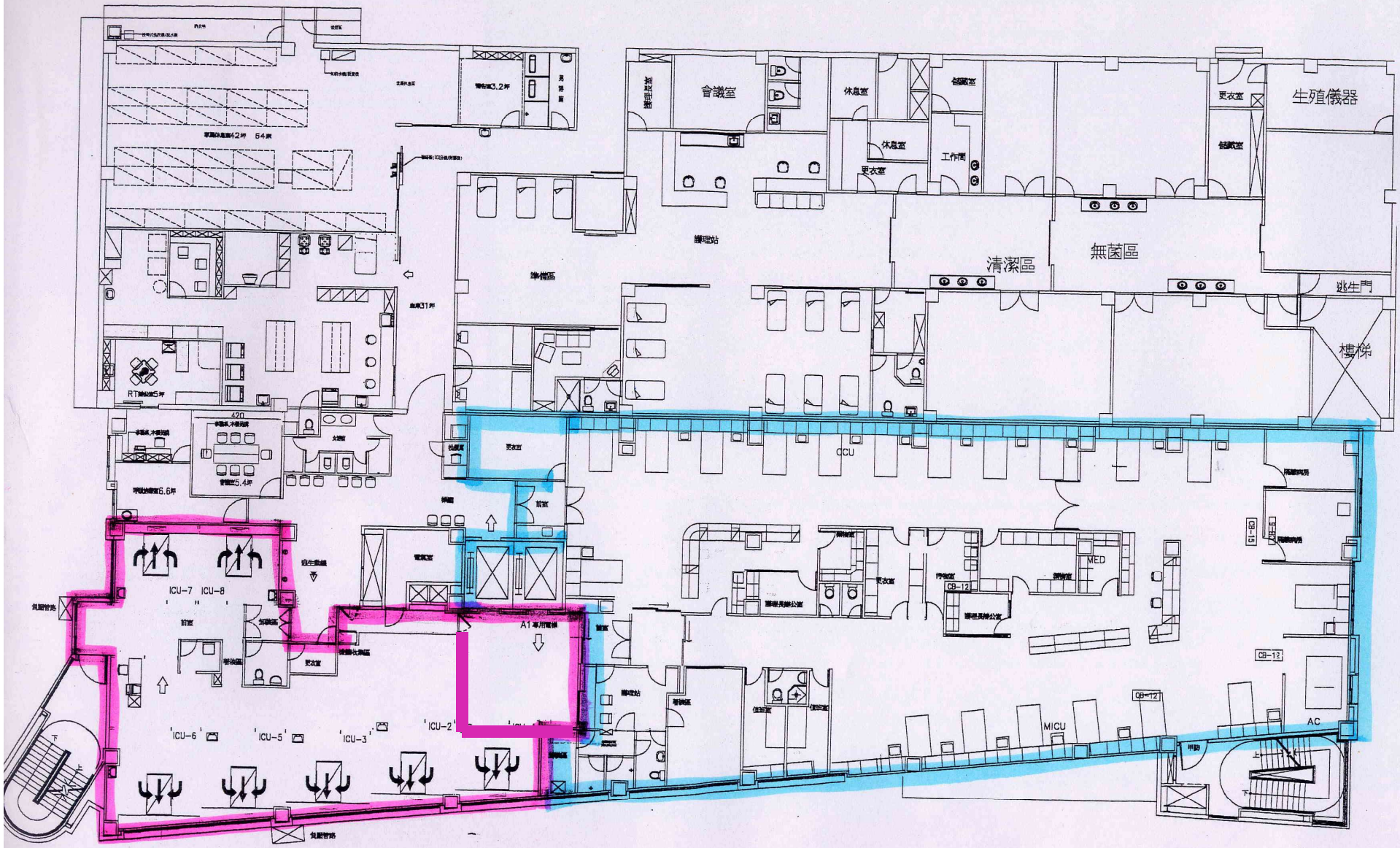
○ Checkpoint: hand washing

* decon: decontamination using 0.5% bleach solution


HCW entering patient room (follow the arrow)
patient
HCWs elevator or stairways
Nurse Station
Transition ward
Patient rooms
HCWs wear N95 and enter nurse's station
HCWs wear PPE and enter hallway
緩衝區 檢疫病房
HCW leaving the patient room (follow the arrow)
回程不再經過檢疫病房
HCWs elevator or stairways
Nurse Station
Hallway as transition zone
Patient rooms
HCWs decon* before entering nurse's station
Clean zone
Intermediate zone
Contamination zone
Checkpoint: hand washing
* decon: decontamination using 0.5% bleach solution

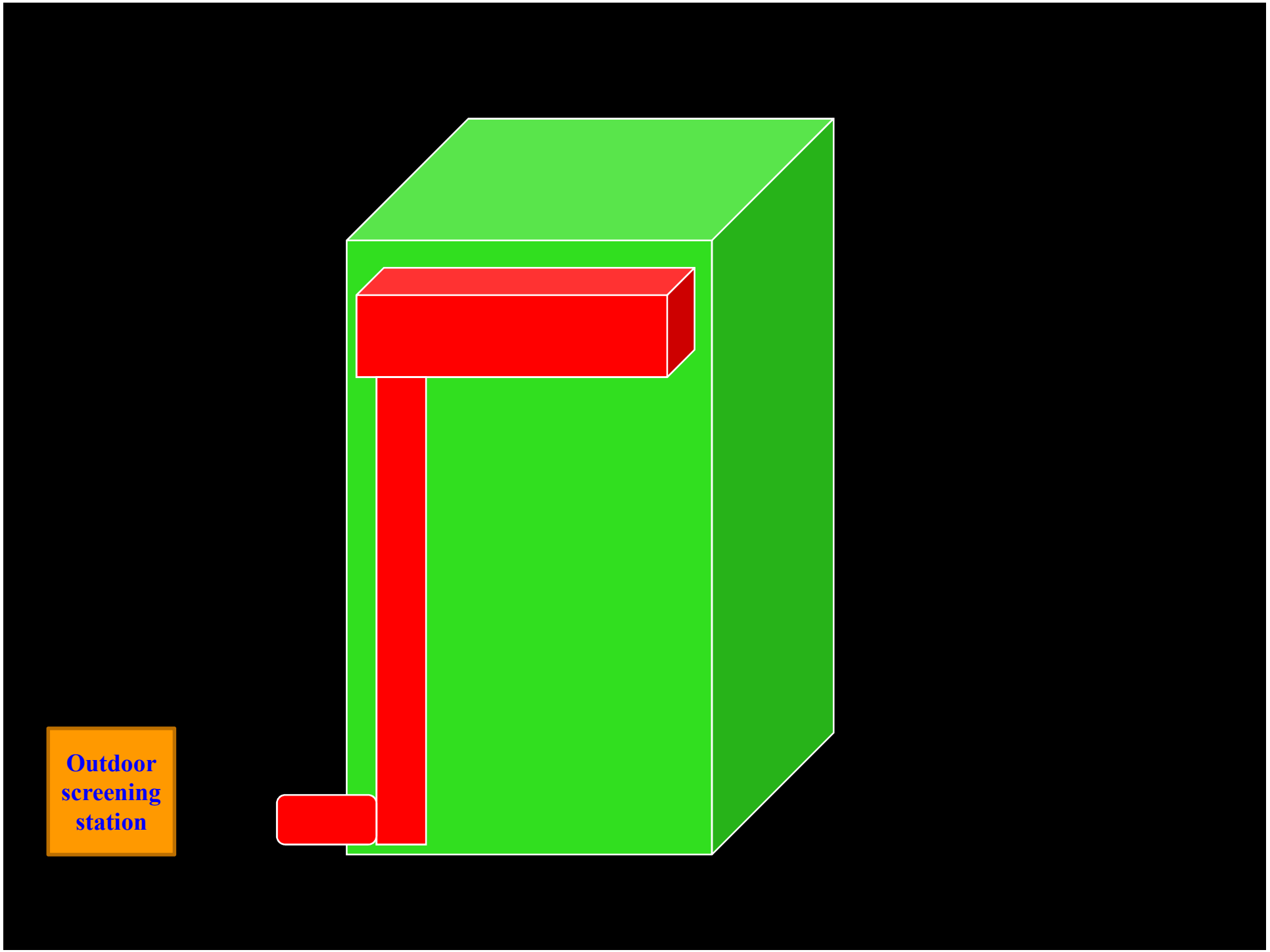
備援病房8A動線規畫

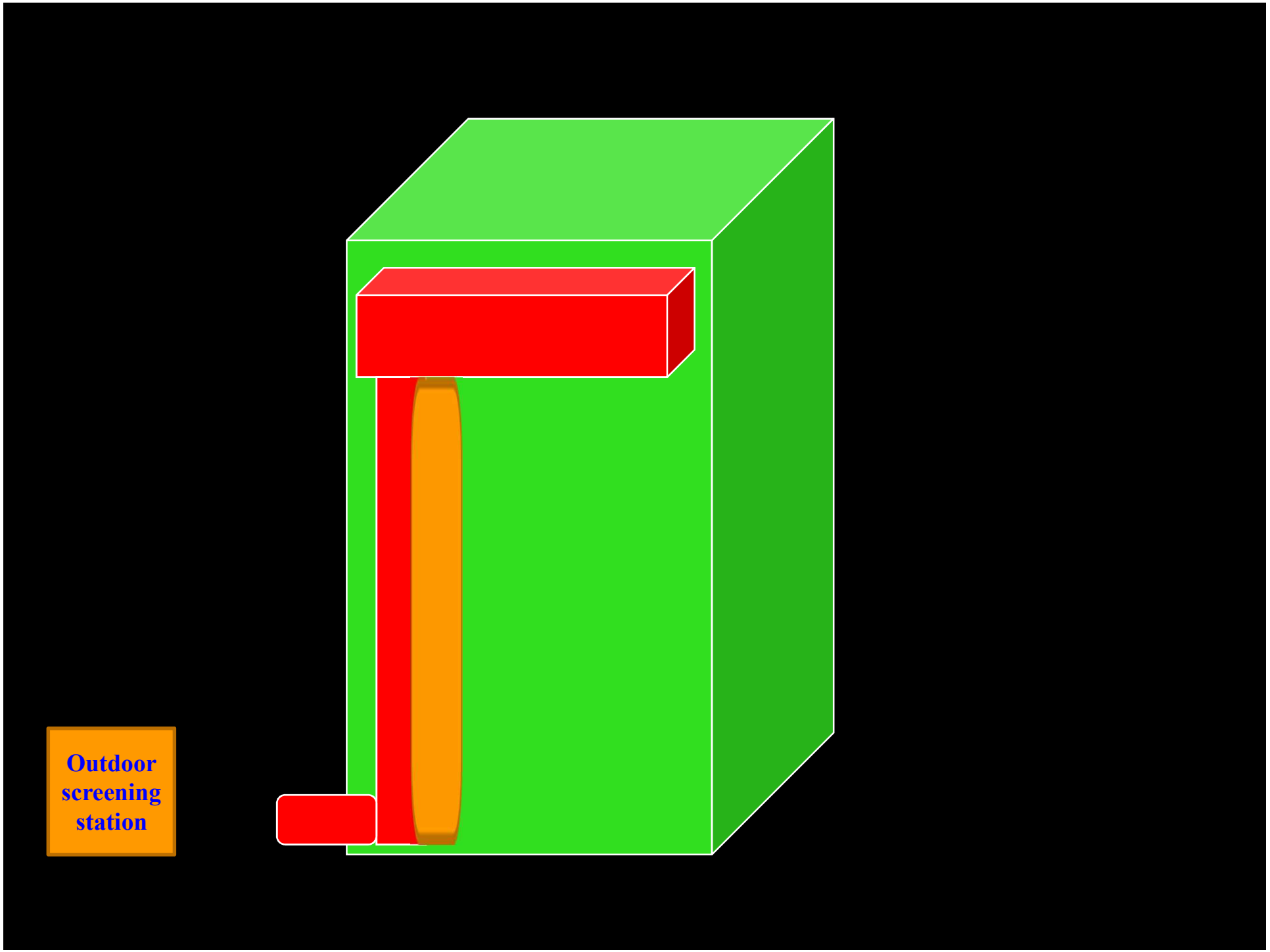
收治病房內加裝抽風設備，排風管線做內部改變，形成室內負壓狀態(測試時可達到-9pa)



負壓隔離病房平面動線圖

ÒNG 206
17
16
AUG 1 2003


Outdoor
screening
station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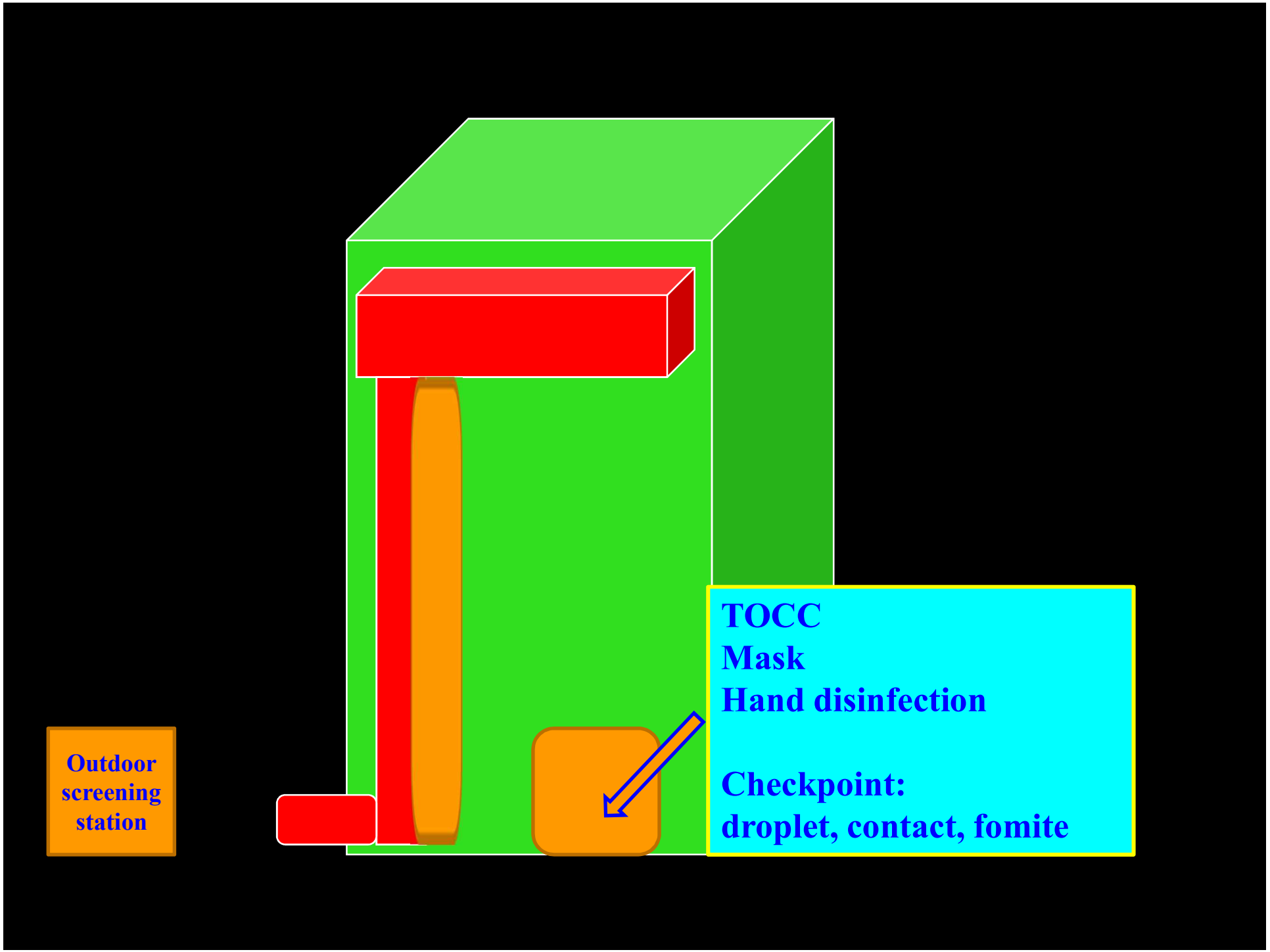
screening
station


Outdoor screening station
TOCC
Mask
Hand disinfection
Checkpoint:
droplet, contact, fomite

EXIT
緊急出口
乾洗手
脫帽子

ATM
熱食放置區

熱食放置區

ATM

進大門時主動以酒精噴消雙手

- 進醫院前洗手是幫助國家，（避免汙染醫院環境）
- 出醫院後洗手是幫助自己。（避免fomite transmission）

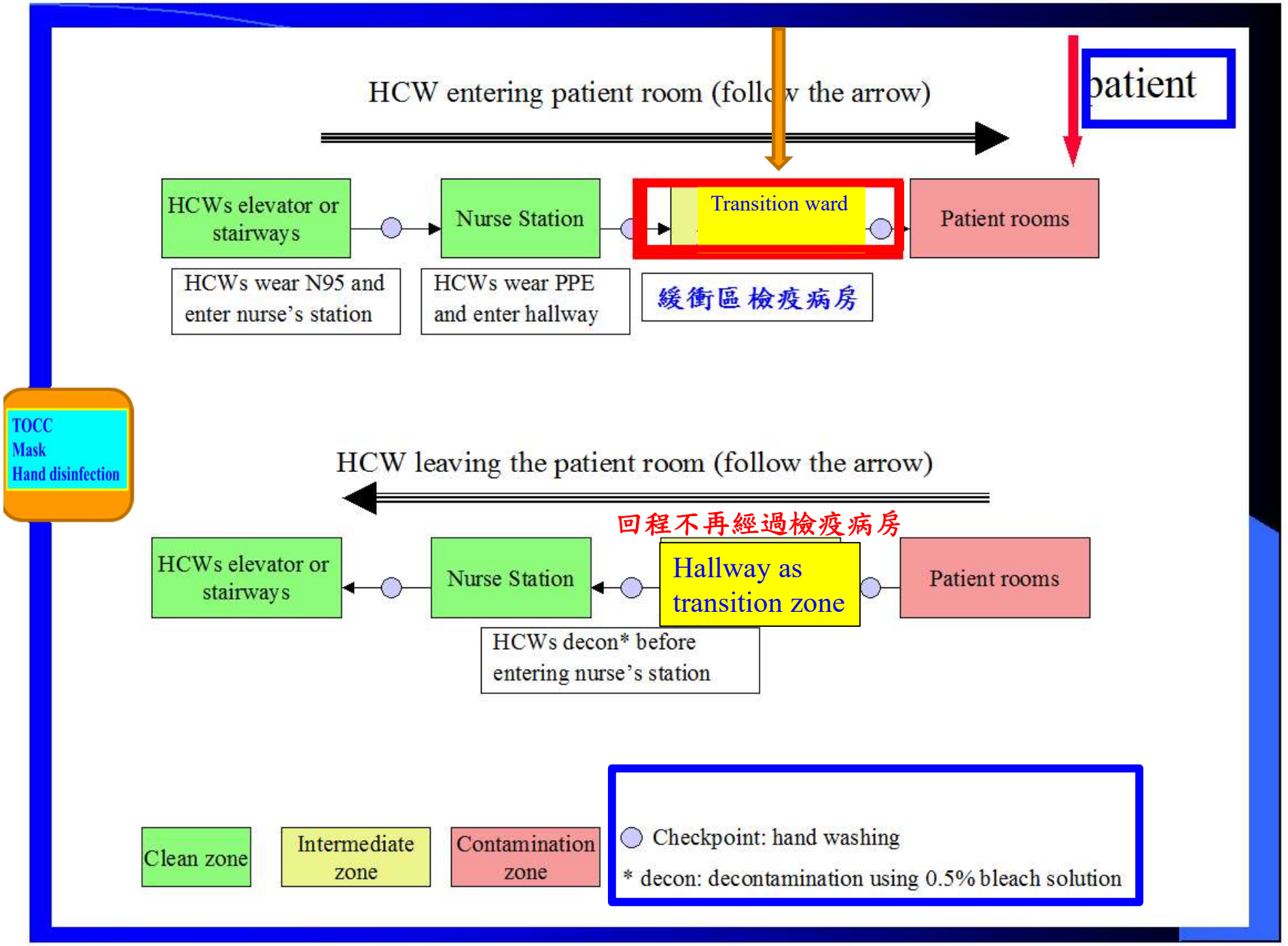
- 當年在松德抗煞病房
  - 三明治洗手法的放大版

顏慕庸提醒，若本身有症狀，而且是進醫院之前才戴上口罩，手上沾滿了病毒，因此為了保護其他人，進醫院前要記得洗手，以免摸了東西留下病毒。離開醫院以後也要記得洗手，以免帶著病毒回家，

進醫院前洗手是幫助國家，出醫院後洗手是幫助自己

https://udn.com/news/story/120940/4354023?fbclid=IwAR2cFnynhGoQCOkbJy7Bh_2MLTMk9rTY65xHI35KWbVpkA0aX7a

installation of alcohol dispensers at checkpoint for glove-on hand rubbing
非工作人員請勿進入
手推後請洗手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TOCC
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HCWs decon* before entering nurse's station
Clean zone
Intermediate zone
Contamination zone
Checkpoint: hand washing
* decon: decontamination using 0.5% bleach solution

除汙除裝　節點洗手

每換個動作之間

每換個步驟之間

Transmissibility

它，來勢洶洶 !!!

較SARS 更為可敬的對手

檢疫病房 Q&A

- 人力配置與著裝：
  - 比照隔離病房， 一套人力，一套裝備，一次走完
- 檢疫病房除了收治病房區以外的其他病室，要全部清空嗎?
  - 是的* 動線管制的之污染分區。跟其他非感染的病人（清潔區）規劃性分開
  - 隔離病房與檢疫病房設在同一區，診斷未明者收檢疫病房，陽性就收隔離病房
- 把負壓隔離和檢疫病房分樓層規劃可以嗎？
  - 可以， 只要上下樓梯列入動線規劃-緩衝區。 上下樓層要一併納入動線管制區
- 圍堵期進入減災期的醫院保全、醫護保命的機制。
- 分區淨空現階段中央挹注經費免除醫院營運壓力
- 下一階段作戰規劃整備: 保障急重症醫療量能

* 2003年最後一役的某醫院即因業績太好， 無法淨空病房， 最裡頭的負壓隔離病房收治一個SARS 病人後， 醫院就淪陷了

6
訪客專用
Non-Stop
6
JUN 8 2003

亞東紀念醫院
Far Eastern Memorial Hospital
急診處
EMERGENCY
遠東國際
13.09.2009

最需要洗手的6個時機

吃東西前

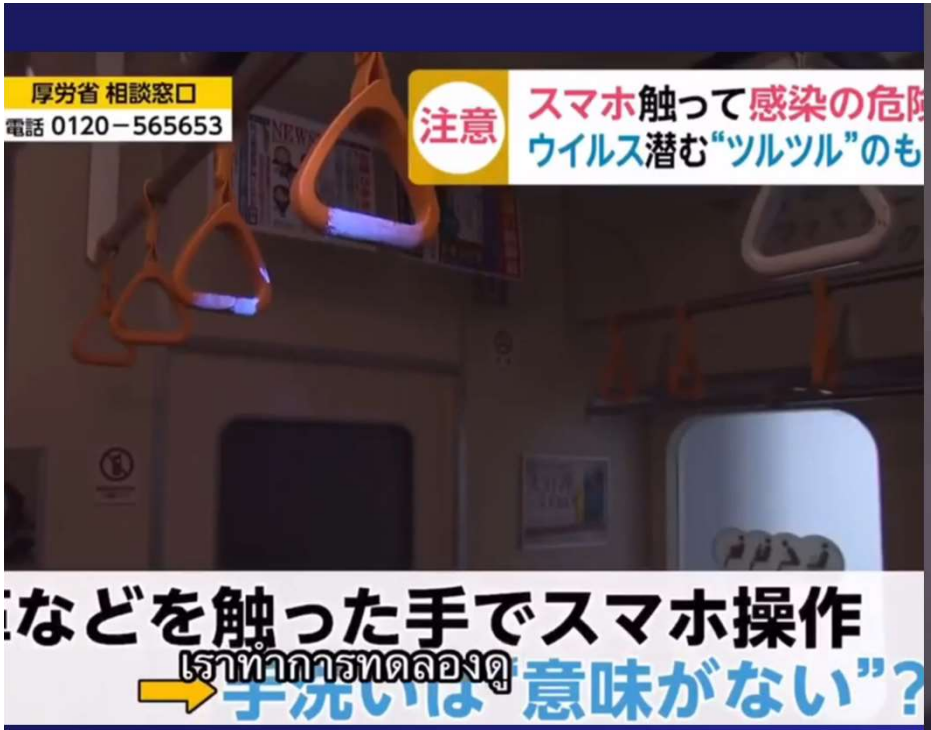
擤鼻涕後

照顧小孩前

看病前後

上完廁所後

外出回家後


厚労省 相談窓口
電話 0120－565653
注意
スマホ触って感染の危険
ウイルス潜む“ツルツル”のも
などを触った手でスマホ操作
เราทำการทดลองดู
意味がない”?

注意
スマホに付いたウイルスで…
新型肺炎 感染の落とし穴
พอให้จับที่จับแบบเสาดู

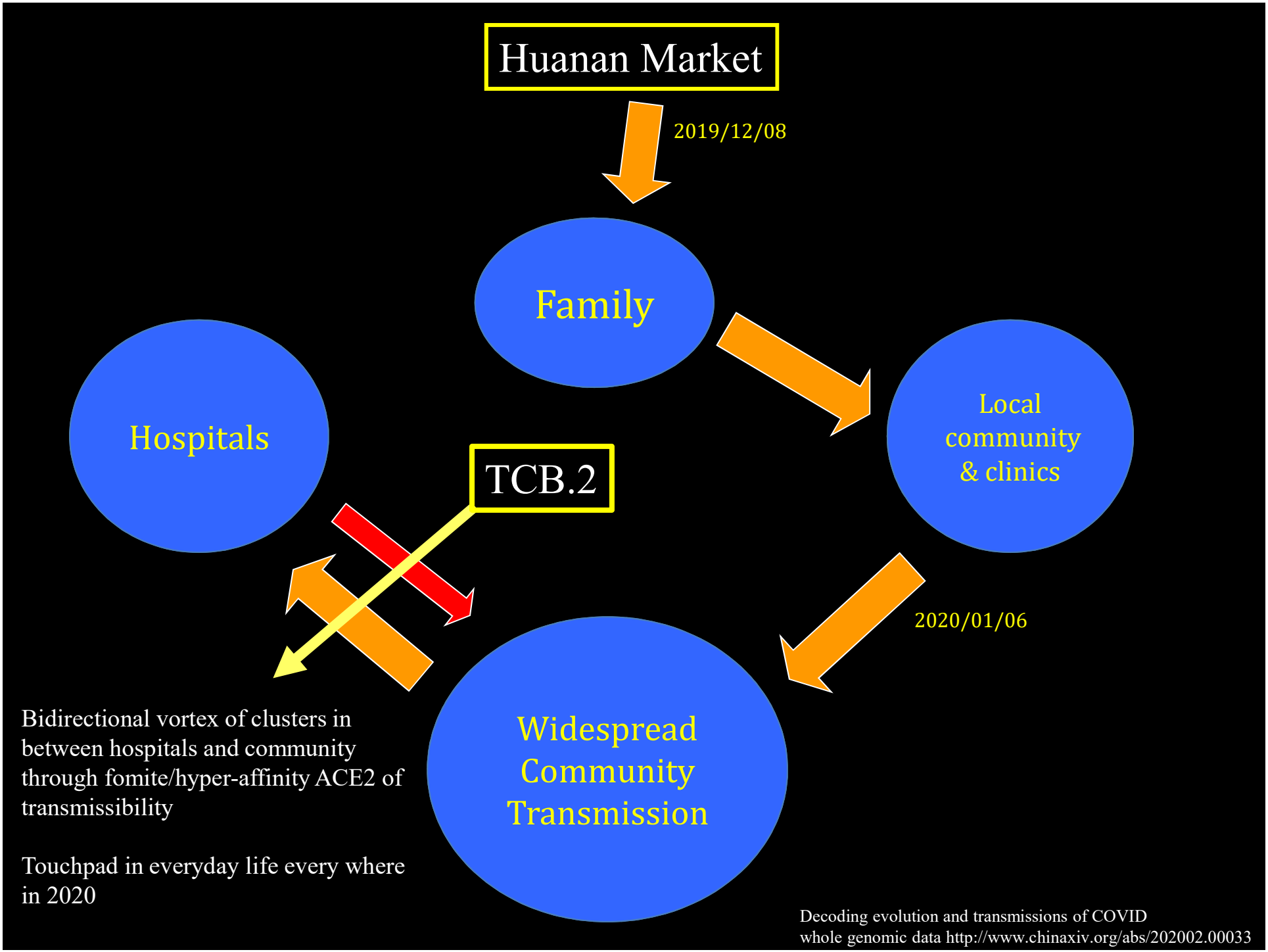
注意
スマホ触って感染
ウイルス潜む“ツルツ
พอเอามือนั้นมาจับตา จมูก หรือปาก

注意
スマホ触って感染の危険
ウイルス潜む“ツルツル”のも
ไวรัสจะเข้าร่างกายได้
口や鼻を触ると
ウイルスが体内に入り感染が—

注意
厚労省 相談窓口
電話 0120−565653
スマホ触って感染の危険
ウイルス潜む“ツルツル”のもの
蛍光塗料
ウイルスと仮定
つり革からスマホへ付着
Touchpad in everyday life every where in 2020

- 以這個影片為例，搭乘大眾交通工具摸了手把以後，進入佛堂或者教堂大家讀取經書，病毒沾到佛經表面， 存活兩三天的時間，有太多的機會再繼續傳播出去。這是香港的實境。

- 當然圖示的六個洗手時機是最終的管制點，
- Based on fomite transmission, 建議洗手時機加上**觸摸環境**後，能夠把環境傳播的風險降到最低。


Huanan Market
2019/12/08
Family
Local community & clinics
2020/01/06
Widespread Community Transmission
Hospitals
TCB.2
Bidirectional vortex of clusters in between hospitals and community through fomite/hyper-affinity ACE2 of transmissibility
Touchpad in everyday life every where in 2020
Decoding evolution and transmissions of COVID
whole genomic data http://www.chinaxiv.org/abs/202002.00033

高雄長庚與高醫大學附設醫院規畫設計戶外分流/院內分區之動線管理

對比2003年台灣的進步

Outline

- SARS and Traffic Control Bundling (TCB)
- Fomite transmission
- SARS 2.0 vs TCB 2.0 (ETCB)
- **Impact on future pandemic response**

社區流行 動線管制

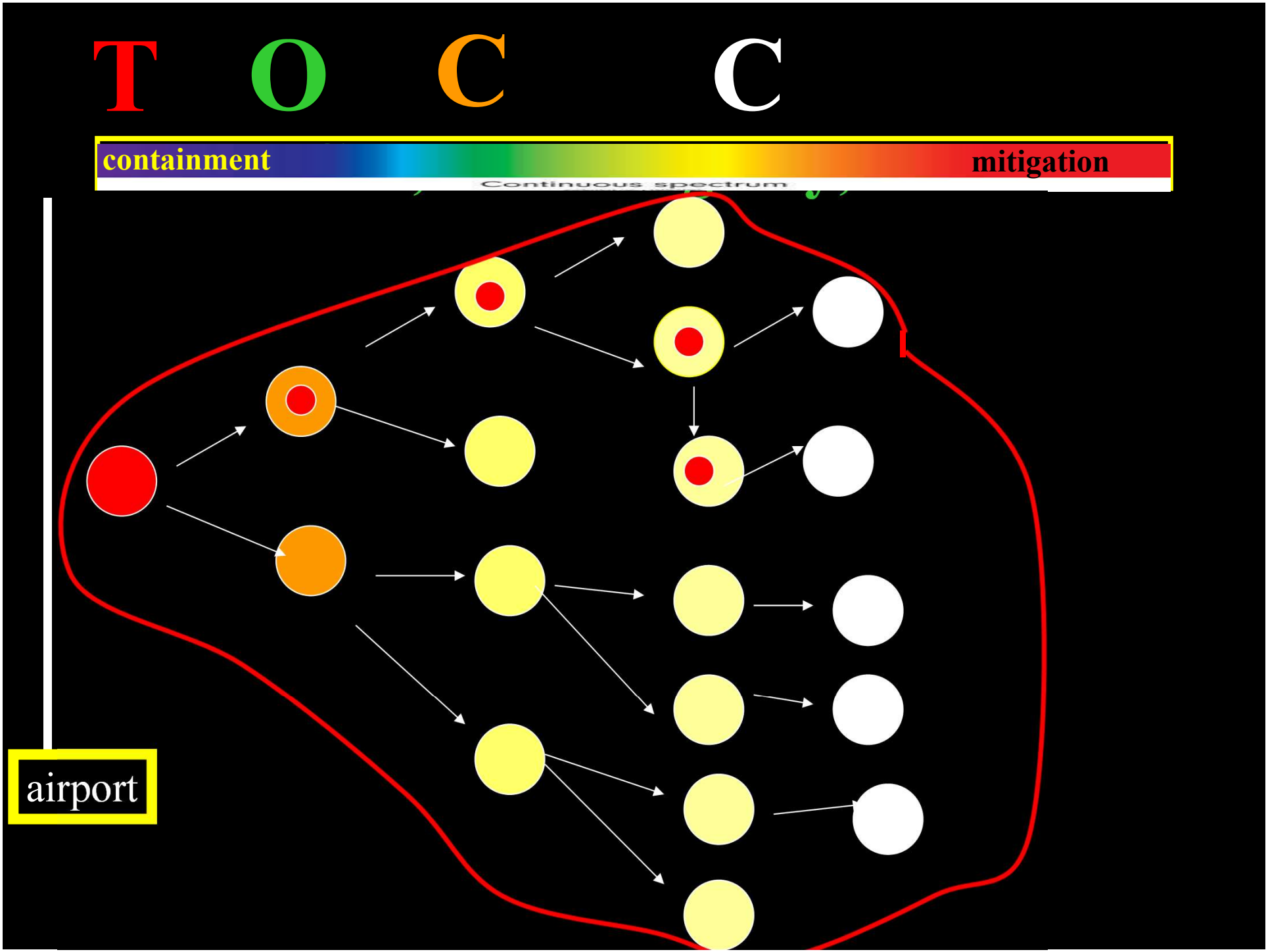
- Transition from containment to mitigation
  - COVID的輕症潛行/傳播率高的詭異特性， 沒有好的圍堵策略在前，後面的減災就不容易做- 因為醫院群聚以及社區傳播很快會接踵而至。 兩者來回傳播的cascades 很快會進入社區大流行community saturation 的引爆點
  - Quarantine
  - TOCC
    - 執著旅遊史反而更危險， 要轉進 檢疫病房模式。
    - **2020/0219-24th 例**

- 流感輕症化？
- 病毒發生突變？

TOCC 不是 旅遊史 !!!

- Transition from spectrum of containment to mitigation
- TCCO? TCOC? 4 characters, each character ask one by one
- **T 1** 旅遊史 (一級、 二級、 三級、 轉機...)
- O **2** 醫護、空服、遊覽車、 導遊，Taxi
- C **3** 2nd contact of TOCC
- C **4** 群聚、 醫護發燒 …
- Hospital outbreak as early sign of community saturation.

T O C C



衛福部醫事司新聞稿 2020-02-26
因應疫情發展 醫院應加強人員管制措施

- 擴大社區篩檢， 案24 感染源未明

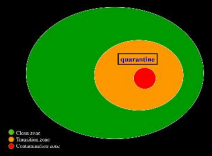
- 衛福部表示，為擴大收治量能超前部署，將要求全國傳染病指定隔離醫院及應變醫院共134家規劃設置**專責病房或區域**，以收治疑似呼吸道疾病或嚴重特殊傳染性肺炎(COVID-19)個案，該專責病房應以一人一室收治為原則，並**固定照護團隊，輪替時亦同**。應**避免人員頻繁輪調或跨單位服務**，以降低院內感染風險及衝擊。
- 衛福部強調，疫情瞬息萬變不可輕忽，為超前部署擴大防疫量能，並強化醫院感染管制措施，**避免發生群聚感染耗損醫療人員**，請各醫院參酌上開原則，盡速完成建置

- 專責病房或區域， **指的就是檢疫病房**。因為**檢疫、簡易**病房不容易分得清楚，開會討論的過程採用**專責(觀察)病房**的用詞

https://www.cdc.gov.tw/Bulletin/Detail/kdUsy8csgKS6ins9KJlGRg?typeid=9

新光醫院侯勝茂院長的支持下，已經快速劃分出一個病房區當作檢疫病房，昨天晚上就開始收治病人。2020/0227

檢疫病房:等待篩檢或通報病房？



2020/0229/09:30

- 目前社區傳播的風險
- 確診隔離與其他清潔區病人之間一個緩衝觀察區的機制。

- 優先醫療量能與醫院保全、醫護保命的大前提下治療病人
  - 至於圍堵篩檢以及其隨後的通報，應該是次要考量。

- 當社區風險擴大時
- 檢疫病房: 其他(非感染)疾病住院， 卻在第3～7天後才出現發燒咳嗽的緩衝區觀察功能
  - 第34案(0228)，鐘南山宣布武漢醫院群聚第一例(0122)

39

台灣確診數

1

死亡數

資料來源　衛福部疾管署
製作人　蔡佩蓉
視覺設計　蘇士堯
網頁製作　楊若榆、胡淨悟、周融聖
製作單位　聯合報新媒體中心、視覺設計中心
監製　聯合報新聞部

群聚感染案例增
圖解台灣新冠肺炎個案關係

台灣境
境外
案例34-38為一起院內群聚感染事件，案34為北部50多歲女性，有糖尿病、心血管疾病等慢性病史，2月14日因低血糖、全身倦怠情形就醫並收治住院，21日起出現咳嗽、喉嚨痛及發燒症狀，26日診斷出肺炎並通報送驗，28日確診。案34近期無出國史，感染源釐清中。
案35-38為案34確診前於北部某醫院之接觸者，分別為1名清潔人員及3名護理人員，4人陸續於2月18至25日間出現咳嗽、流鼻水、發燒等症狀，29日確診。
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聯合: 今天公布的內容，讓人想哭啊～
中時: 會變成和平那樣的封院嗎? 2020/0229/15:30

- 可預期的結果，這也是之前一直呼籲的檢疫病房的重要性
- 院內感染或院內群聚，不要苛責，是這波疫情預期會發生的現象。

- Option 1 (1918)
- 以第34例看起來，檢疫病房要考慮擴大實施。不限於急診或者肺炎住院的個案，而是一般住院的個案，都要先行在檢疫病房進行初步觀察。整個醫療的動員會更加辛苦與嚴謹。

- Option 2 (2009)
- 如果無法實施普級的檢疫病房，或以流感輕症化的角度來看，至少大家先養成接觸病人前後先洗手，注意**fomite transmission**! 也就是除了原本的動線管制設計以外，醫院一般清潔區以及病房區內盡量廣設乾洗手劑，方便大家接觸環境後隨時洗手。

Vortex 社區-醫院-社區

2020.02.29 星期六

- 2020/0228 案34例
- 入院第7天症狀出現，也不能完全排除醫院感染
- 兩個都有可能。但如果是院內感染的話，也是另一個大問題

- 0229 15:30
- 兩者兼具，社區感染進入醫院造成院內感染 (沒有TCB.2)

- 從急診，到門口，一路到醫院病房的檢疫病房都要守好。
- 進入醫院以後還是需要廣設洗手點

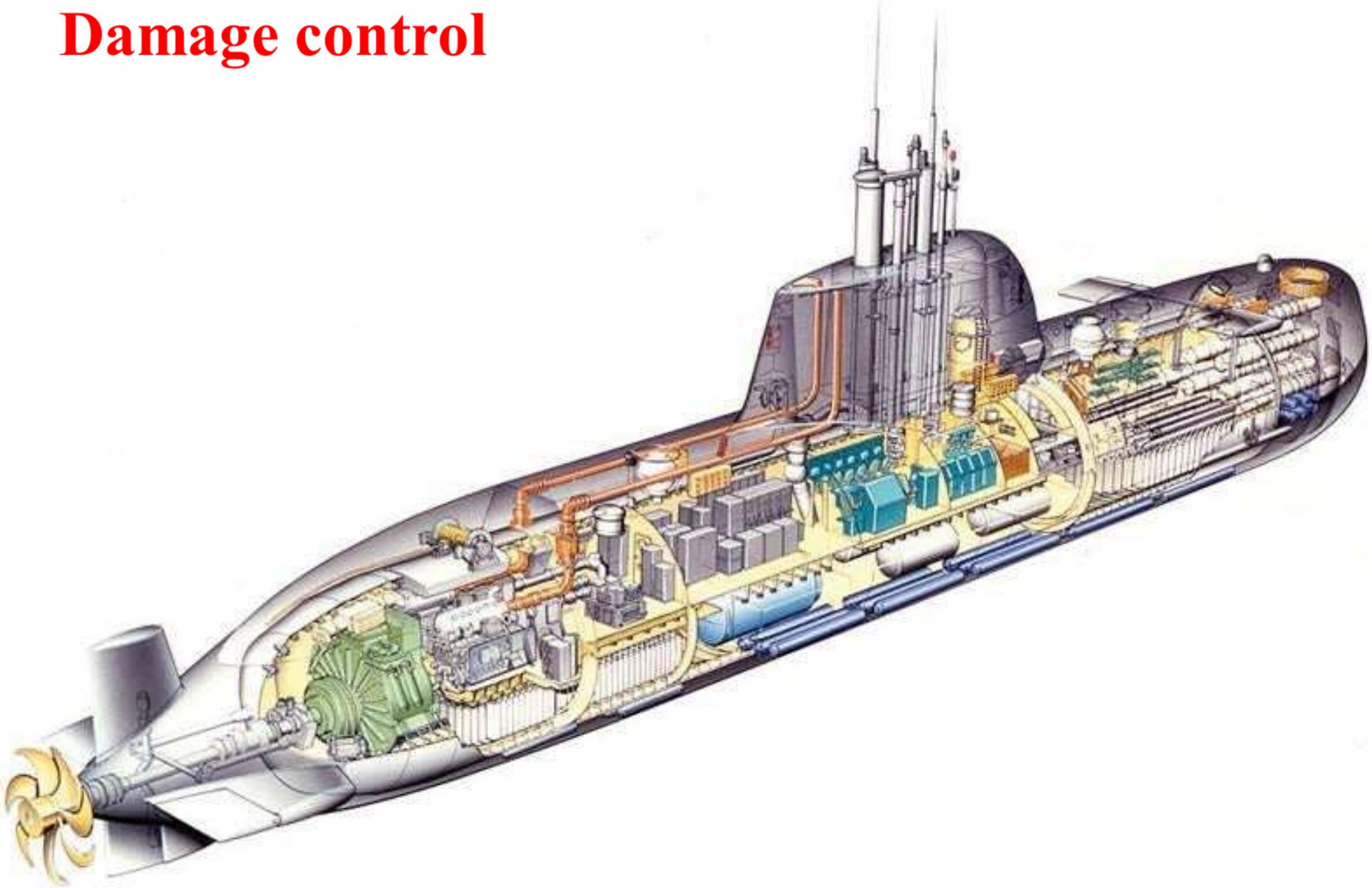
- 儘量做吧， 不應該苛責任何一家院內感染的醫院。 這個對手太強

清潔區的動線分區管理

- 六標準差， 越切越小越好管理
- 動線管制**TCB.2**，從急診，到醫院門口，直到醫院病房，到檢疫病房、隔離病房都要守好。

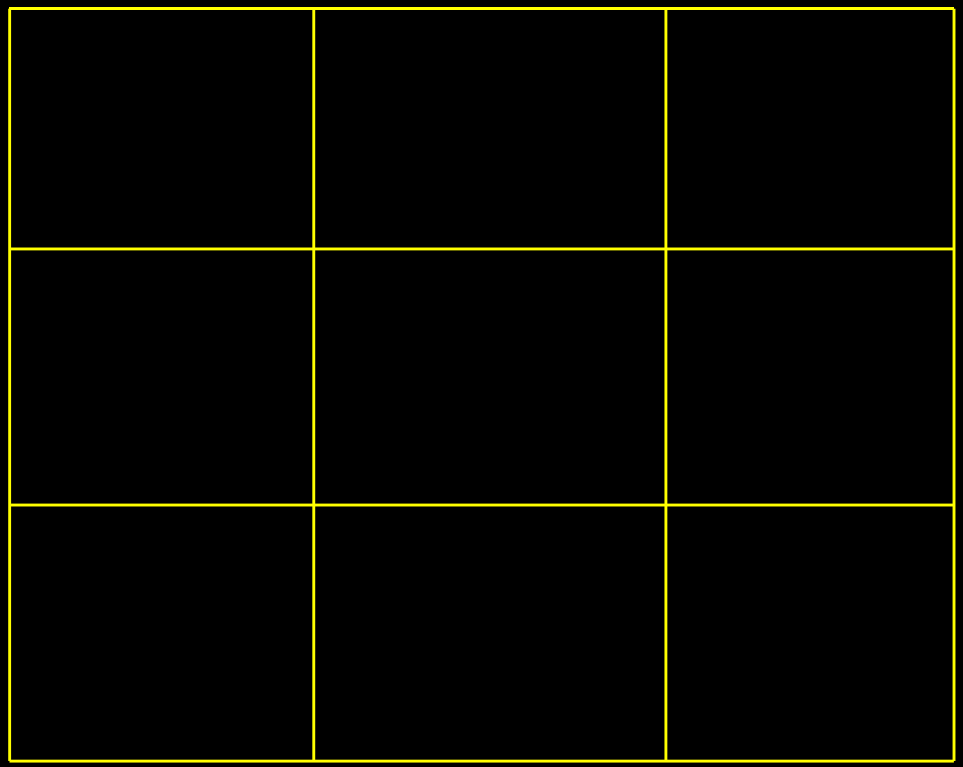
- 清潔區的規劃
  - 基本感染管制SOP
  - 接觸病人前後先洗手，注意同時fomite transmission!
  - 醫院一般清潔區以及病房區內盡量廣設乾洗手劑，方便大家接觸環境後隨時洗手。
  - 固定照護團隊與區塊。避免人員頻繁輪調或跨單位服務
  - 醫事司長石崇良：做好分艙、分流，落實服務區塊化
    - 就不會落為整個醫院都感染，要封院的機率就會非常低。

Damage control

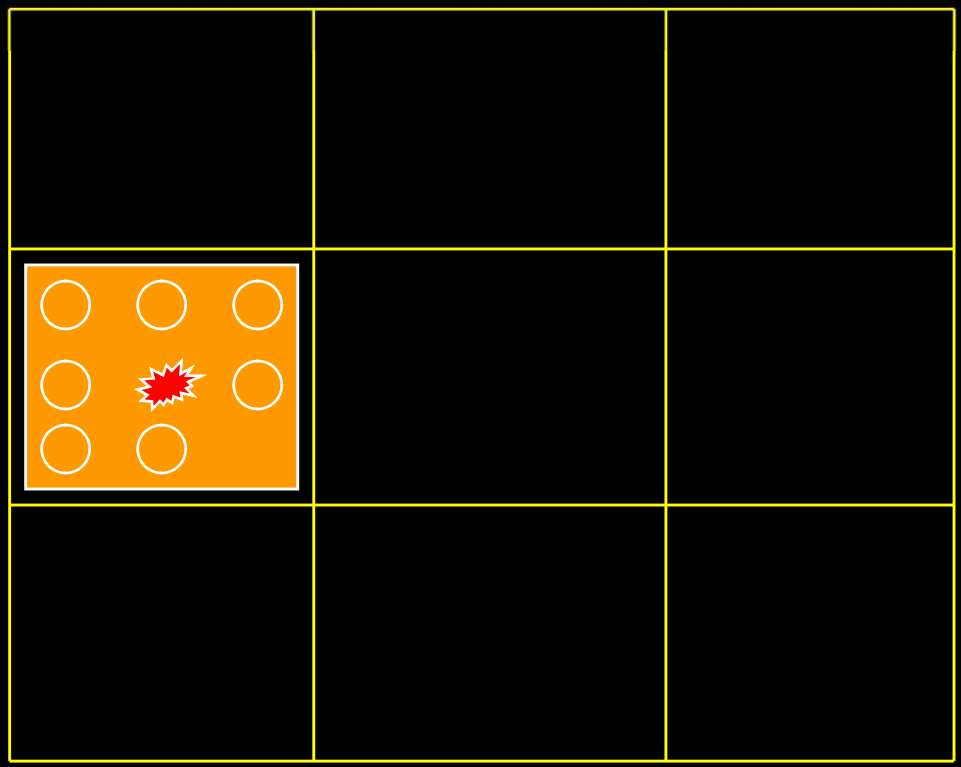


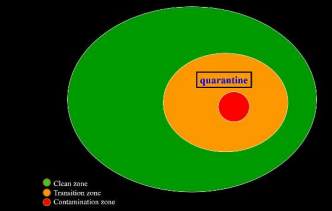
https://www.mentor.com/products/mechanical/engineering-edge/volume4/issue1/designing-modern-submarine

General Ward, HD, ICU, etc cut in sectors



General Ward, HD, ICU, etc cut in sectors

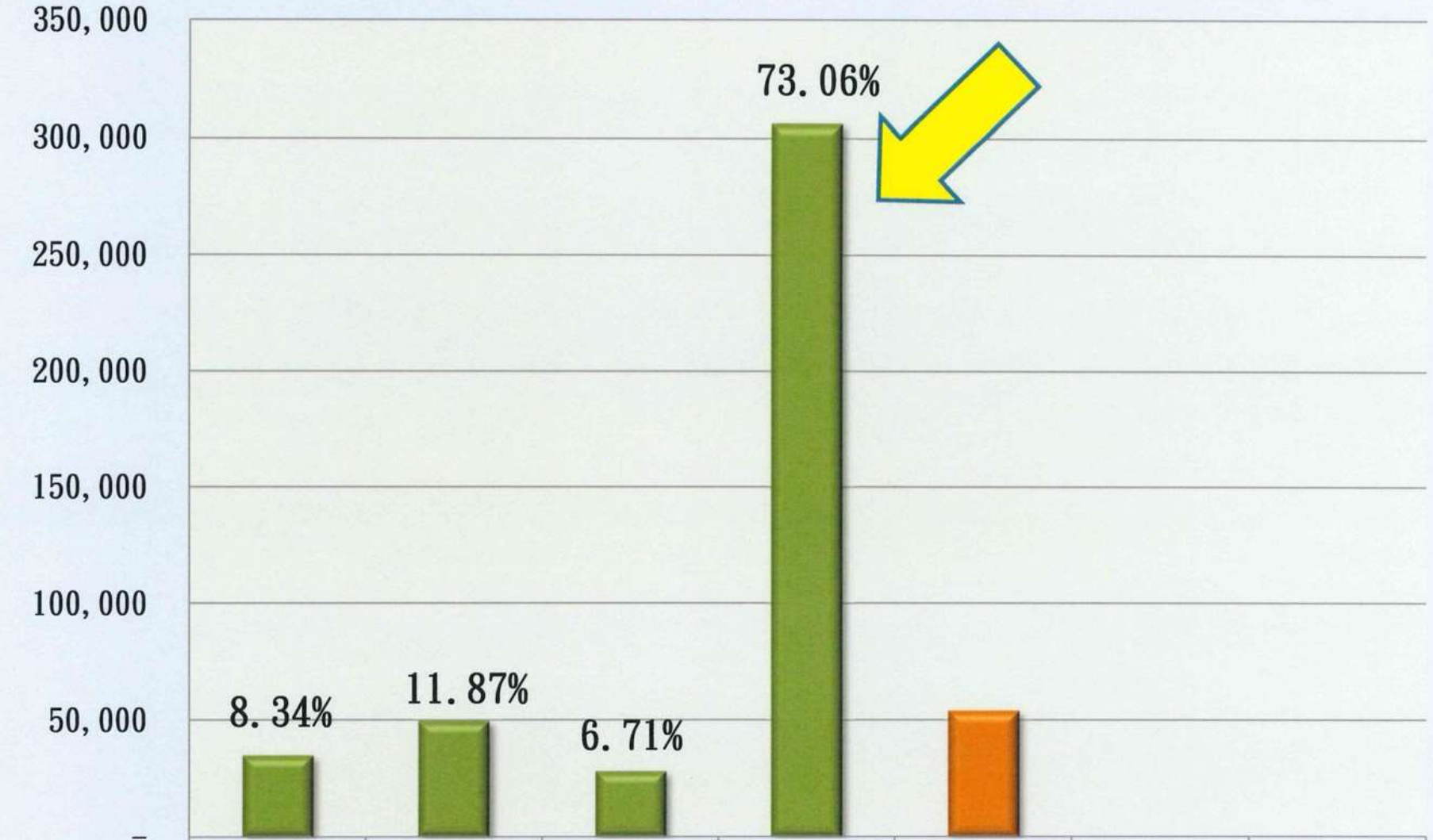




社區流行 動線管制

- 巷戰看是跟弱雞打還是跟洛基打
- 流感輕症化
  - 2009 H1N1 pdm
    - Triage before hospital
      - Community screening center
      - Class suspension
    - Anti-viral/ vaccination
- 病毒發生突變
  - 2018 H1N1 Spanish influenza

防疫名單(中港澳回國)就醫之醫療院所統計圖(109.1.13-2.12)

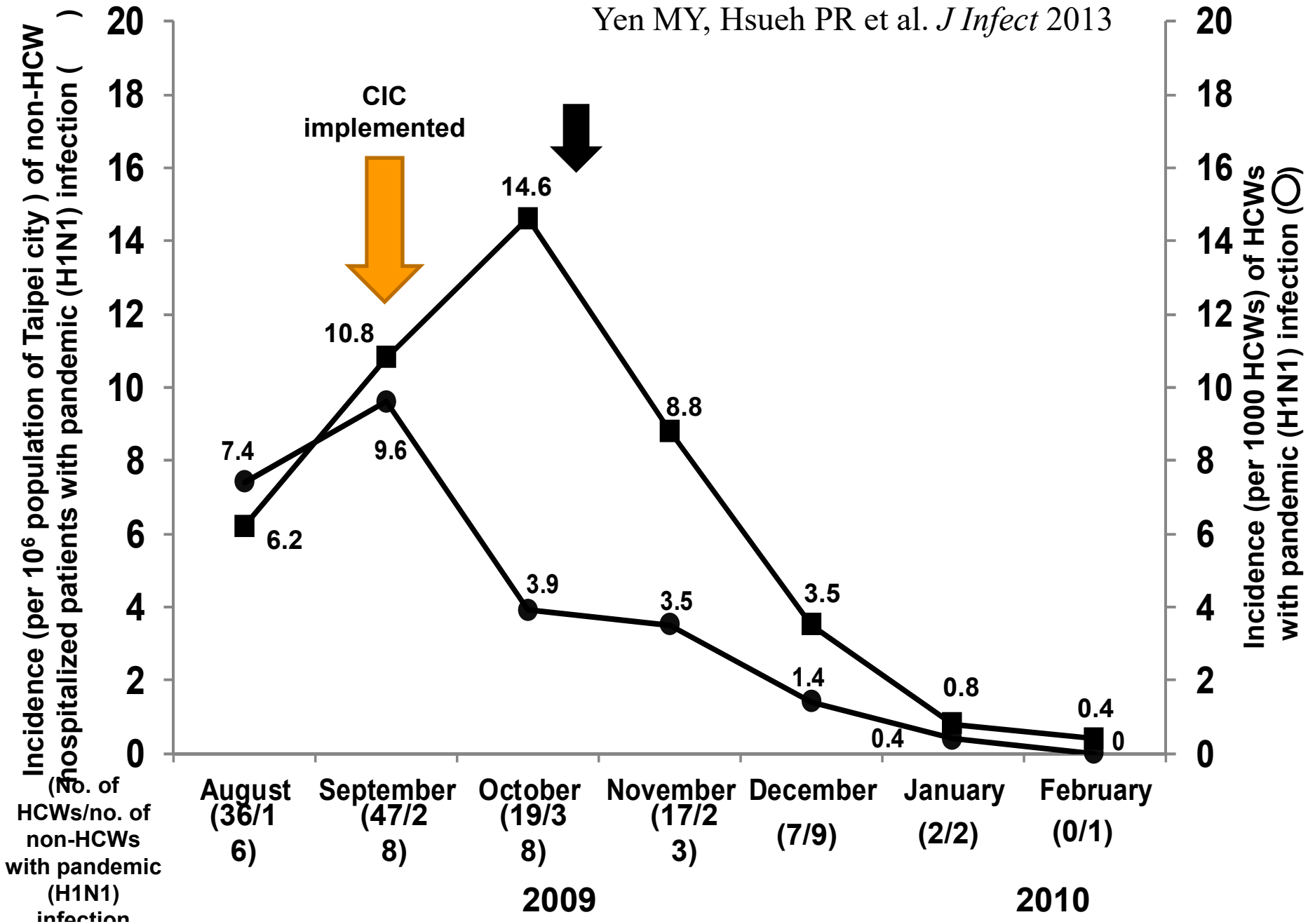


	醫學中心	區域醫院	地區醫院	診所	藥局領藥	居家照護	物理治療
就醫人次	34,975	49,766	28,139	306,265	54,159	5	12

資料來源:中央健康保險署

中華民國醫師公會全聯會製109.2.14

Fig. 2


Yen MY, Hsueh PR et al. *J Infect* 2013
CIC implemented
Incidence (per 10^6 population of Taipei city) of non-HCW hospitalized patients with pandemic (H1N1) infection ( )
Incidence (per 1000 HCWs) of HCWs with pandemic (H1N1) infection (○)
20
18
16
14
12
10
8
6
4
2
0
14.6
10.8
8.8
7.4
9.6
6.2
3.9
3.5
3.5
1.4
0.8
0.4
0.4
0
August (36/16)
September (47/28)
October (19/38)
November (17/23)
December (7/9)
January (2/2)
February (0/1)
2009
2010
(No. of HCWs/no. of non-HCWs with pandemic (H1N1) infection

進出大門時以酒精噴消雙手

- 進醫院前洗手是幫助國家，（避免汙染醫院環境）
- 出醫院後洗手是幫助自己。（避免fomite transmission）

- 出門前洗手為國家，
- 入門前洗手為家人。

顏慕庸提醒，若本身有症狀，而且是進醫院之前才戴上口罩，手上沾滿了病毒，因此為了保護其他人，進醫院前要記得洗手，以免摸了東西留下病毒。離開醫院以後也要記得洗手，以免帶著病毒回家，

進醫院前洗手是幫助國家，出醫院後洗手是幫助自己

https://udn.com/news/story/120940/4354023?fbclid=IwAR2cFnynhGoQCOkbJy7Bh_2MLTMk9rTY65xHI35KWbVpkA0aX7axZyXrDiY

本大樓依政府規定全面禁煙敬請配合
01.06.2009

請多加利用手部消毒器
28.07.2009

Power Sourcing with TAIWAN
HONG KONG
22 de 2009

世界通商大樓
11F TRI 拓墣產業研究所 TOPOLOGY RESEARCH INSTITUTE
10F SEKISUI 台灣積水化學股份有限公司
9F PANALPINA 寶雅運通股份有限公司PANALPINA TAIWAN LTD
8F 青上化工(股)公司 安正化工(股)公司
7F PANALPINA 寶雅運通 瑪花纖體 Marie France Bodyline
6F With ウィズ With人材派遣センター Softnext 中華數位科技股份有限公司
5F 勇利新友船務代理(股)公司 PANALPINA 寶雅運通 傑尋船舶安全管理顧問(股)公司
4F 台灣鹽野義製藥股份有限公司 TAIWAN SHIONOGI & CO., LTD.
3F Spencer's 史雲遜專業健髮
2F
1F 合作金庫商業銀行中山分行 TAIWAN COOPERATIVE BANK JHONGSHAN BRANCH
B1F
21.07.2009

特別警戒実施中
03.02.2010

社區流行 動線管制

- NEJM Pandora's box and successful story of Singarpor
- 流感輕症化
  - 2009 H1N1 pdm
    - Triage before hospital
      - Community screening center
      - Class suspension
    - Anti-viral/ vaccination
- 病毒發生突變
  - 2018 H1N1 Spanish influenza

SARS 防疫流程動線

醫院分流管理

分層 分流 分區 分塊

1 Mistake ?

1 down, 10 isolate

Exhausted for the rest

2 mistakes

- - - - - -

2020: 檢疫病房功能： 避免大量醫護隔離骨牌效應的開始， - SARS story

Shut down & Isolation of the hospital

Next hospitals

SARS as a ghost shadow ,

可敬的對手

mistake is acceptable

Wuhan Hubei

Collapse of medical infra-structure &
fundamental social security

to mitigate the negative impacts and to
maintain social order and

functioning health care system.

醫院保全 是決戰關鍵！阻斷「社區-醫院-社區 」傳播鏈

Protection of HCWs !!!

醫院動線管制，社區分區管理

Pandemic Response and Mitigation

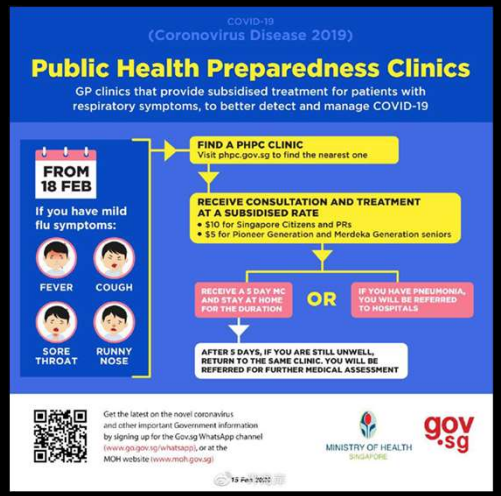
- **Traffic Control Bundles, triage before hospital**
  - screening stations outside hospitals OR
  - CICs (community influenza center 社區分流).
- **Traffic Control Bundles, zones of risk**
  - hospital level (動線管制)
  - community level (專責醫院分流)
- **Traffic Control Bundles, checkpoint control**
  - TCB may serve as a social distancing measure and cut off the vicious cycle of transmission at checkpoints 節點管制 within society and contribute to mitigating the epidemic.

風險移行與風險分級

- 從圍堵到減災的光譜移行過程
  - 篩檢的角色在社區傳播時會漸弱化
- 進一步進入社區傳播期時
  - 民眾 – 家庭 – 社區基層 – 醫院 的分流體系
  - 政府全方位宣導，日本目前的策略
- 醫療的困境，住院率沒大幅下降，人力與病房空間不足。
  - 這是戰士的戰爭， 需要後勤體系總動員
  - 中央應會考慮到醫療體系營收面的紓困

基層醫師之分流與防護

- 診所防護
  - TOCC, PPE, 動線
  - Resources allocation
    - N95、隔離衣、護目鏡、防護面罩



- 社區分流
  - 以里或次分區為單位
  - 疫病聯合診療中心
  - 由社區診所醫師輪值
  - 衛生所、PHC
  - 社區醫院
  - 其他社區空間
  - 學校

Pandemic Response and Mitigation

- Traffic Control Bundles, triage before hospital
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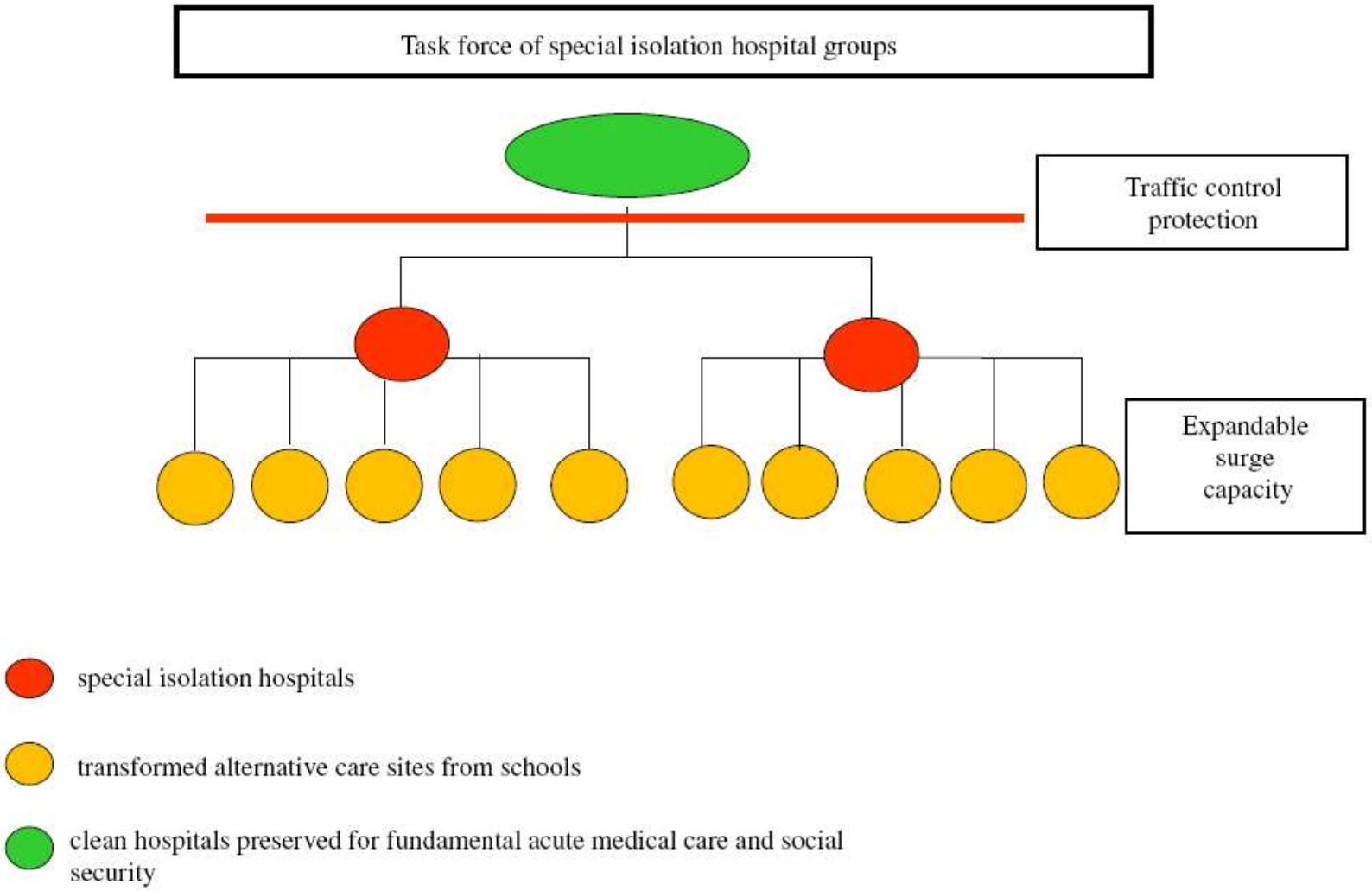
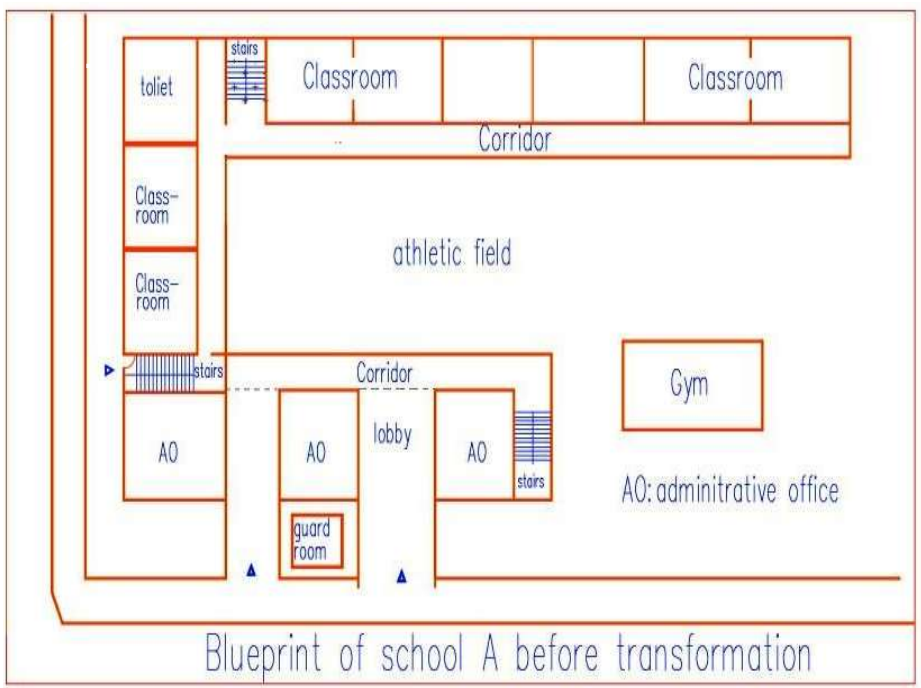
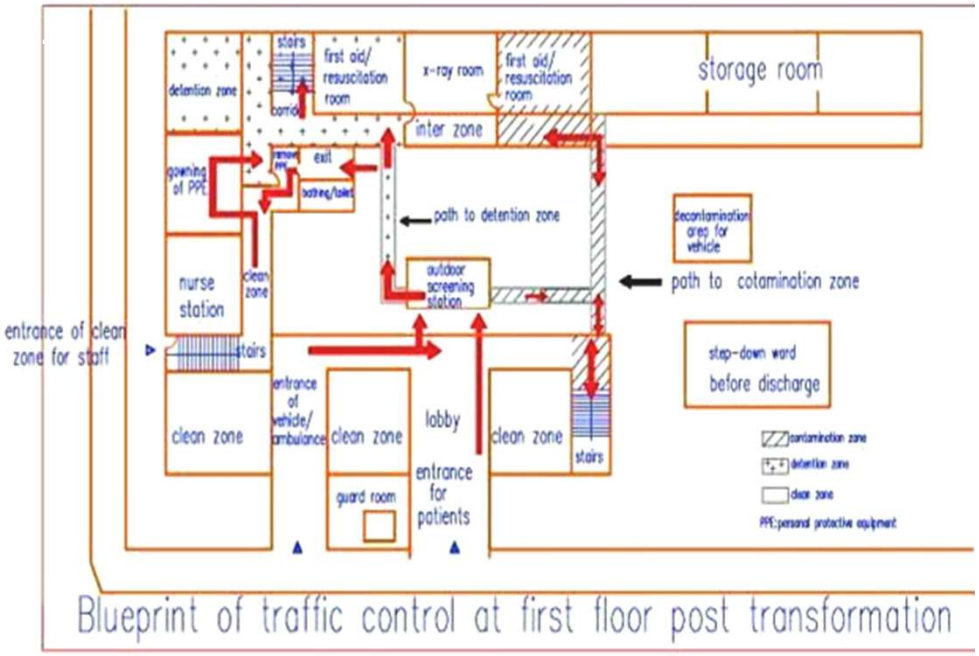


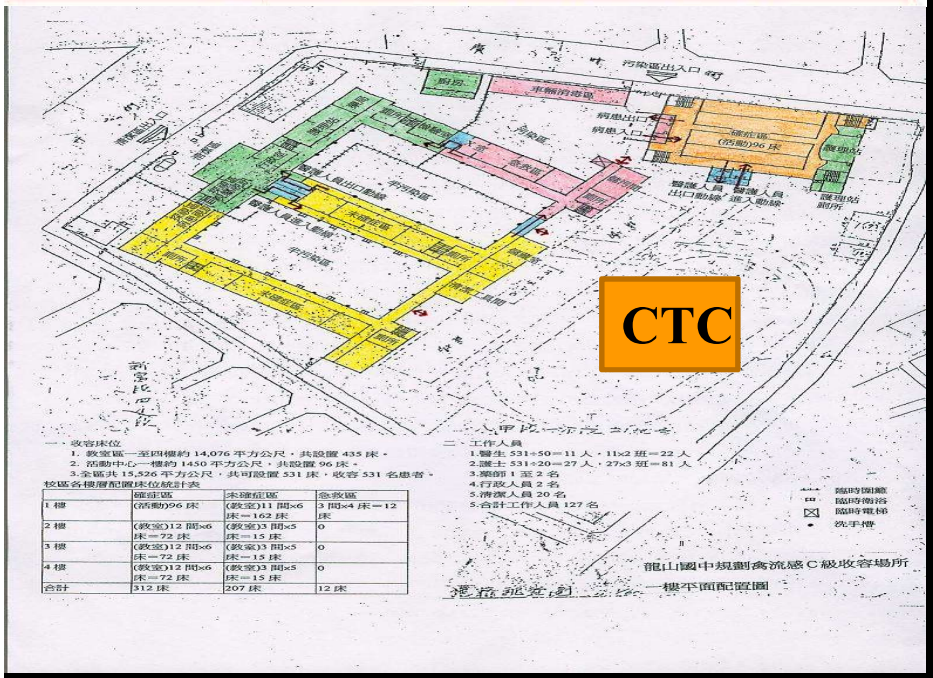
Figure 3. Conceptual scheme of expandable task forces of special isolation hospital groups for surge capacity in mitigating novel pandemics. Each working group comprised one designated communicable disease isolation hospital (red ovals) with five alternative care sites (yellow circles) transformed from recruited schools. Other general hospitals (green ovals) should prioritize strict infection control to remain free from nosocomial outbreaks of novel pandemic and maintain the integrity of the healthcare system.



Blueprint of school A before transformation



Blueprint of traffic control at first floor post transformation



CTC: community triage center

Yen MY, Shih FY. *J Formos Med Assoc*,2008;107(9):673-676.

Transforming schools into pre-designed ACS as part of preparedness plan for pandemic H5N1 influenza.

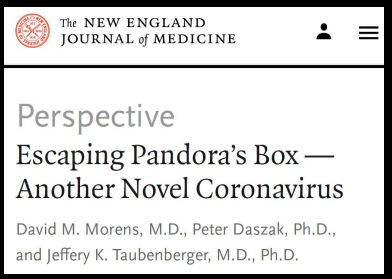
-Yen MY, *J Formos Med Assoc*,2008;107(9):673-676.-

Accessibility
Availability
Safety
Expandability

專責醫院啟動，要各醫學中心支援，設備沒有比較好，會有多大幫忙？

看是2009或1918的情境

With Covid-19, are we seeing a replay of 1918?



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Outdoor Triage Stations / CTC

Schools as CTC

Observation

Treatment Area

Waiting area

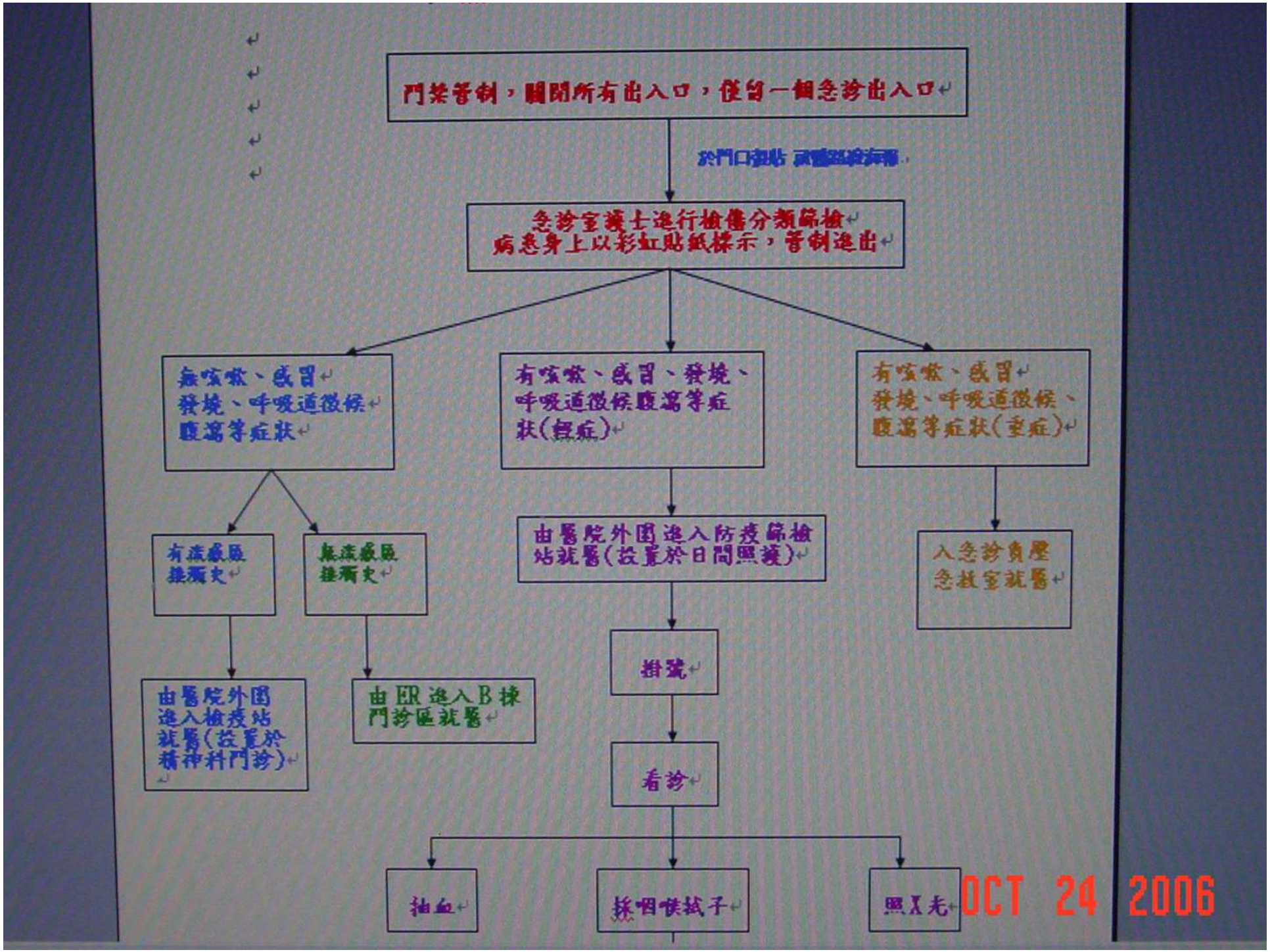
Triage

Entrance

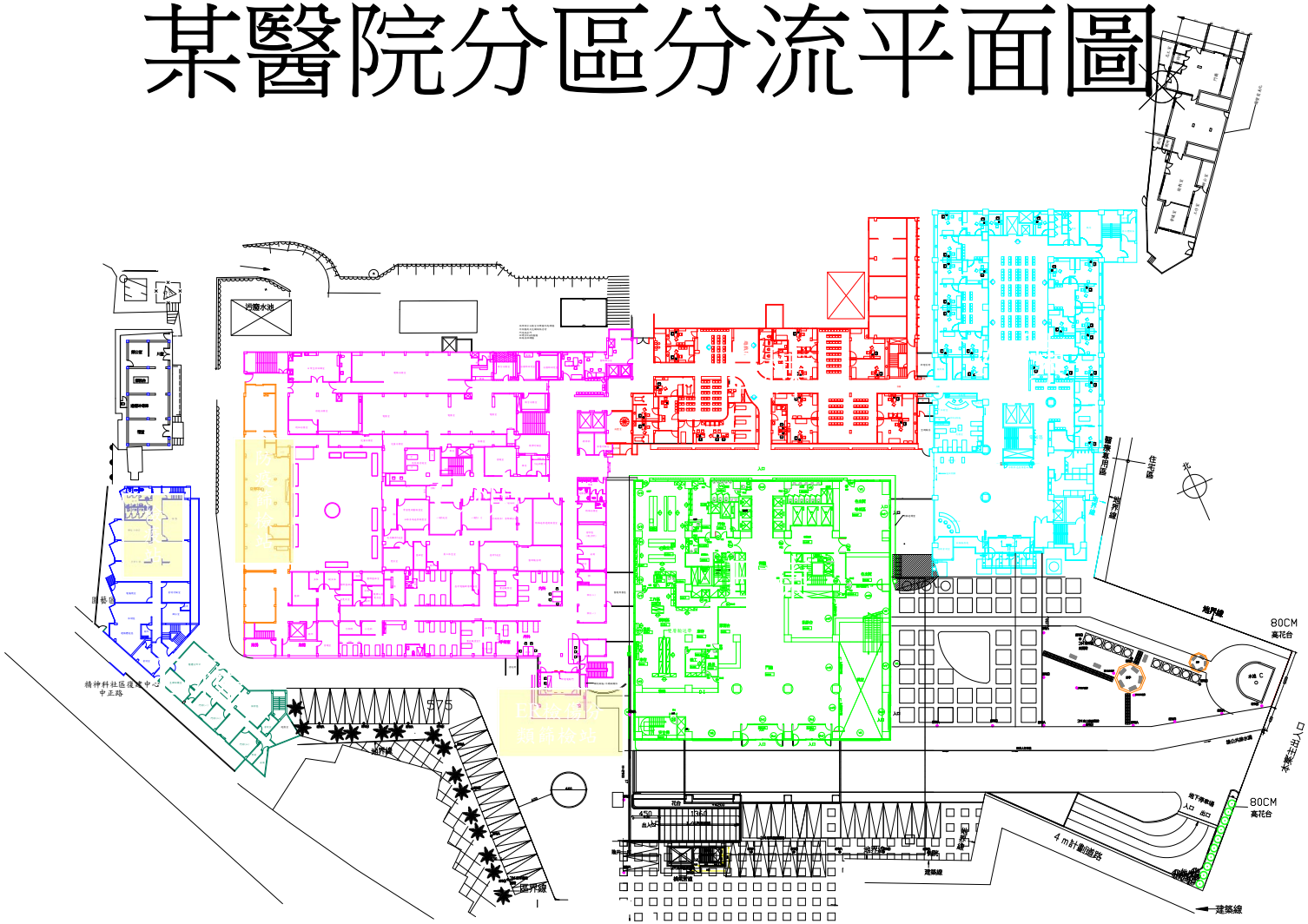
Emergency management

檢疫病房 (quarantine ward)

- 觀察病患住院後才出現COVID 症狀
- 設置檢疫病房強化第二道「檢疫隔離」措施
- 獨立空間、諸科俱全、急救檢驗設備齊全。就地轉型為檢疫病房最適之規劃。
- 所有HCW著裝保護 & 病人隔離狀態下執行醫療，檢疫觀察數天無礙後方才回歸各次專科住院治療。
- 急診之規劃?


門禁管制，關閉所有出入口，僅留一個急診出入口
於門口張貼
急診室護士進行檢傷分類篩檢
病患身上以彩虹貼紙標示，管制進出
無咳嗽、感冒
發燒、呼吸道徵候
腹瀉等症狀
有咳嗽、感冒、發燒、
呼吸道徵候腹瀉等症
狀(輕症)
有咳嗽、感冒
發燒、呼吸道徵候、
腹瀉等症狀(重症)
有流感疫區
接觸史
無流感疫區
接觸史
由醫院外圍進入防疫篩檢
站就醫(設置於日間照護)
入急診負壓
急救室就醫
由醫院外圍
進入檢疫站
就醫(設置於
精神科門診)
由ER進入B棟
門診區就醫
掛號
看診
抽血
採咽喉拭子
照X光
OCT 24 2006

某醫院分區分流平面圖



Pandemic Response and Mitigation

- Traffic Control Bundles, triage before hospital
  - screening stations outside hospitals OR
  - CICs (community influenza center 社區分流).

- Traffic Control Bundles, zones of risk
  - hospital level (動線管制)
  - community level (專責醫院分流) / ICU 分流

- **Traffic Control Bundles, checkpoint control**
  - TCB may serve as a social distancing measure and cut off the vicious cycle of transmission at checkpoints within society and contribute to mitigating the epidemic.

TCB is a powerful, convenient, and economical tool in protecting HCWs against highly contagious diseases.

Casual mistake is acceptable

- When this is all over
- And if we are still alive
- Then we can take off our mask
- And to get to know each other better

YEN, Tao-Yuan VH.

- May 1st, 2003 -

这个夏天过去

醫護天使
抗煞聖戰
The End