

醫療機構如何避免 及處理COVID-19等 病毒之群聚感染



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2023-10-05

聲明

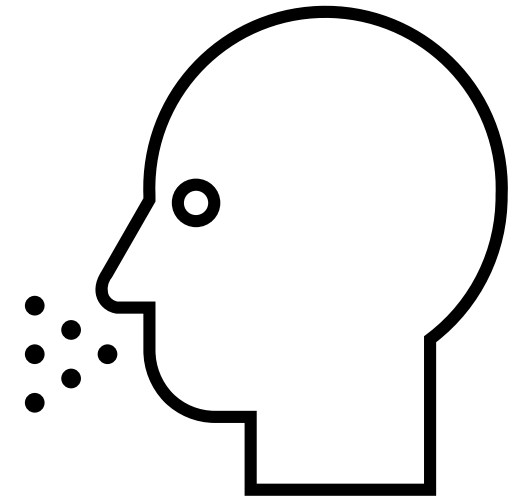
本報告之內容與結論為報告者本人參考國內外相關資料後所撰寫，
不代表疾病管制署、感染管制學會或長庚醫院之立場

內容

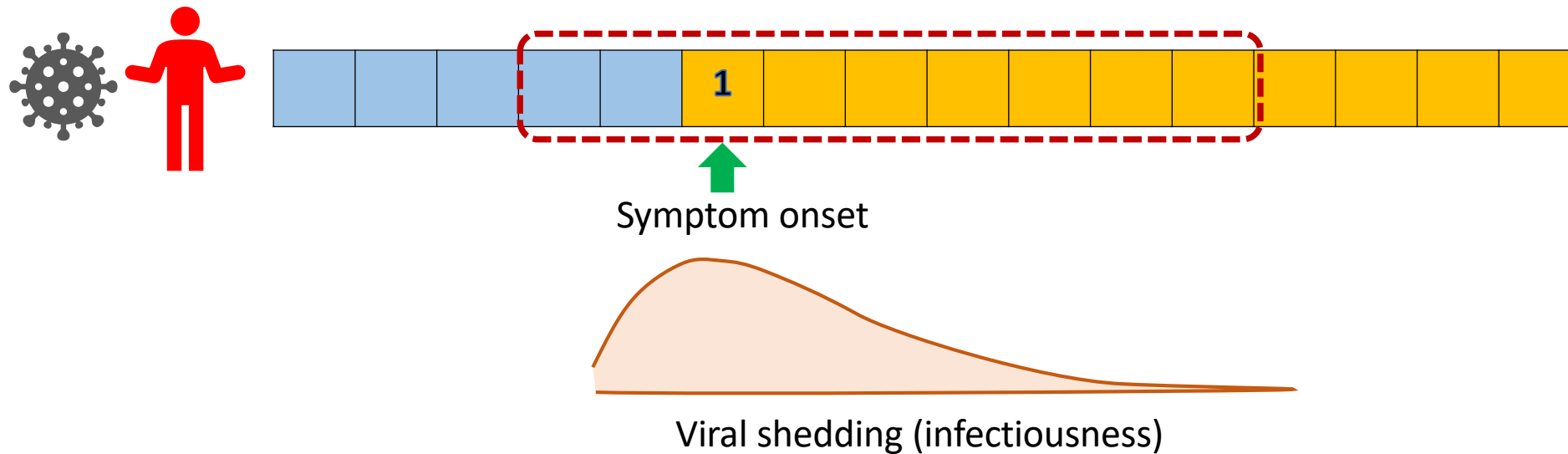
- 病毒特性與傳播
- 超級傳播者
- 感染管制措施
- 總結

傳播途徑

- 飛沫（droplets）
 - 咳嗽、打噴嚏、說話、唱歌
- 氣溶膠（aerosols）
 - 抽痰、插管、噴霧吸入治療
- 污染物（fomites）
 - 病毒污染物體表面後經由手與黏膜等接觸

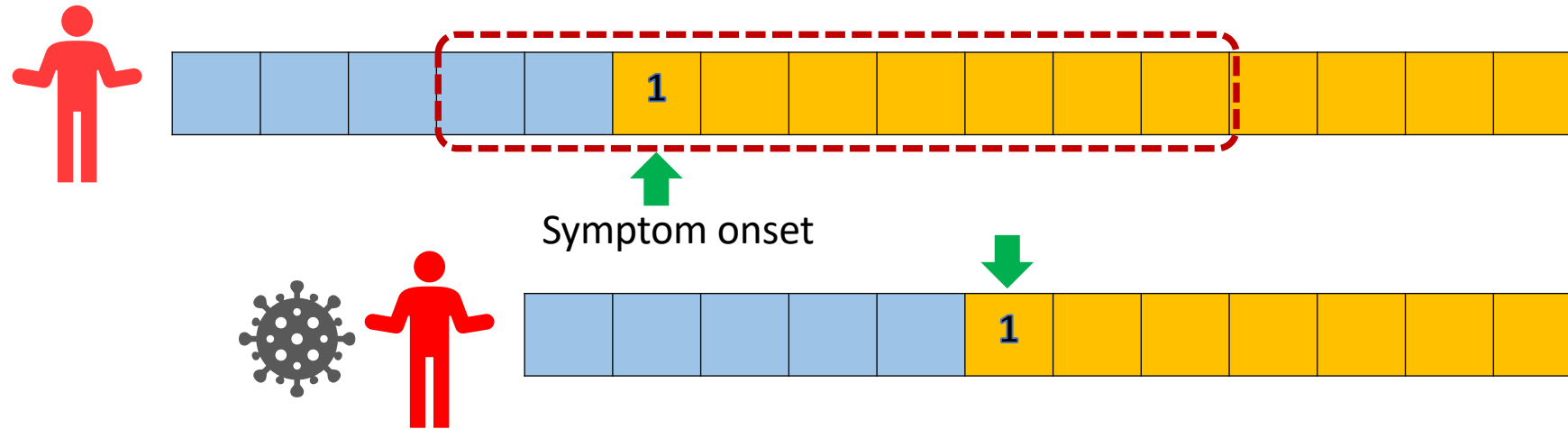


症狀與病毒量



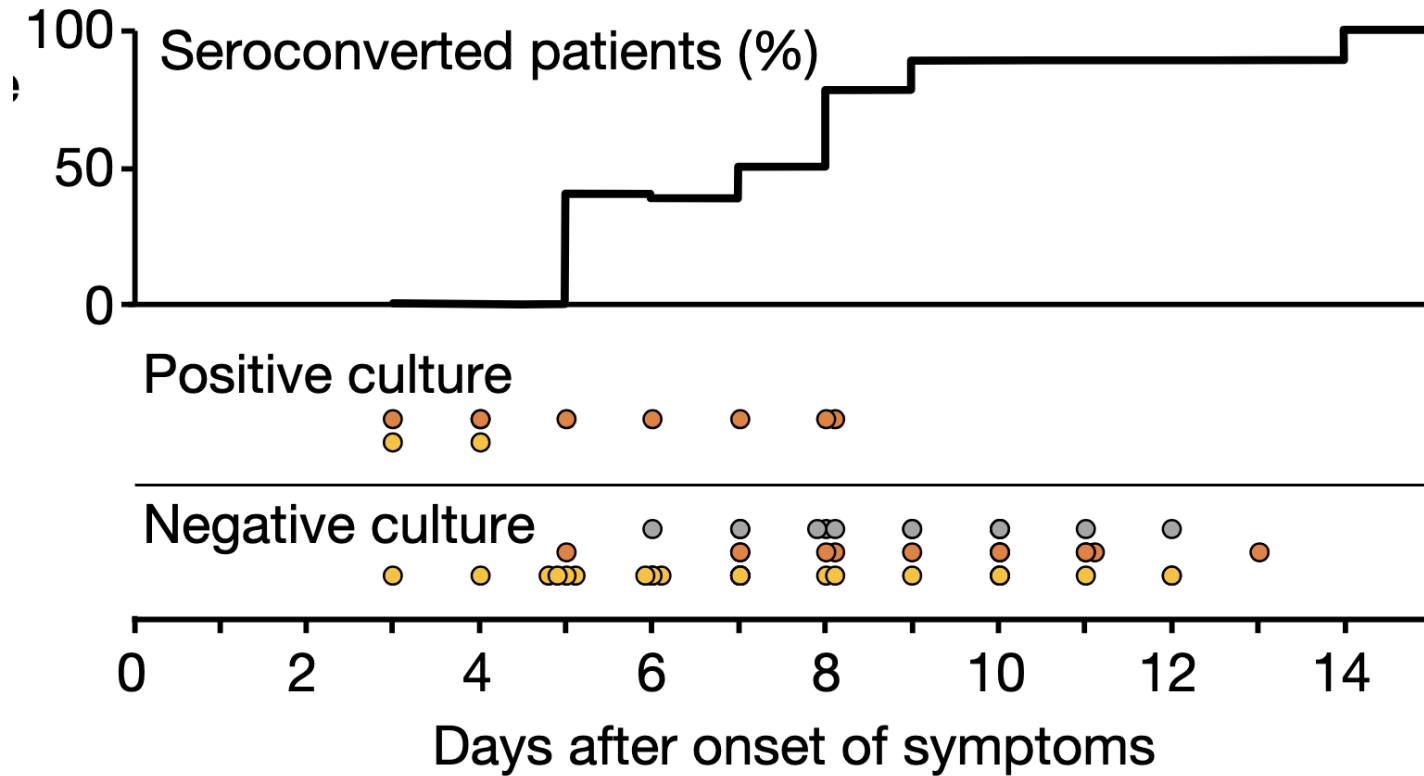
發病前2天至發病初期病毒量達高峰

症狀與病毒量



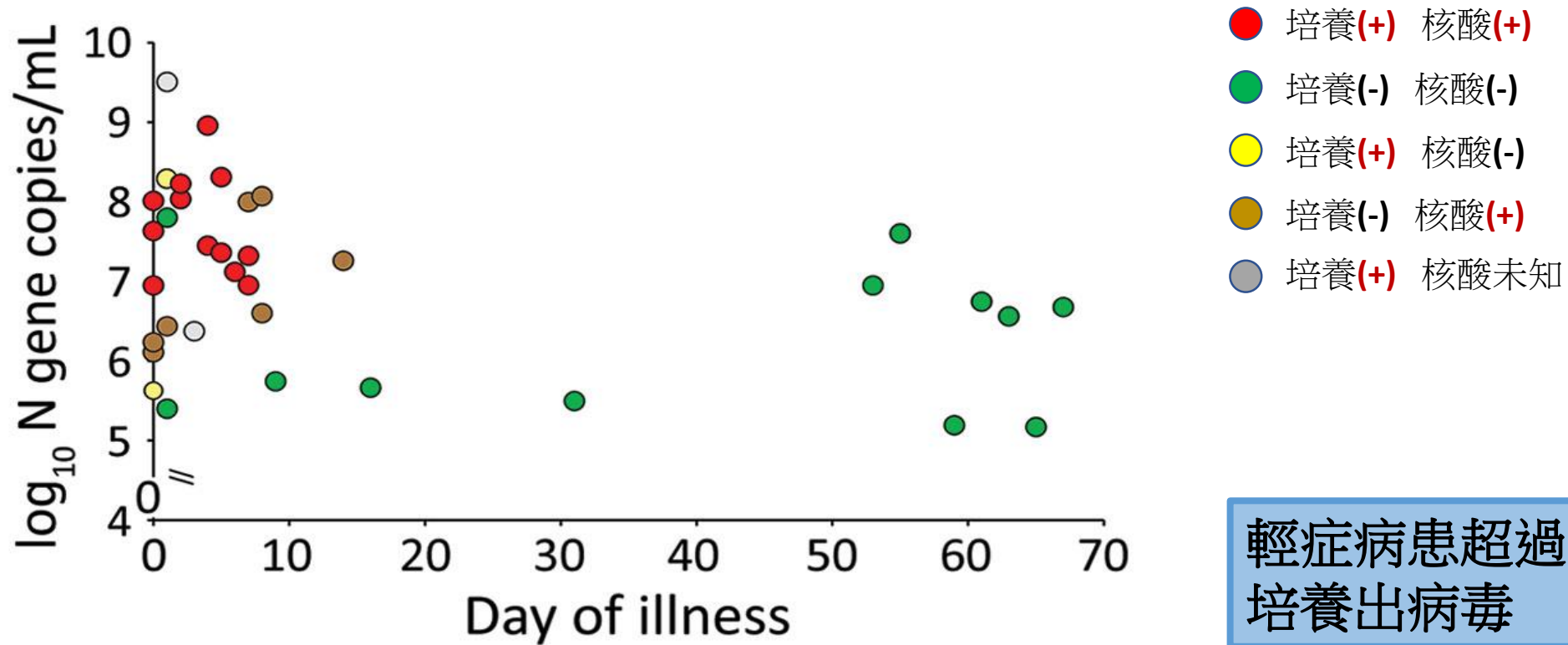
- Serial Interval (世代間隔) < incubation period (潛伏期)
 - 發病前即有傳染力
 - 無症狀傳播 (asymptomatic transmission)

病毒培養與核酸

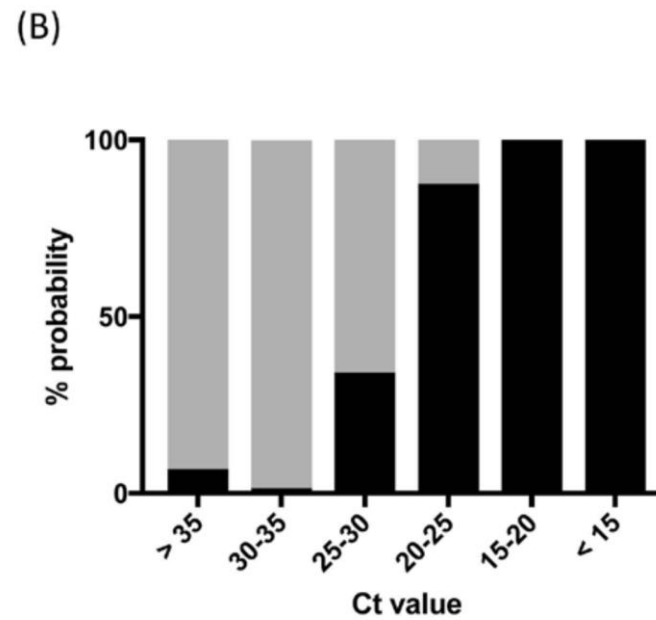
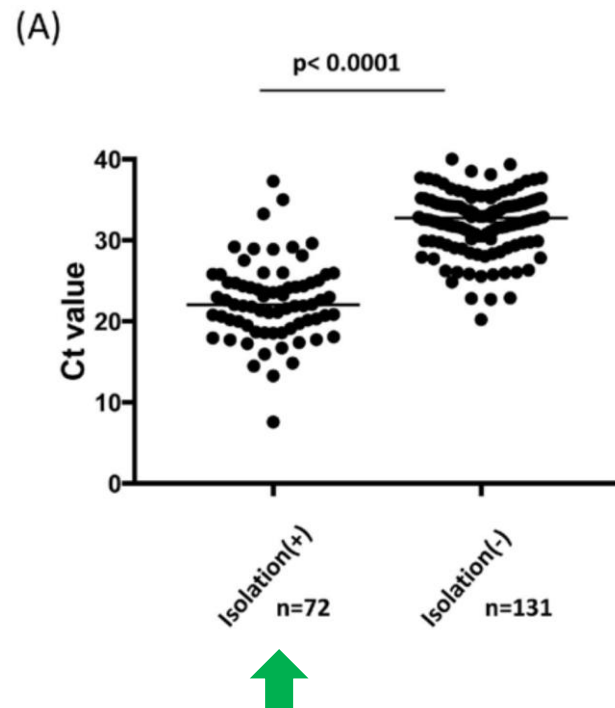


輕症病患超過8天不易
培養出病毒

病毒培養與核酸

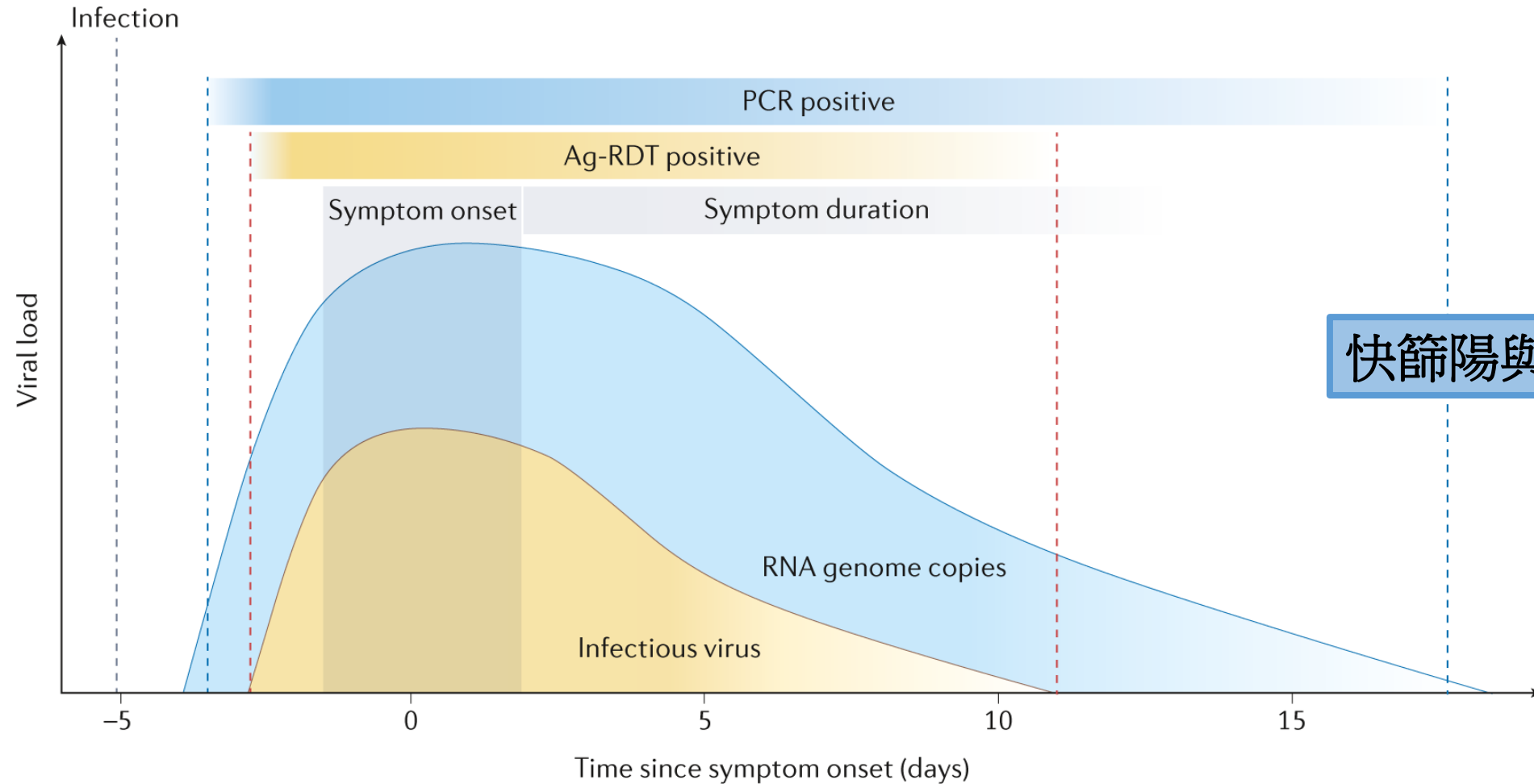


病毒培養與核酸



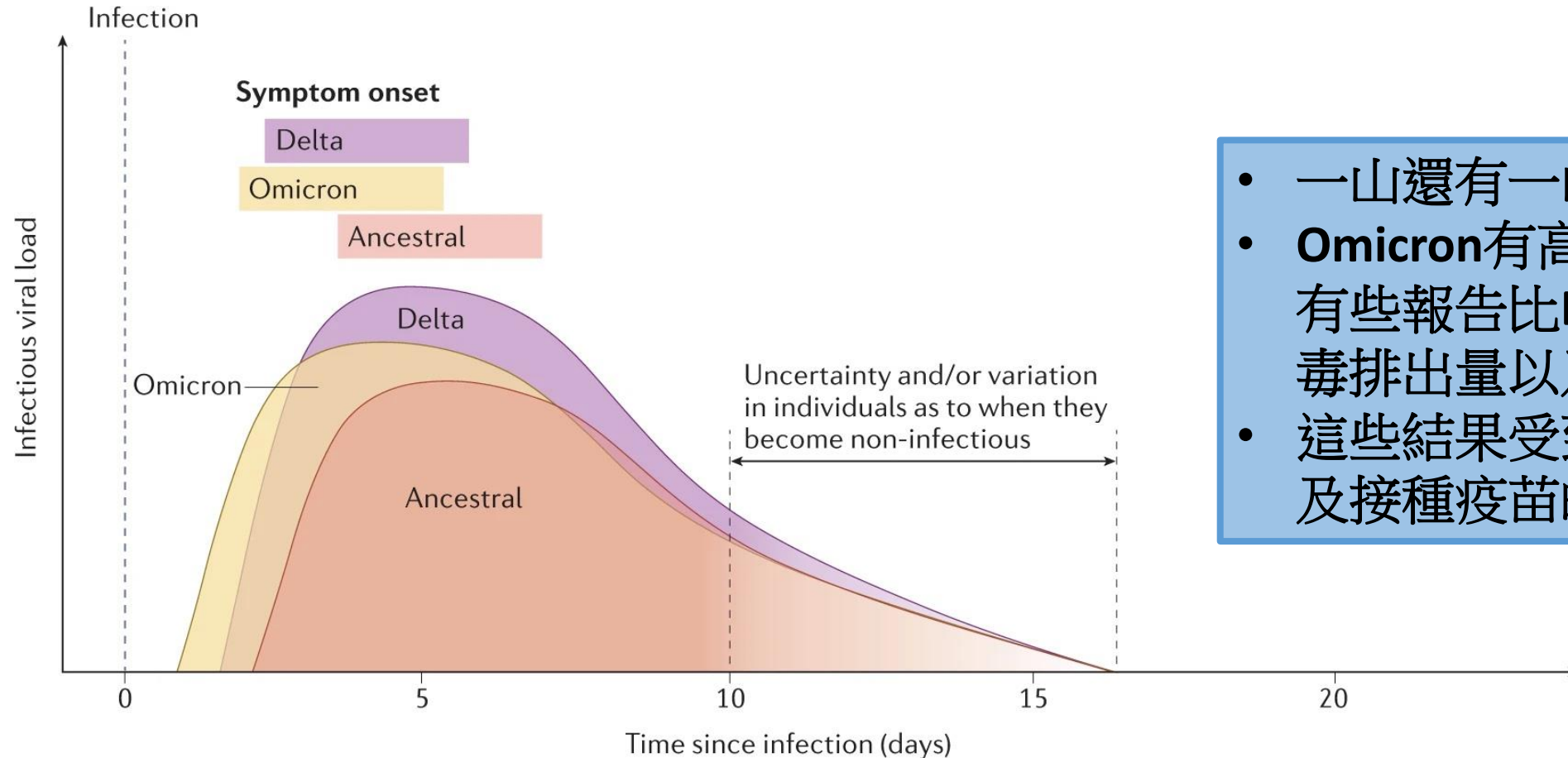
不分疾病嚴重度 Ct 值 > 35
檢體約6.9%培養陽性。
這些結果可能會因個體差異
和其他因素而有所不同。

病毒培養與核酸－輕症



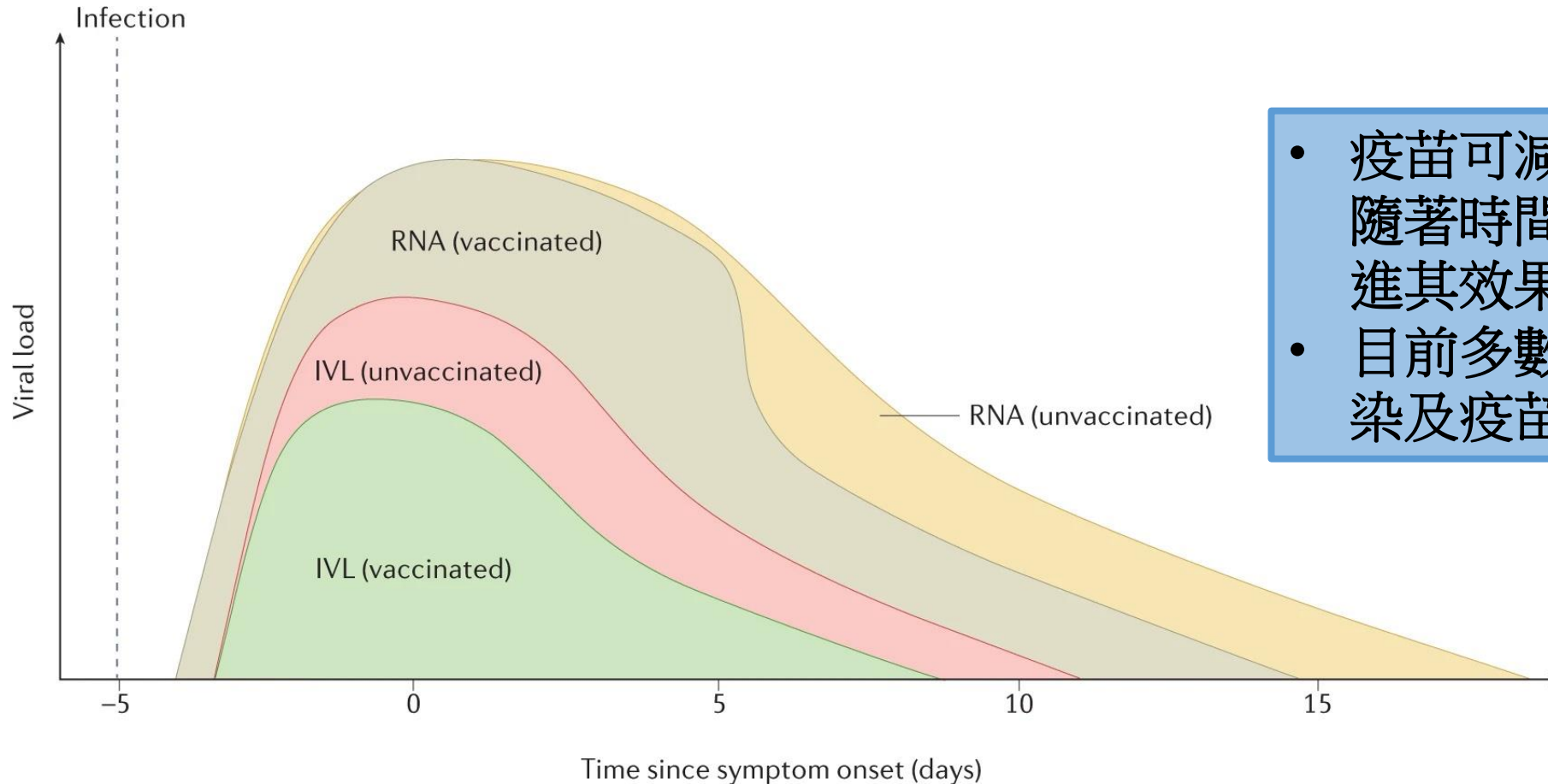
快篩陽與傳染力相關

病毒培養與核酸 – Omicron vs. 其他



- 一山還有一山高
- **Omicron**有高傳染性，但有些報告比**Delta**少的病毒排出量以及培養陽性率
- 這些結果受到大規模感染及接種疫苗的影響

病毒培養與核酸 – 疫苗的影響



- 疫苗可減少病毒量，但隨著時間推移和病毒演進其效果愈不明顯。
- 目前多數人同時具有感染及疫苗帶來的保護力

病毒清除快慢的影響因素

- 年紀^[1,3]
- 性別^[1]
- 症狀到入院時間 ^[1,3]
- 共病^[2]
- 免疫功能^[3] – 類固醇使用、疫苗接種
- 疾病嚴重度^[4]

1. BMC Infect Dis. 2021; 21: 1282.
2. Environ Health Prev Med. 2021 Dec 6;26(1):115.
3. Front Public Health. 2023 Jan 12;10:1087800.
4. Eur Respir J. 2021 Jul 20;58(1):2002724.

免疫功能不全

- 腫瘤治療中
- 血液疾病（CLL, lymphoma/leukemia, multiple myeloma）
- 器官移植
- 類固醇（prednisolone 20mg qd > 2 weeks）
- HIV CD4 < 200 cells/mm³
 - Some people who are immunocompromised have prolonged, symptomatic COVID-19 with evidence of ongoing SARS-CoV-2 replication. Without definitive data, some Panel members would use 1 or more of the following treatment options
 - Longer and/or additional courses of ritonavir-boosted nirmatrelvir (Paxlovid)
 - Longer and/or additional courses of remdesivir
 - High-titer COVID-19 convalescent plasma from a vaccinated donor who recently recovered from COVID-19 likely caused by a SARS-CoV-2 variant similar to the variant causing the patient's illness

病毒特性與傳播－總結

- 傳播途徑：**吸入**和直接/間接**接觸**帶有病毒的**飛沫**或**氣溶膠**粒子
- 潛伏期 2－14 天，發病前2天至發病初期最具傳染力
- 病程第 7－10 天，患者的病毒量已過高峰，通常無法從呼吸道檢體成功培養出病毒。
- 症狀較嚴重或免疫力低下的患者，傳染期可能較長。
- 由於病毒持續，不同變異株的特性及防治措施可能會有所不同，包括傳播速度、疾病的嚴重程度、藥物治療的有效性和疫苗的保護力等。

內容

- 病毒特性與傳播
- 超級傳播者
- 感染管制措施
- 總結

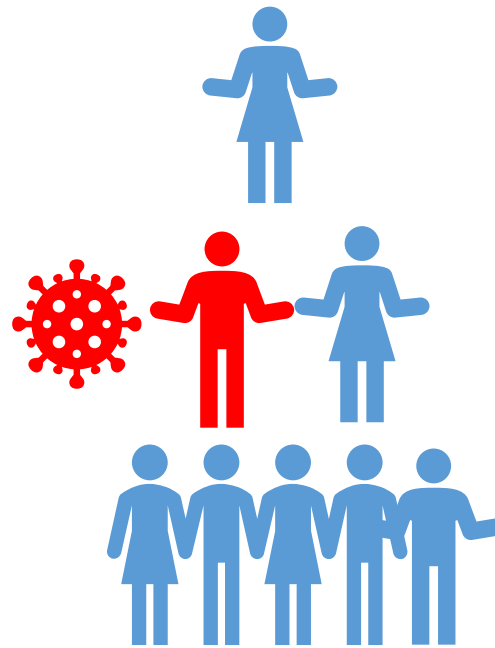
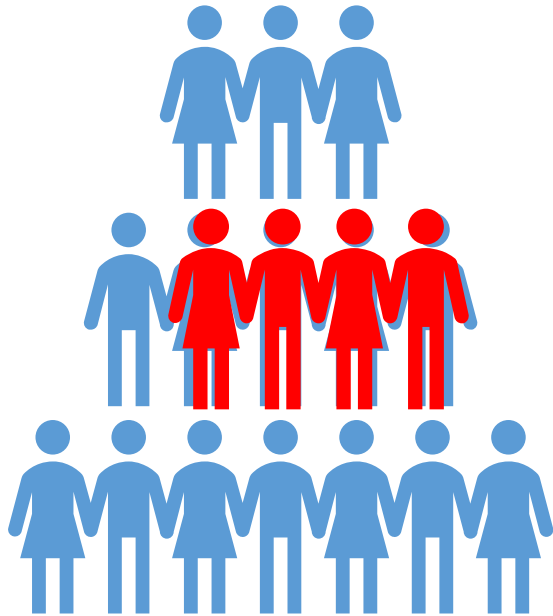
超級傳播者事件 (Superspreading events; SSE)

- 超級傳播者 (疫調用語)
 - 流行病學上，描述傳染病之「超級傳播事件」(Super-spreading event; SSE)，符合**80/20法則**，即大約20%的受感染者導致了80%的傳播個案 [1]
 - One patient infects far more people than an average patient does, which is estimated by the basic reproduction number. [2]

1. Galvani AP, Mary RM. Dimensions of superspreading. Nature 2005;438:293-5.

2. J Hosp Infect. 2020 Jun; 105(2): 111–112.

超級傳播者事件 (SSE)

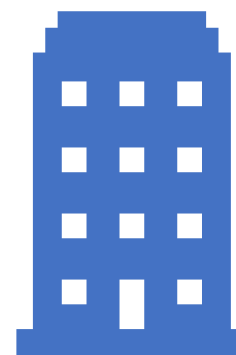
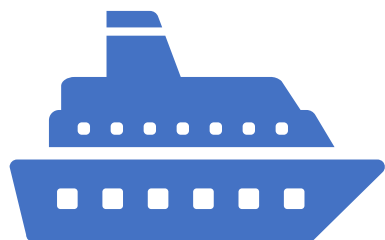
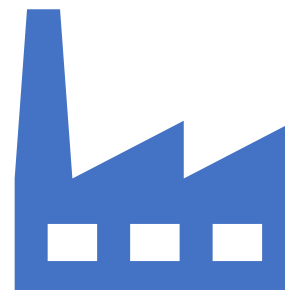
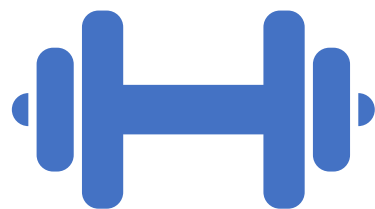


The threshold to observe superspreading events : **3.78**

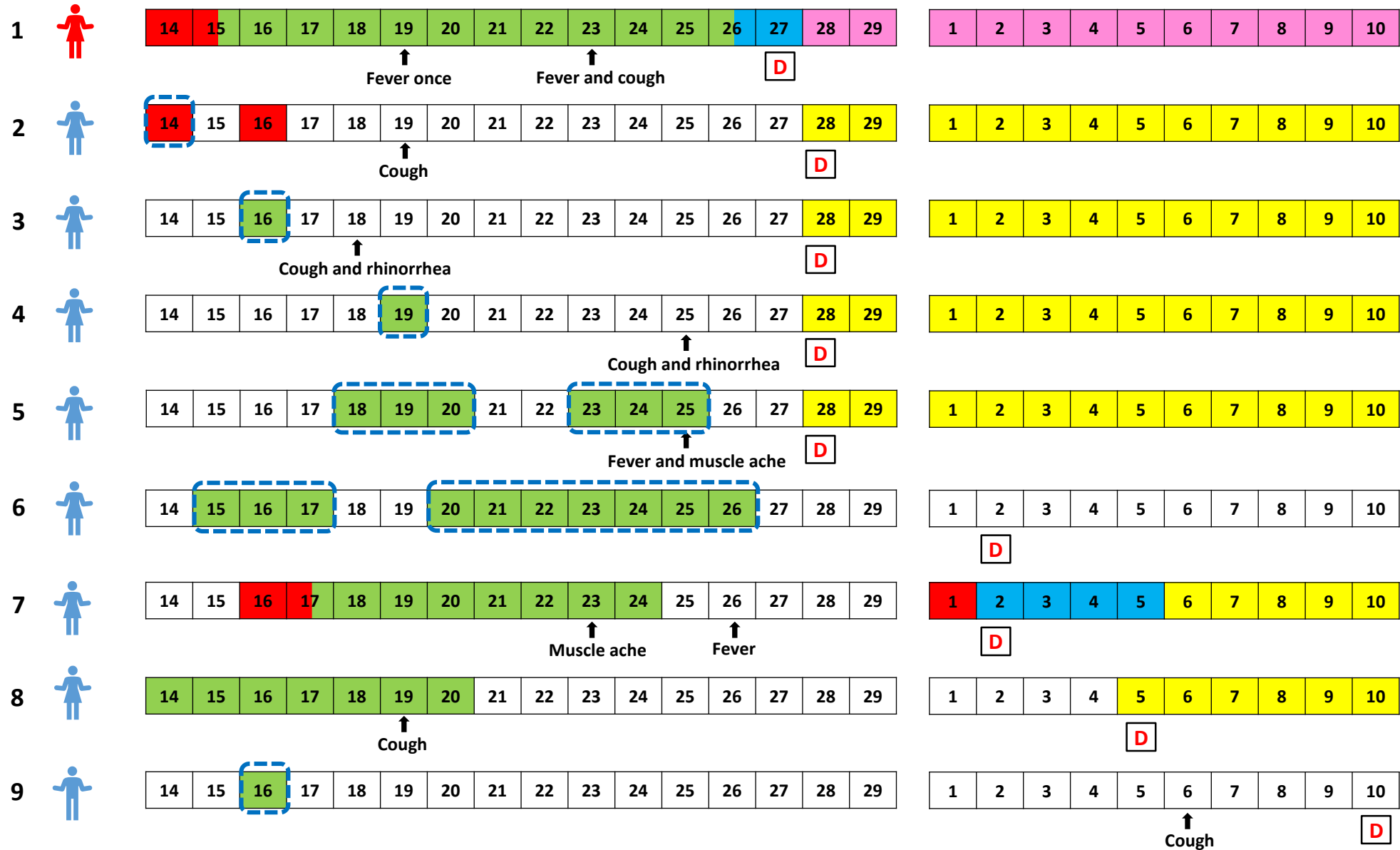
超級傳播者事件（SSE）

- 香港2020年1月23日至4月28日確診的1,038例SARS-CoV-2案例中，51個群聚中有4-7次超級傳播事件（N=309）
- 約**19%**的病例引發了所有傳播事件的**80%**。
- Decreasing the delay between symptom onset and case confirmation did not result in fewer secondary cases ($P = 0.98$), although the odds that an individual being quarantined as a contact interrupted transmission was 14.4 (95% CI, 1.9–107.2).

超級傳播者事件 (SSE)



Hospital A cluster



超級傳播者事件（SSE）

- 80/20法則 – 流行期間約20%的感染者造成80%的傳播
- SSE 與通風不良的封閉空間、人群和密切接觸環境有關。說話、喊叫、唱歌和呼吸也跟病毒的傳播有關
- 早期發現SSE及有效的接觸者追蹤可以防止群聚進一步擴大

內容

- 病毒特性與傳播
- 超級傳播者
- 感染管制措施
- 總結

嚴重特殊傳染性肺炎感染管制措施



行政策略

- 病人分流
- 落實適當的病人安置
- 工作人員體溫監測與健康管理機制
- 工作人員感染管制訓練
- 最新訊息宣導



工程/環境控制

- 換氣通風
- 醫療器材清潔消毒
- 環境清潔消毒
- 廢棄物處理



個人防護裝備

- 工作人員熟知單位內個人防護裝備存放位置
- 正確使用
- 手部衛生
- 物資儲備量充足

感染管制措施

- **病人分流**避免候診區擁擠情形出現，落實適當的病人安置
- 工作人員**體溫監測與健康管理**機制
- 感染管制**訓練與訊息宣導**等行政策略(administrative controls)
- 維持機構內良好的**換氣通風**與足夠的環境清潔等工程 /環境控制策略 (engineeringenvironmental controls)
- 使用適當的**個人防護裝備**(personal protective equipment, PPE)與**手部衛生**則是整體感染管制和預防策略的最後一道防線

Algorithm for COVID-19 patient triage and referral^a for resource-limited settings during community transmission

Safe referral and transport

- Wear medical mask
- Spatial separation into areas
- > 1 m distance

Fever or respiratory symptoms (e.g. cough, sputum production, shortness of breath)

Be aware of other presentations: fatigue, sore throat, myalgia, diarrhoea



Supported by existing or new mechanisms including hotlines, online platforms, drive-through testing, community health workers, other primary care services

Isolate or cohort

- Single room, if available
- Cohort, if not

Designated Primary and Secondary Facilities

Initial assessment and management

Criteria for referral to designated hospital may include:^b

- Signs and symptoms of severe illness: altered mental state, shortness of breath, SpO₂ < 94%, respiratory rate > 30/min, systolic blood pressure < 90 mm Hg or other signs of shock or complications²
- Be aware of co-morbidities or age > 60 years³

Mild cases →

Community Care and Isolation⁴

Including at home or in designated non-health facilities

← Condition deteriorates

UTIONS¹

UTIONS¹

社區分流與Call Center

- 2020年英國研究約4萬人次phone triage評估其預後
- 整體而言 3% 後續惡化（death or organ support）
- 60% 居家/非緊急，其中 1.3% 惡化
- 敏感度 74% 特異性 62%
- 多變數分析發現**反覆進線**跟**偽陰性**相關
 - 2 contacts (OR 1.77, 95% CI: 1.14 to 2.75)
 - 3 or more contacts (OR 4.02, 95% CI: 1.68 to 9.65)

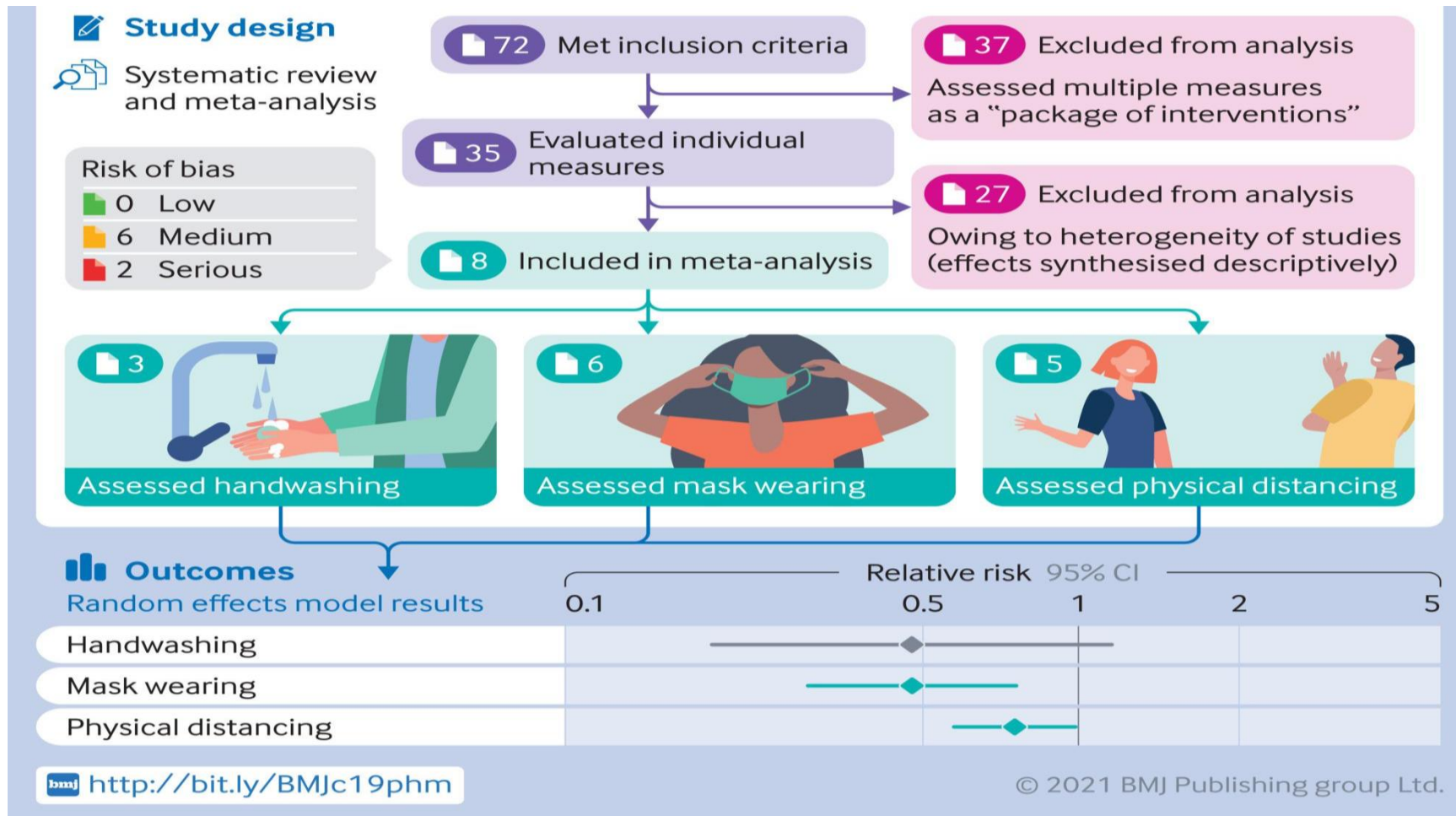
What this study adds

- ▶ Patients advised to self-care or receive non-urgent clinical assessment had a small but non-negligible risk of deterioration and significant adverse outcomes.
- ▶ Telephone triage has comparable performance to methods used to triage patient acuity in other emergency and urgent care settings.
- ▶ Accuracy of triage may be improved by better recognition of multiple contact with services as a predictor of adverse outcomes.

急門住診分流、動線管制

- 出入口管制
- 輕重症分流
- 急診篩檢站
- 疫情門診
- 戶外藥來速
- 視訊診療
- 其他




統合研究顯示 口罩、保持社交距離及洗手可減少新個案發生率



通風排氣的效果

- 2022 一月至三月 Omicron 流行期間
- 兩個學校90位學生
- 比較口罩、空氣清淨機、及無任何介入措施
- 使用空氣採樣、連續性的分子診斷監測，並比較同期流行病學資料
- **口罩減少約70%的微粒**，空氣清淨機約40%但效果不顯著
- 作者推估研究期間共7週，口罩使用可減少約2-18個COVID-19感染人次

SARS-CoV-2 transmission with and without mask wearing or air cleaners in schools in Switzerland: A modeling study of epidemiological, environmental, and molecular data

Nicolas Banholzer , Kathrin Zürcher , Philipp Jent, Pascal Bittel, Lavinia Furrer, Matthias Egger, Tina Hascher, Lukas Fenner 

通風排氣的效果

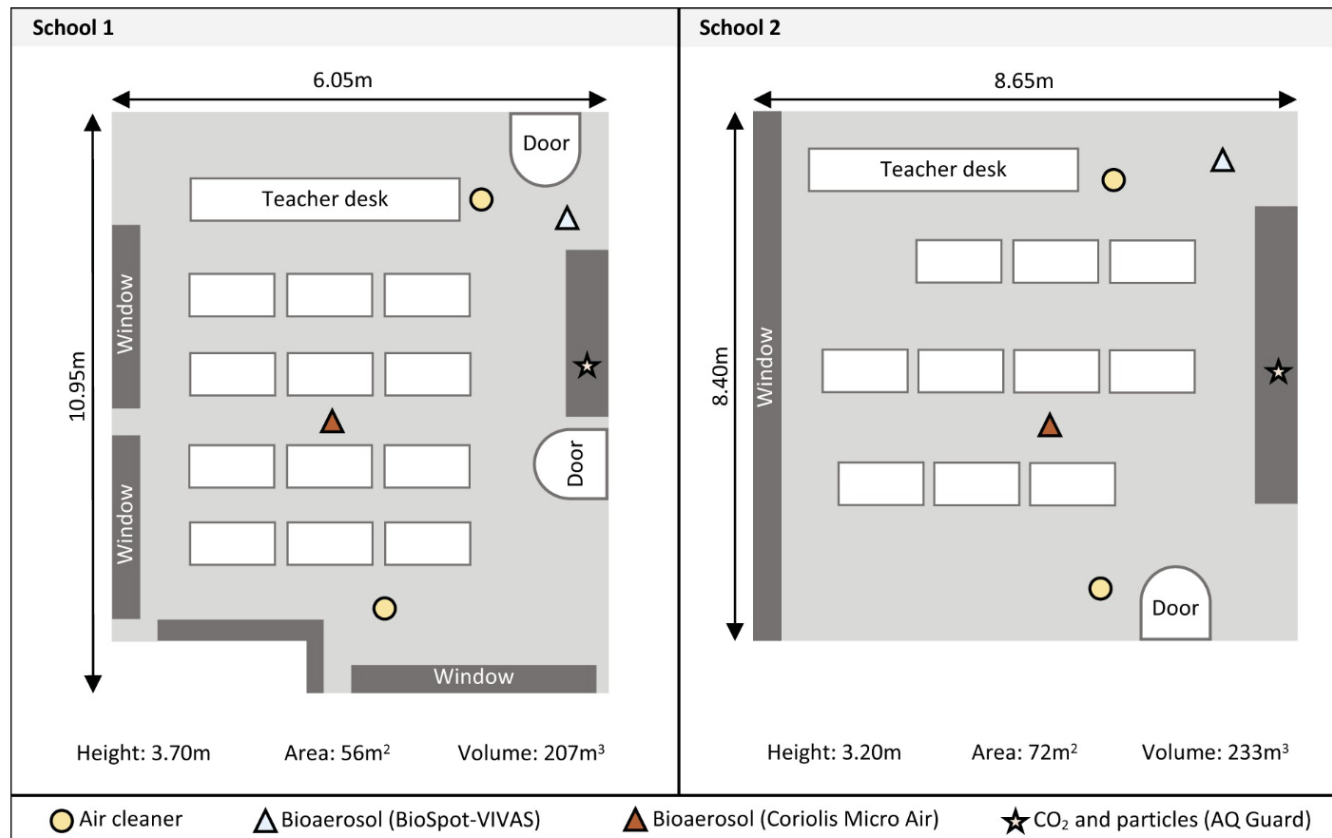


Fig 1. Study setting. Schematic study setup of classrooms where environmental data was collected in each school. One air cleaner was placed in

b Community

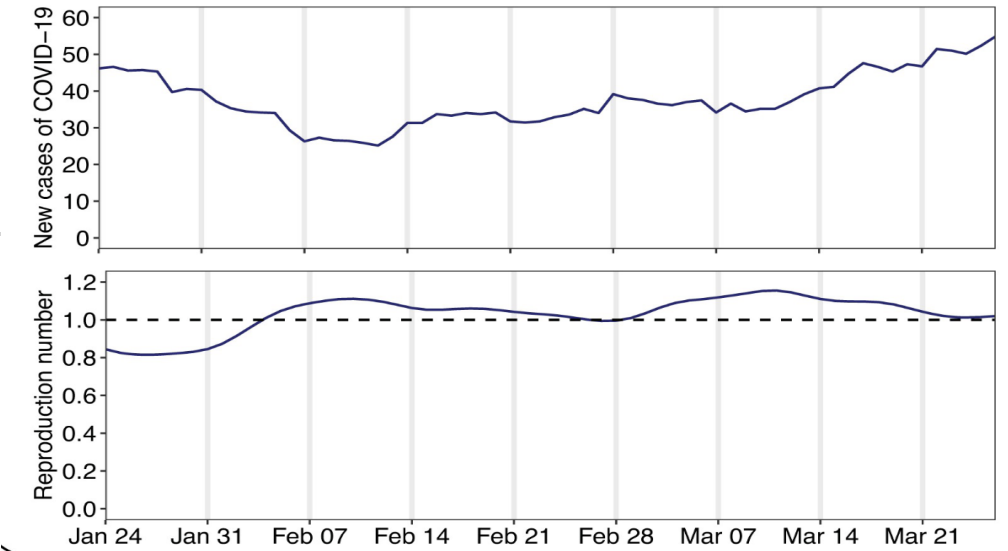
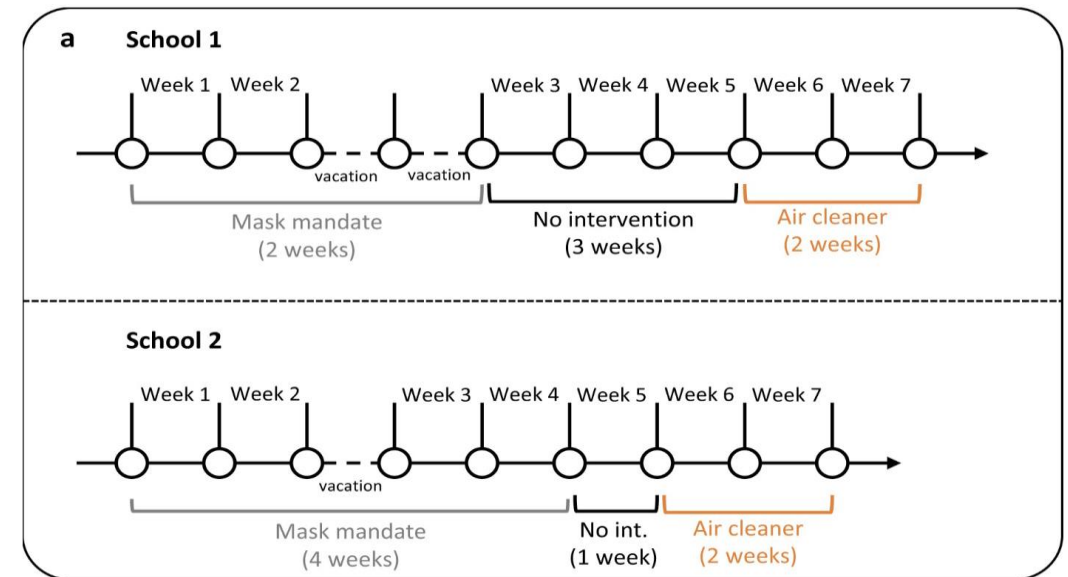


Fig 2. Study design and community transmission during the study period. (a) Study conditions over the seven-week study period



通風排氣的效果 – 評估

- **CO2 監測**[1]
- 風速計（vaneometer） [2]
- **ASHE 工具/建議**[3]
- 其他量表[4]



1) Select an Area

Invasive Patient Care Area

2) Select the best description of the main activity in this space

Bronchoscopy

Hide Results

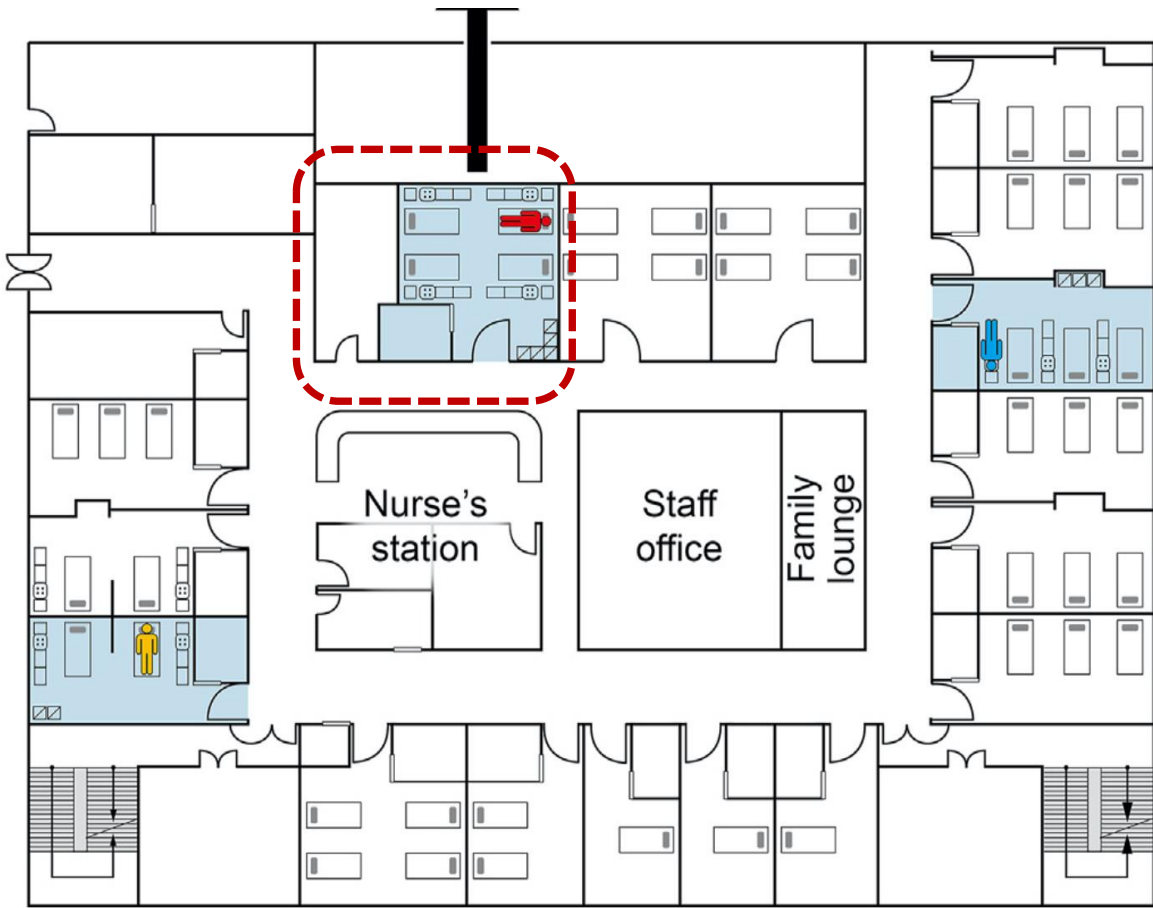
Clear Filters






**Selections: Invasive Patient Care Area:
Bronchoscopy**

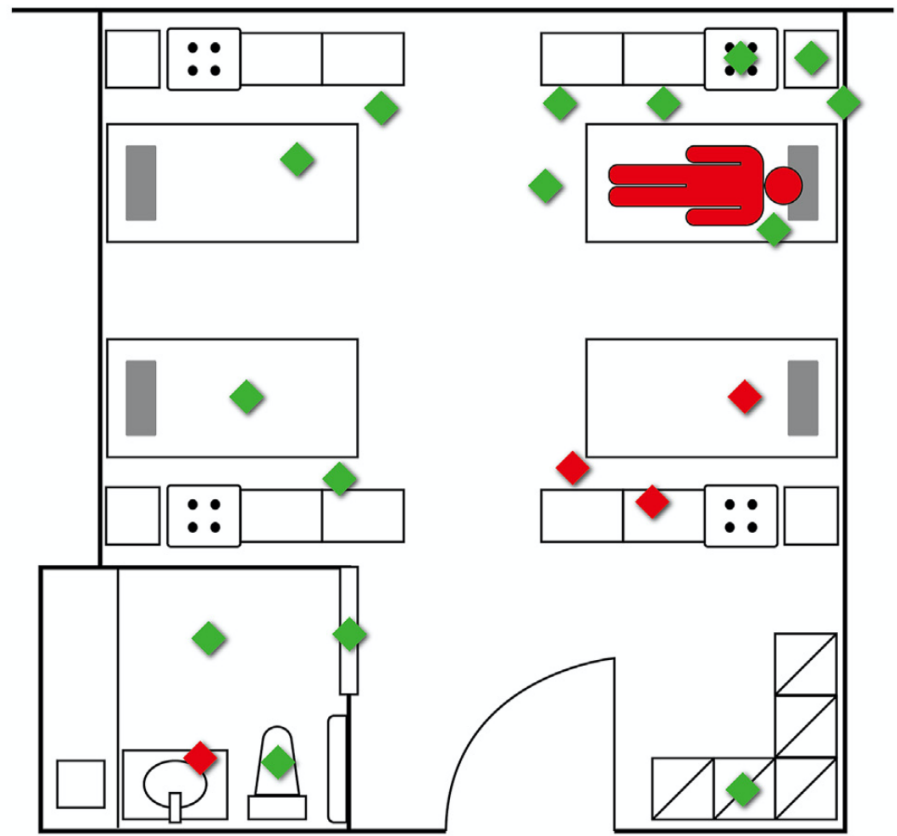
1. Air Change Per Hour
12
2. Outdoor Air Change Per Hour
2
3. Room Pressurization
Negative
4. All Room Air Exhausted Directly to Outdoors
Yes
5. Air Recirculated by Means of Room Units
No

1. <https://www.nist.gov/news-events/news/2022/07/nists-indoor-co2-tool-can-help-assess-ventilation-and-indoor-air-quality>
2. BMC Infectious Diseases volume 17, Article number: 325 (2017)
3. <https://www.ashe.org/project-firstline/ventilation-assessment-tool>
4. <https://safetyculture.com/checklists/ventilation/>

Hospital A cluster



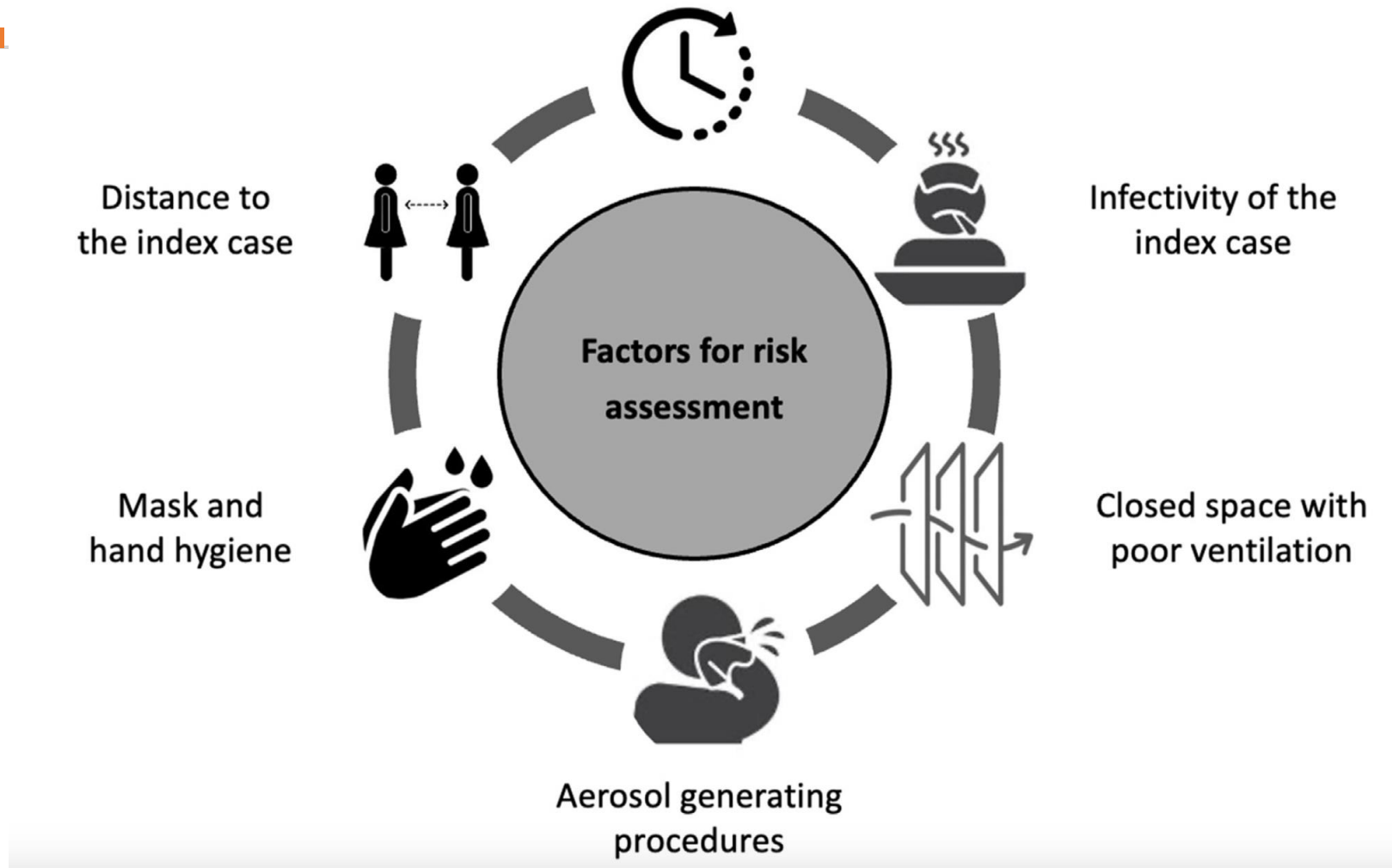
-  Patient 1
-  Patient 7
-  Patient 8
-  Negative sample
-  Positive sample



環境清潔確效

- 目視
- 螢光標示
- **ATP**生物冷光
- 微生物培養（aerobic colony count）

總結



總結

- 疫苗
- 偵測/預警/介入
 - 陽性率、新個案數、分佈地圖
 - 也包含其他呼吸道病毒（流感、腺病毒、RSV等）
- 脆弱族群
 - 免疫功能不全、ICU重症
- 領導、團隊與分工

	Mar	Apr	May	Jun	Jul	Aug
陽性件數	115	20	33	45	16	5
總收件數	174	43	44	63	27	14
陽性率	66%	47%	75%	71%	59%	36%

謝謝聆聽

pyhuang@gmail.com

致謝

長庚感染管制團隊、感染科、胸腔科、內科護理暨行政團隊
衛福部疾病管制署