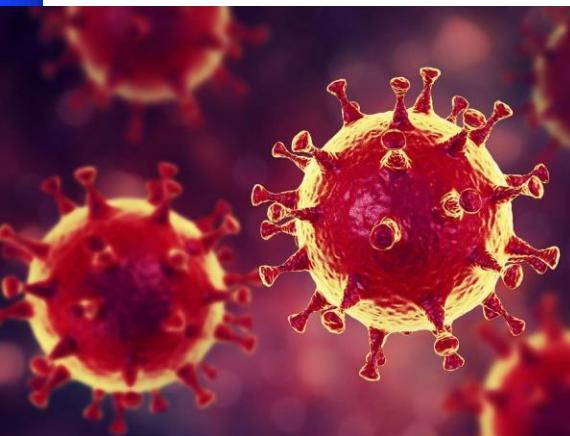


110學年度健康促進學校輔導計畫增能活動

防疫新聞有看沒有懂 變異株、清消、PCR、致死率、 疫苗效力等背後原理



許俊傑教授

Fulbright Specialist

Professor, University of Toledo

Adjunct Professor, Radford University





2018-2023 Fulbright Specialist



2014-17 ISC-SC
2012-14 HIIT Chair
2009-10 HCWG Chair

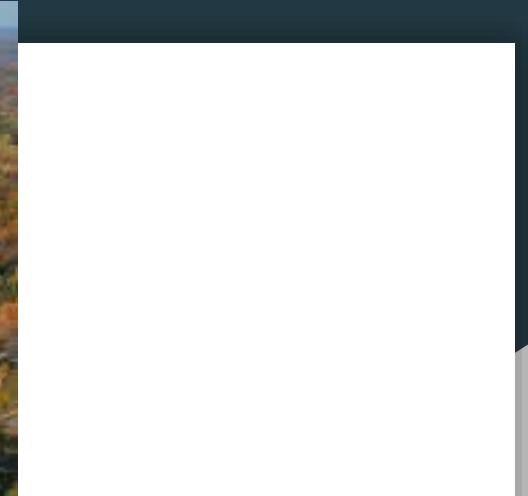


- 2014-2017 PhD in Health Education Program Director
- 2016-2017 BS in Public Health Program Director



Credentialing Excellence in Health Education

2005-09 DBPPP Director
2008-09 BOC Commissioner
2009 Treasurer







 THE UNIVERSITY OF
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MAIN ENTRANCE**

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PARKING

Table 3. Ranking of Doctoral Program

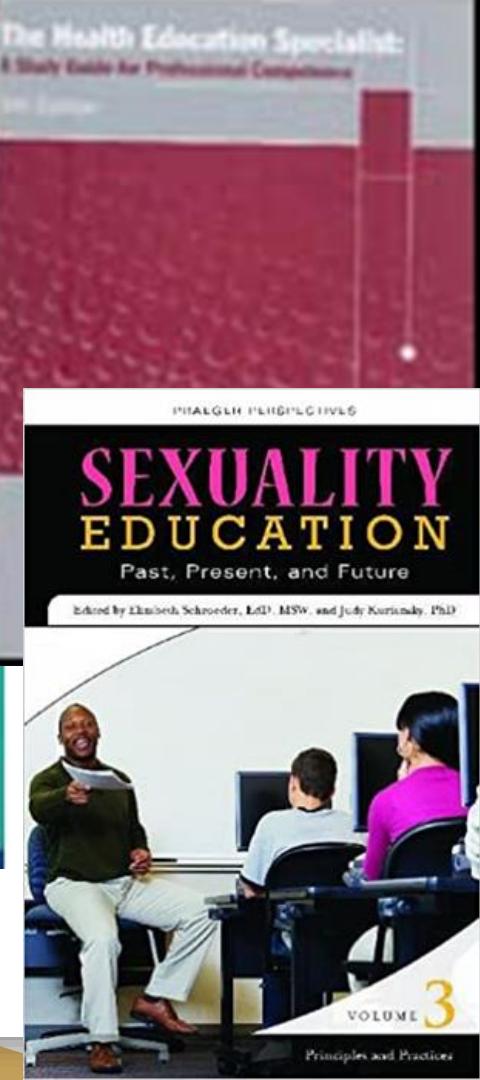
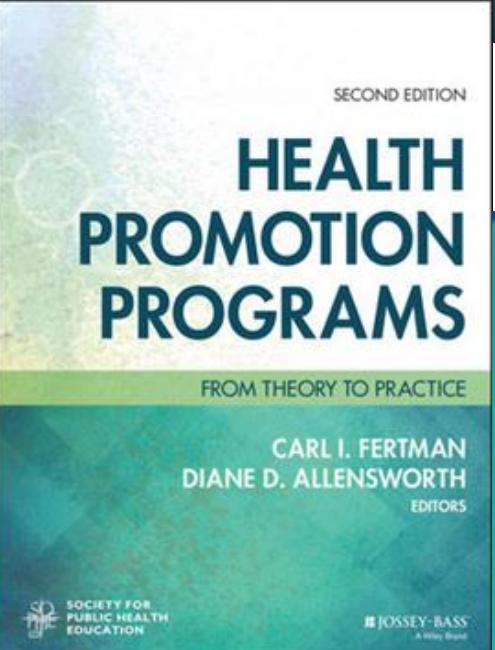
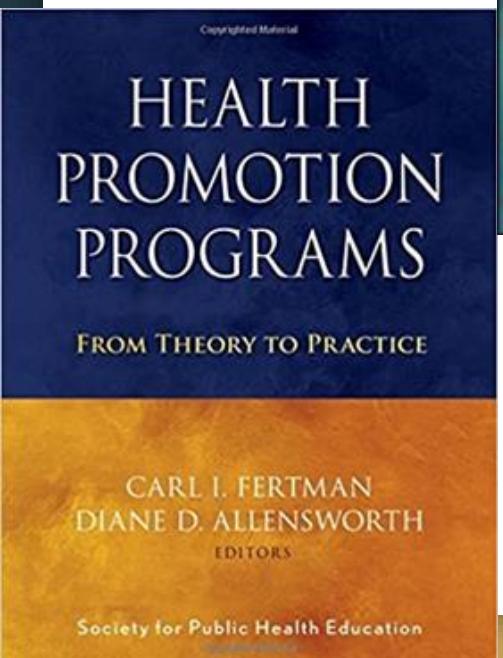
Program	Wt Score	Rank	Art
University of Texas Health Science Center at Houston ^A	81.1	1	1
Univ. of South Florida ^A	61.8	2	9
University of Michigan ^A	57.4	3	8
University of North Carolina ^A	55.8	4	4
Indiana University	55.2	5	13
Univ. of South Carolina ^A	52.8	6	2
University of Alabama & University of Alabama at Birmingham	48.5	7	10
Texas A&M University	47.0	8	7
University of Maryland	43.5	9	12
University of Toledo	40.7	10	6
Southern Illinois Univ.	40.4	11	3
University of Florida	39.3	12	16
Purdue University	34.5	13	17
University of Georgia	32.1	14	19
The Johns Hopkins Univ. ^A		20	
Kent State University		20	
University of Arkansas		15	
Loma Linda University ^A	19.0	19	18
Temple University	14.2	20	22
University of Kentucky	10.5	21	21
University of Utah	9.5	22	14
University of Texas	6.9	23	23
University of Missouri	3.3	24	24
Kansas University			

American Journal of
Health Education,
2004, 35(3), 132-140

Table 2. Ranking of Top 20

University	Wt. Score	Rank	Fund	Art	Ment	S. Act	Ratio	Cit	Ed	Sp
Indiana	58.85	1	8	7	9	3.5	5	4	1	4
Texas-Houston	55.61	2	1	1.5	19	—	9	2	19.5	1.5
North Carolina	53.16	3	19	4.5	1	7	15	3	15	20
Illinois-Chicago	53.06	4	2	1.5	14	—	—	1	8	1.1
South Carolina	51.19	5	7	3	5	16	—	7	—	12
Michigan	48.96	6	3	9	2	18	20.5	11	18	18
Alabama/UAB	48.45	7	13	10.5	4	3.5	16	8	5	13.5
Maryland	47.32	8	5	6	8	12.5	18	6	6	6
Toledo	47.11	9	—	8	3	6	7	—	—	11.5
Univ. of South Florida	40.90	10	4	14.5	11	—	—	—	—	—
Southern Illinois Univ.	35.84	11	17	12.5	6	9	4	9	—	—
Florida	35.32	12	18	4.5	20	14.5	3	9	—	11.5
Oregon State	35.14	13	14	—	13	3.5	2	—	—	11.5
Massachusetts	34.61	14	16	—	12	10.5	—	12	16.5	4
UCLA	32.89	15	6	—	10	19.5	—	15	18.5	13.5
Oklahoma	32.18	16	12	17.5	—	3.5	11	—	15	3
Texas-Austin	31.49	17	15	12.5	7	—	—	1	18.5	—
Illinois	29.33	18	—	17.5	18	—	10	—	—	21.5
Utah			—	—	—	—	14	13	—	6
Loma Linda			—	16	15	—	—	17	10	10
Arkansas ^A			—	—	—	12.5	—	—	14	19.5
Georgia ^A			—	—	—	17	12.5	—	20	16.5
Kent State ^A			—	14.5	—	19.5	—	—	—	—
Kentucky ^A			—	10.5	—	—	—	12.5	16	—
			—	—	19	—	—	17	—	—
			—	—	—	—	10.5	17	—	—
			—	—	—	8	8	—	—	—
			—	—	—	—	—	19	—	—

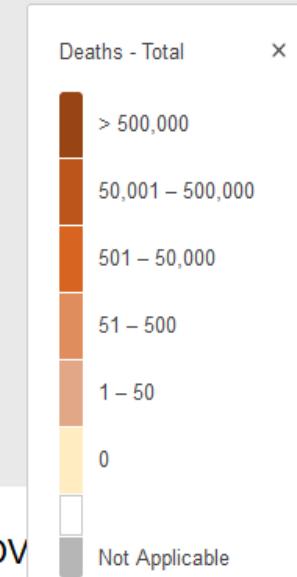
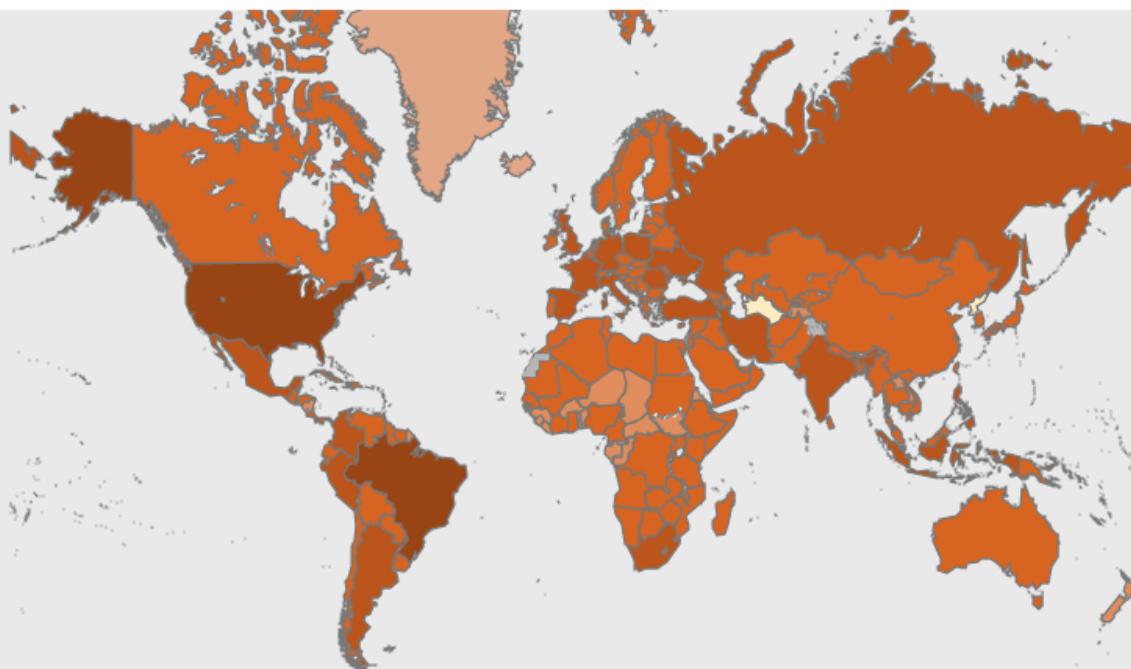
American Journal of
Health Education,
2000, 31(2), 81-89



WHO Coronavirus (COVID-19) Dashboard

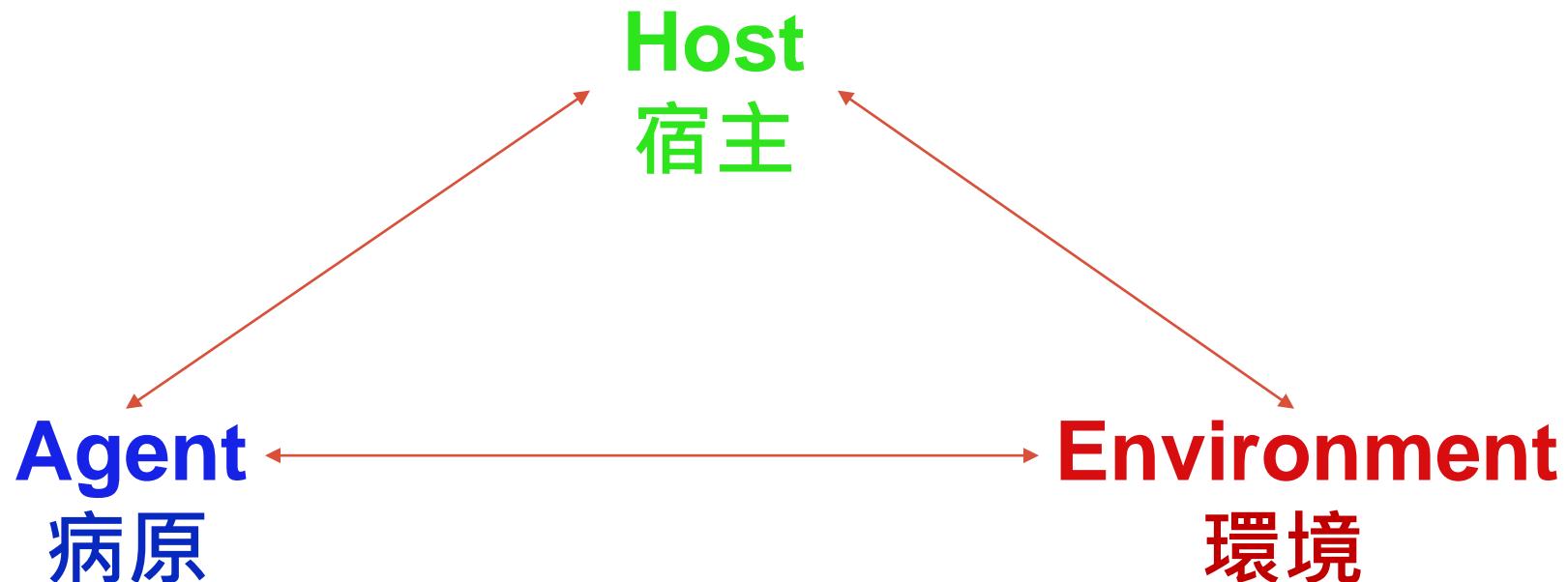
[Overview](#)[Measures](#)[Data Table](#)[Explore](#)

Deaths	▼
Total	▼
7,605	new deaths
5,411,759	cumulative deaths
281,808,270	cumulative cases

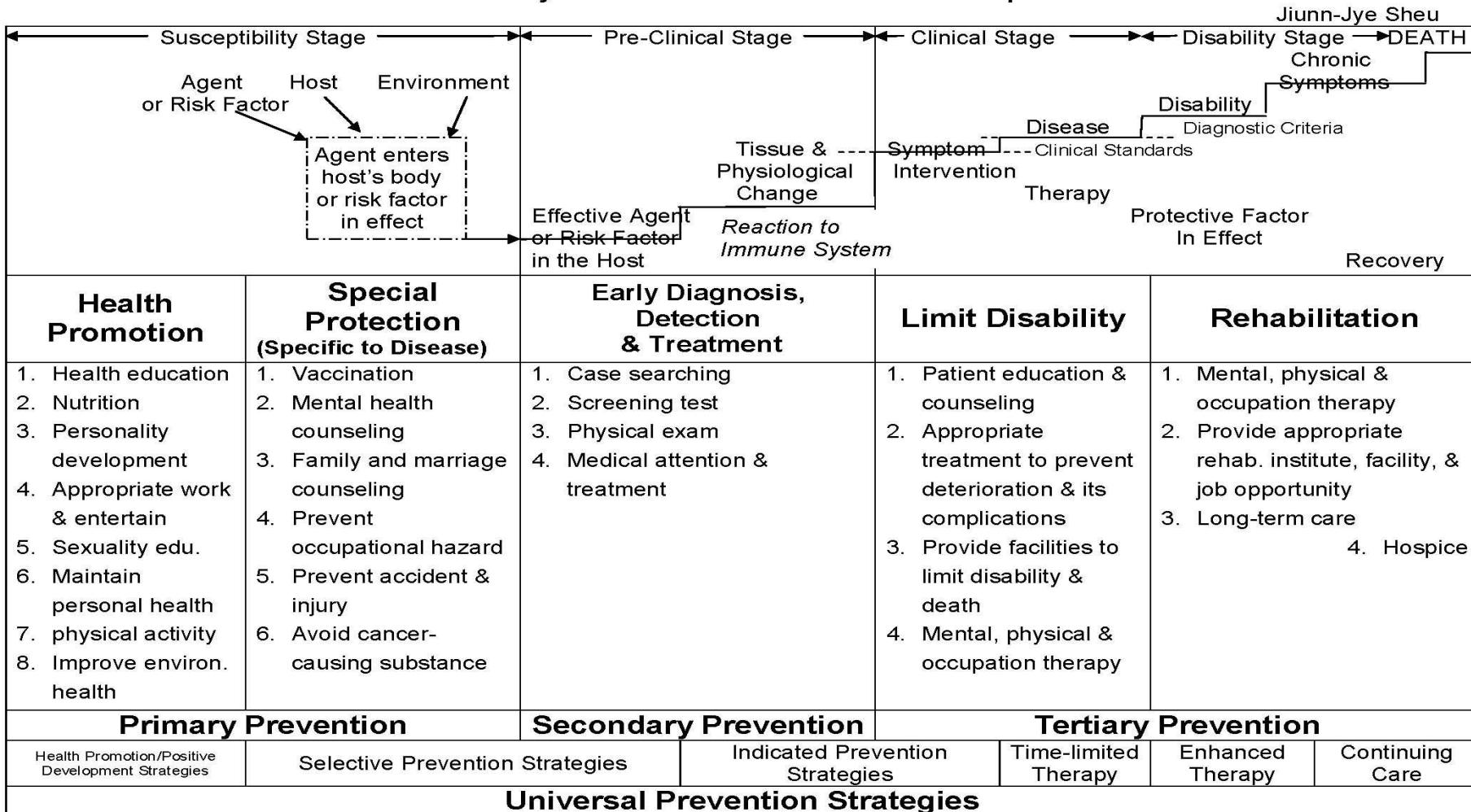


Globally, as of 4:14pm CET, 29 December 2021, there have been **281,808,270 confirmed cases** of COVID-19, **5,411,759 deaths**, reported to WHO. As of 28 December 2021, a total of **8,687,201,202 vaccine doses** have been administered.

Epidemiologic Triangular Model



Natural History Model of Diseases & Prevention Spectrum



The Triangle in Action: COVID-19

Agent

- SARS-CoV-2

Host

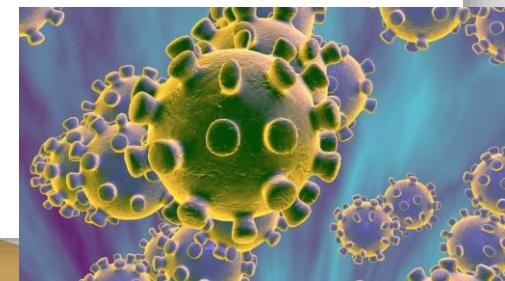
- Humans and some animals (bats, cats)
- Mainly respiratory droplets
- Highest risk= older persons, immunocompromised, people with preexisting health conditions

Environment

- Overcrowding, poor sanitation, lack of water for hand-washing

COVID-19 (Coronavirus Disease-2019)

- 病毒學名為SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2)，冠狀病毒科β屬
- 屬冠狀病毒科，分 α , β , γ , 與 δ 四個屬
- 單股RNA病毒，基因序列與蝙蝠冠狀病毒八成相似
- 會引起人類和脊椎動物的疾病，屬人畜共通傳染病
- 宿主可能有蝙蝠、豬、牛、火雞、貓、狗等
- 潛伏期為1至14天（多數為5至6天）



臨床表現

- 包含發燒、乾咳、倦怠，約三分之一會有呼吸急促
- 其他症狀包括肌肉痛、頭痛、喉嚨痛、腹瀉等
- 部分出現嗅覺或味覺喪失（或異常）
- 患者多數能康復，少數嚴重患者進展至嚴重肺炎、呼吸道窘迫症候群或多重器官衰竭、休克、死亡等

疾病名稱	嚴重急性呼吸道症候群 (SARS)	中東呼吸症候群冠狀病毒感染症 (MERS)	嚴重特殊傳染性肺炎 (COVID-19)
致病源 (病毒)	SARS-CoV (β -CoV)	MERS-CoV (β -CoV)	SARS-CoV-2 (β -CoV)
傳染方式	近距離飛沫、接觸 (直接或間接)	近距離飛沫、接觸 (直接或間接) 、 動物接觸傳染或飲用駱駝奶	傳染方式可能為近距離飛沫、接觸 (直接或間接) 、動物接觸傳染 (待釐清)
潛伏期	2至7天 (最長10天)	2至14天	約2至14天
可傳染期	發病前不具傳染力 發病後10天內	無法明確知道天數， 若病人體液或分泌物可分離出病毒，則仍具傳染力	未知
動物宿主	果子狸、蝙蝠、麝香貓等	駱駝等	未知
主要流行地區	中國大陸東南地區	中東地區	全球擴散
臨床症狀	發燒、咳嗽、可能伴隨頭痛、倦怠及腸胃道症狀等，可併發呼吸困難或急促		發燒、乾咳、肌肉痠痛或四肢乏力等，少數患者隨病程進展出現呼吸困難
致死率	約9.5%	約36%	約2.6%

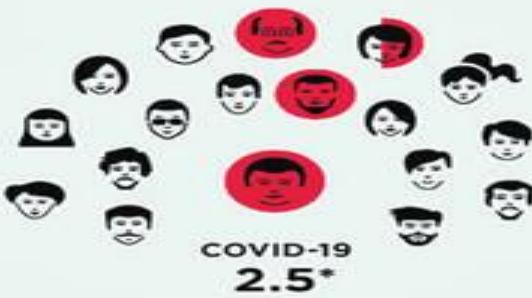
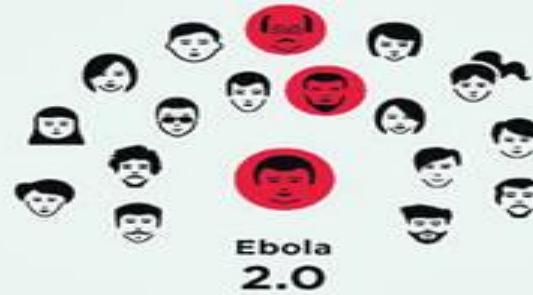
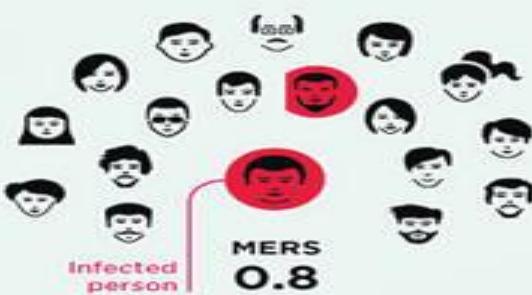
致死率 Case Fatality Rate

一定時期內某種疾病確診病例中死亡者所占的比例

Rabies	Viral	~100%
AIDS/HIV infection	Viral	99%
Tetanus, Generalized	Bacterial	50%
Hantavirus infection	Viral	36%
Dengue haemorrhagic fever (DHF)	Viral	26%
Typhoid fever	Bacterial	[10–20]%
Severe acute respiratory syndrome (SARS)	Viral	11%
Pertussis (whooping cough), infants in developing countries	Bacterial	~3.7%
Measles (rubeola), in developing countries	Viral	~[1–3]%
Coronavirus disease 2019 (COVID-19)	Viral	~1.61%
Seasonal Influenza, Worldwide	Viral	< 0.1–0.5%
Malaria	Parasitic	~0.3%

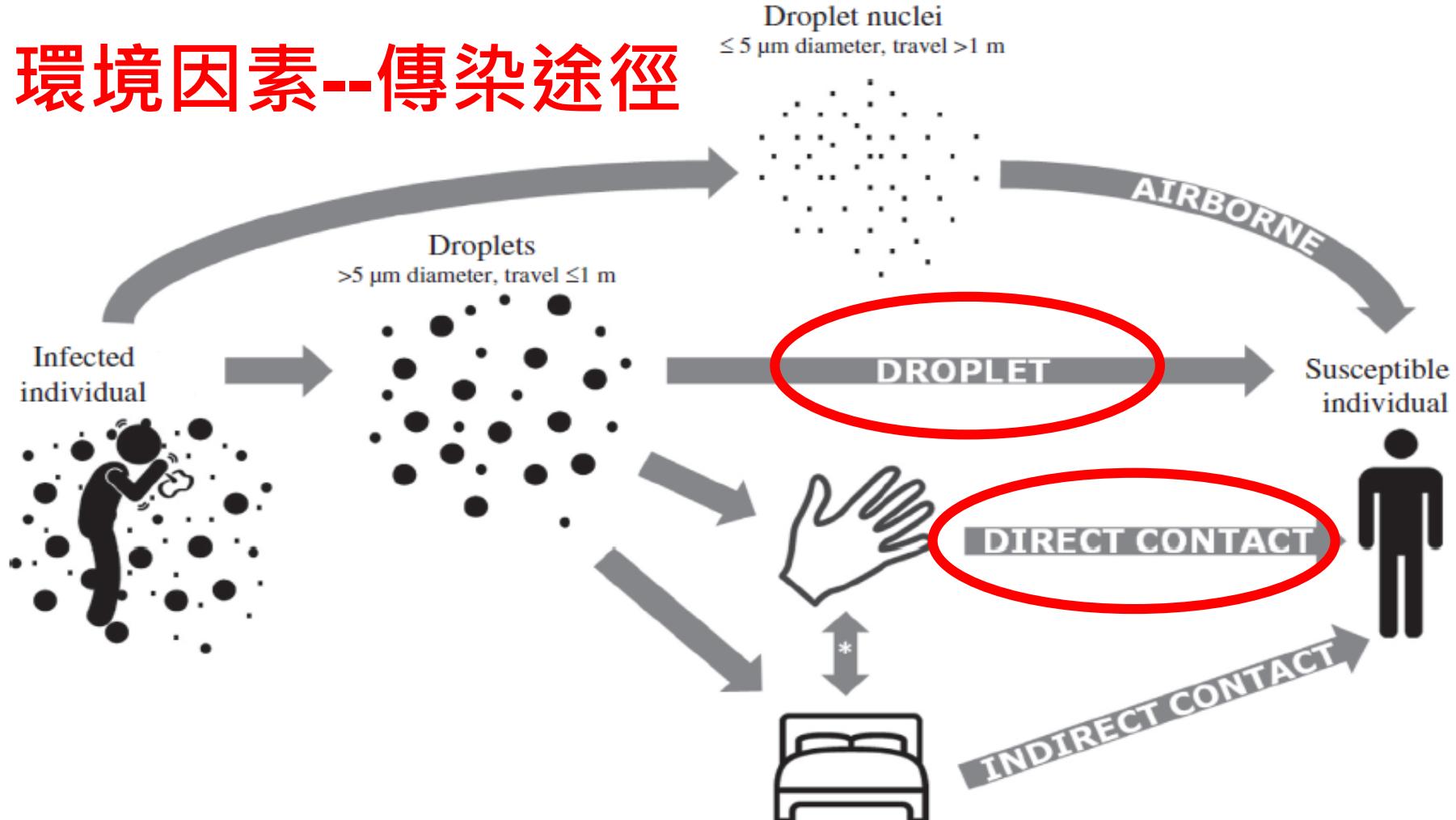
RO (basic reproduction number) of diseases

A measure of how many people each sick person will infect on average



*This number may change as we learn more about this new disease

環境因素--傳染途徑



環境控制與監測

- 為什麼MERS R₀ 小於1?
- 負壓病房
- 車廂 機艙 郵輪 旅館 室內空間中央空調
- 空氣濾網監測
- 廢水監測
- <https://www.13abc.com/2020/09/29/oregon-pop-up-covid-testing-site/>

宿主危險因子

- 65歲及更長
- 長期照護機構或護理之家住民
- 有以下疾病
 - 慢性肺部疾病/氣喘
 - 嚴重心臟疾病
 - 免疫抑制
 - 極度肥胖
 - 糖尿病
 - 嚴重腎臟疾病
 - 肝臟疾病

宿主因素

- 65歲以上成人佔：
 - 所有被感染者的31%
 - 所有住院者的45%
 - 所有加護病房住院者的53%
 - **死亡病例的80%**
- 年齡別致死率：
 - >85: 10-27%
 - **65-84: 3-11%**
 - 55-64: 1-3%
 - 20-54: <1%

死亡個案多具有潛在病史，如糖尿病、慢性肝病、腎功能不全、心血管疾病等

疾病控制方法

- 群體免疫(herd immunity): ??%
- 邊境管制
- 檢疫與隔離
- 盡早發現案例再加以治療
- 個人衛生：
 - 戴口罩
 - 量體溫
 - 勤洗手
 - 保持社交距離
 - 避免人群聚集空氣不流通的密閉空間

該不該讓它自然流行以形成群體免疫？

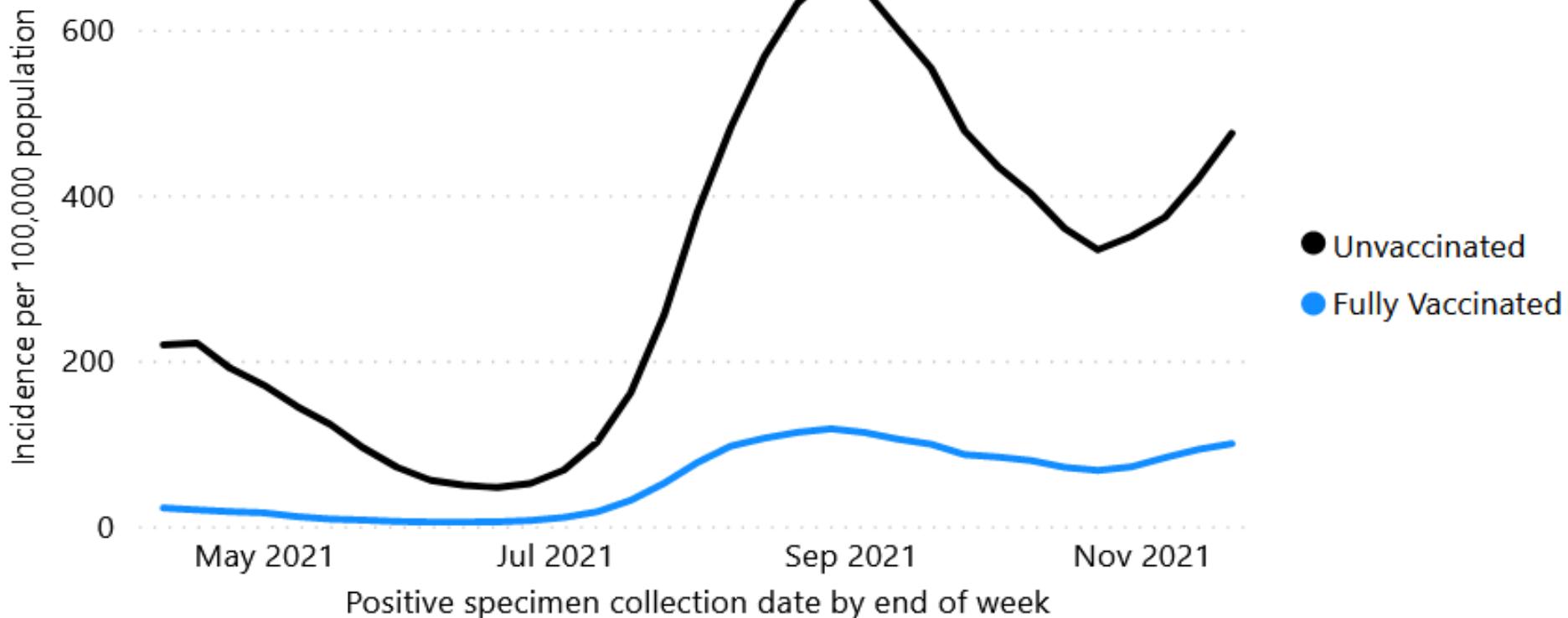
PCR 聚合酶連鎖反應

- 新冠病毒的基因體是RNA，先反轉錄為DNA
- 用聚合酶反覆催化DNA複製，連鎖放大下去，直到聚合酶或反應物質不夠為止
- 10次PCR循環就可以放大 1024 (2^{10}) 倍，等比級數的放大
- 讓樣本中原本難以測得的微量DNA，放大到可以偵測到螢光
- 如果Ct值是30，代表病毒的核酸放大了 10 億 (2^{30}) 倍
- <https://www.youtube.com/watch?v=Di7BX7LtdZs>

Rates of COVID-19 Cases by Vaccination Status

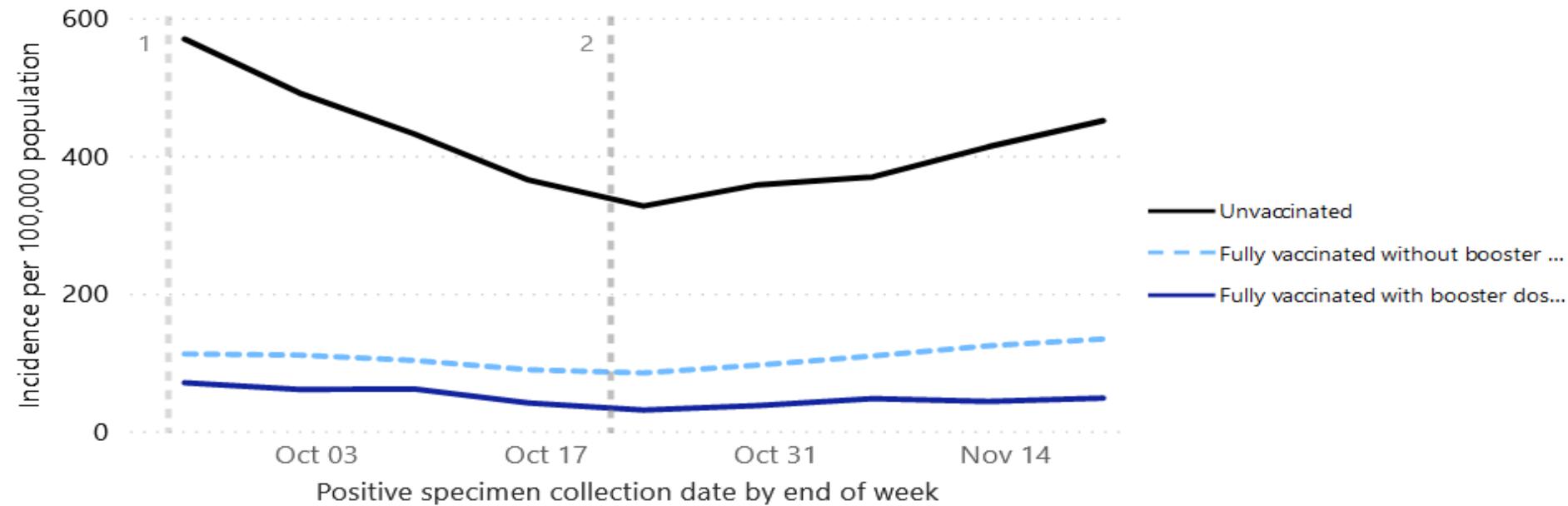
April 04 - November 20, 2021 (27 U.S. jurisdictions)

疫苗對群體的效益



Rates of COVID-19 Cases by Vaccination Status and Booster Dose*

September 19 - November 20, 2021 (17 U.S. jurisdictions)



In October, unvaccinated persons had:

10X

Risk of Testing Positive for COVID-19

AND

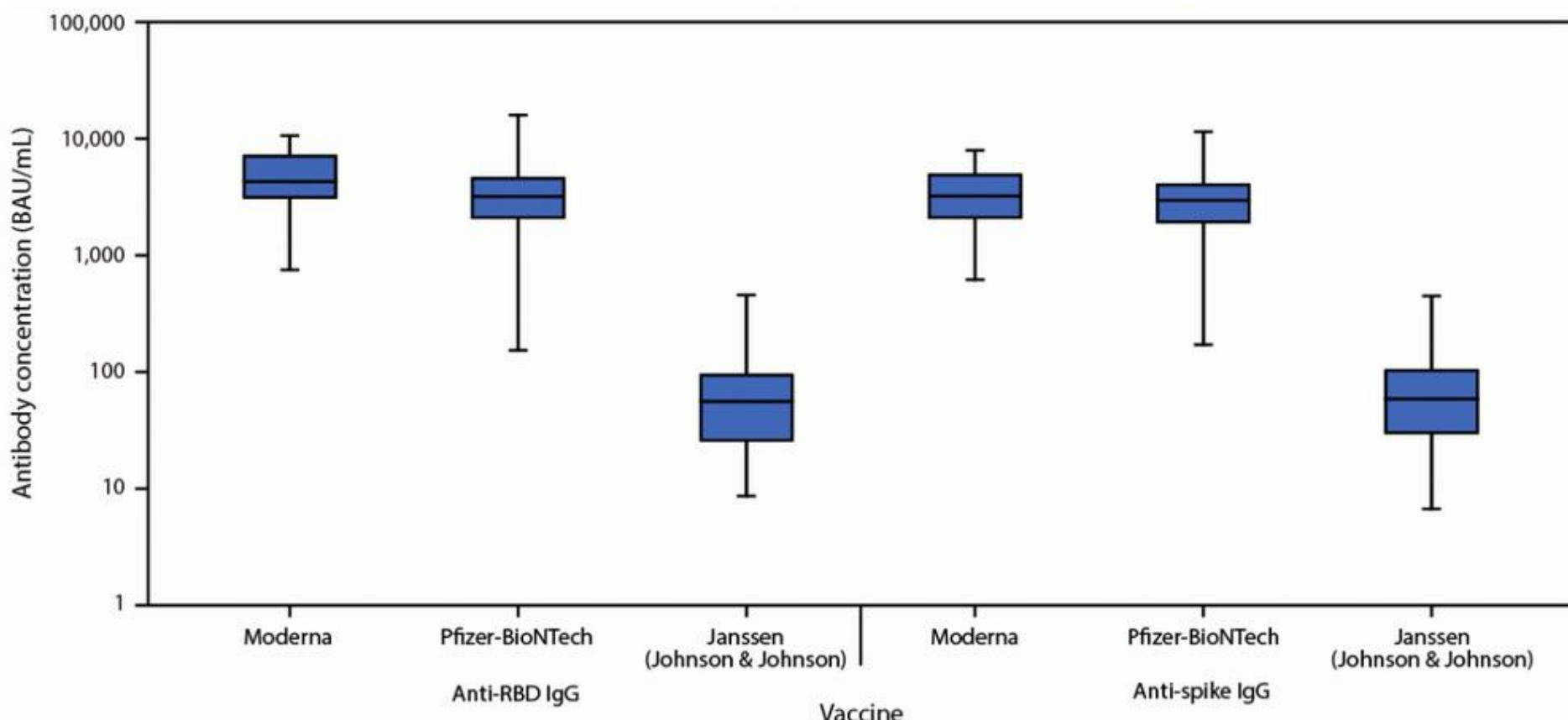
20X

Risk of Dying from COVID-19

疫苗效力

Vaccine/Period		Vaccinated patients/Total patients (%)	VE against COVID-19 hospitalization (95% CI)
	Case-patients	Control-patients	
Moderna VE after full vaccination			
Full surveillance period [§]	54/1,517 (3.6)	422/1,321 (31.9)	93 (91–95)
14–120 days after full vaccination	36/1,499 (2.4)	345/1,244 (27.7)	93 (90–95)
>120 days after full vaccination	18/1,481 (1.2)	77/976 (7.9)	92 (87–96)
Pfizer-BioNTech VE after full vaccination			
Full surveillance period	128/1,591 (8.0)	610/1,509 (40.4)	88 (85–91)
14–120 days after full vaccination	65/1,528 (4.3)	495/1,394 (35.5)	91 (88–93)
>120 days after full vaccination	63/1,526 (4.1)	115/1,014 (11.3)	77 (67–84)
Janssen (Johnson & Johnson) VE after full vaccination			
Full surveillance period	37/1,500 (2.5)	76/975 (7.8)	71 (56–81)
>28 days after full vaccination	33/1,496 (2.2)	59/958 (6.2)	68 (49–80)

FIGURE. Serum anti–receptor binding domain and anti–spike immunoglobulin G levels 2–6 weeks after full vaccination among healthy adult volunteers — three hospitals in three U.S. states,*† April–June 2021



Abbreviations: BAU = binding antibody units; IgG = immunoglobulin G; IQR = interquartile range; RBD = receptor binding domain.

單株抗體

具以下任一風險因子，未使用氧气且於發病七天內之成人病患：

- (1)年齡 ≥ 65 歲
- (2)年齡 ≥ 55 歲 且有下列任一情形：糖尿病、慢性腎病、心血管疾病(含高血壓)、慢性肺疾、 $BMI \geq 30$ ，或其他影響免疫功能之疾病
- (3)懷孕

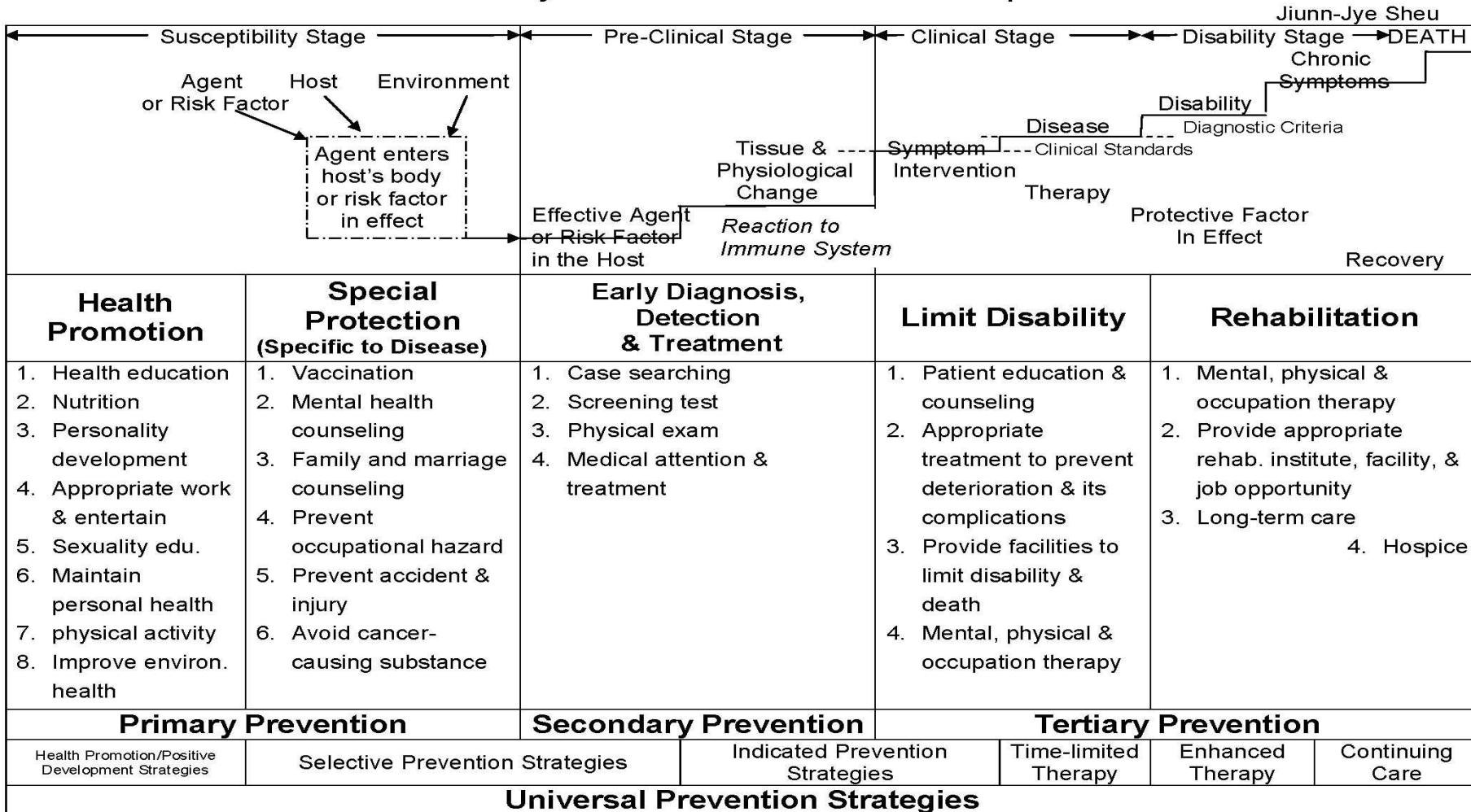
中和性抗體 (noun. Neutralizing Antibody)

指能使病毒失去感染性、對細胞有保護力的抗體。

因為病毒主要是靠刺突蛋白上的受體結合域 (RBD) 與人體細胞受器 (ACE2) 結合，才能入侵細胞進行破壞。中和性抗體可以與新冠病毒刺突蛋白上的RBD結合，阻止病毒進入細胞，避免感染。



Natural History Model of Diseases & Prevention Spectrum



Questions? Comments?

