

COVID-19とSARS-CoV-2 (動物由来ウイルス感染症)

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2021年7月17日

SARS



本日の講演内容

- SARS
- MERS
- COVID-19

新規ウイルス感染症 SARS流行の発見

- 2002年11月：中国南部（広東省）の奇病（肺炎）
- 2003年2月：ベトナムハノイにおける呼吸器感染症様疾患の院内流行（French Hospital）
- 2003年3月：Severe Acute Respiratory Syndrome (SARS, 重症急性呼吸器症候群) の命名（WHO）
- 2003年5月：SARSに関する論文発表（N Engl J Med）

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MAY 15, 2003 VOL. 348 NO. 20

A Novel Coronavirus Associated with Severe Acute Respiratory Syndrome

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Global spread of SARS

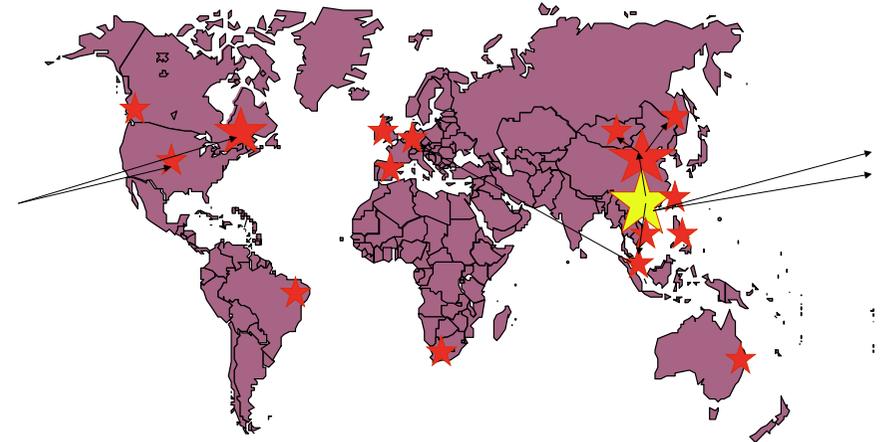
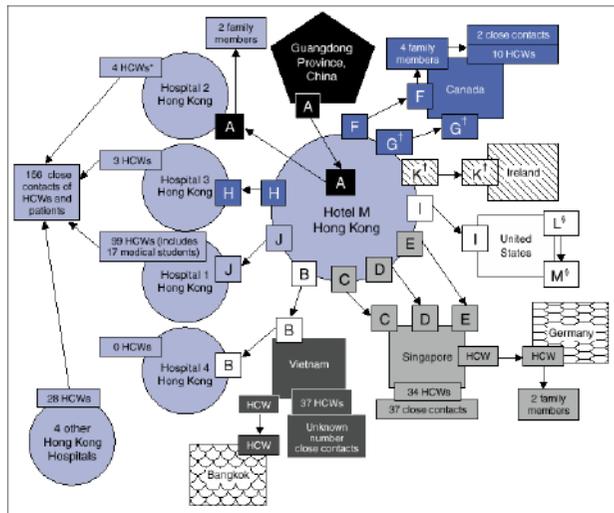
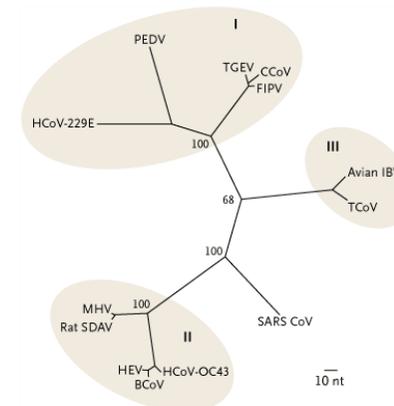


FIGURE 1. Chain of transmission among guests at Hotel M — Hong Kong, 2003

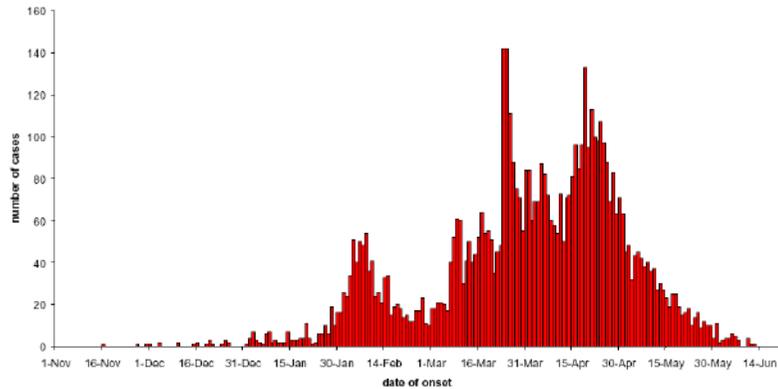


*Health care workers.
 †All guests except G and K stayed on the 9th floor of the hotel. Guest G stayed on the 14th floor, and Guest K stayed on the 11th floor.
 ‡Guests L and M (spouses) were not at Hotel M during the same time as index Guest A but were at the hotel during the same times as Guests G, H, and I, who were ill during this period.

Figure 3. Estimated Maximum-Parsimony Tree Based on the Sequence Alignment of 405 Nucleotides of the Coronavirus Polymerase Gene Open Reading Frame 1b (Nucleotide Numbers 15173 to 15578 Based on Bovine Coronavirus Complete Genome Accession Number NC_003045) Comparing SARS Coronavirus with Other Human and Animal Coronaviruses.

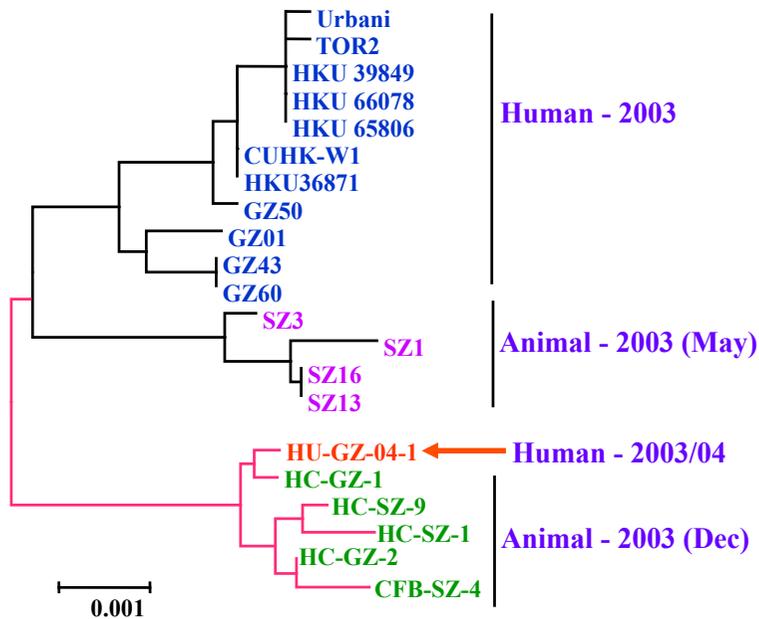


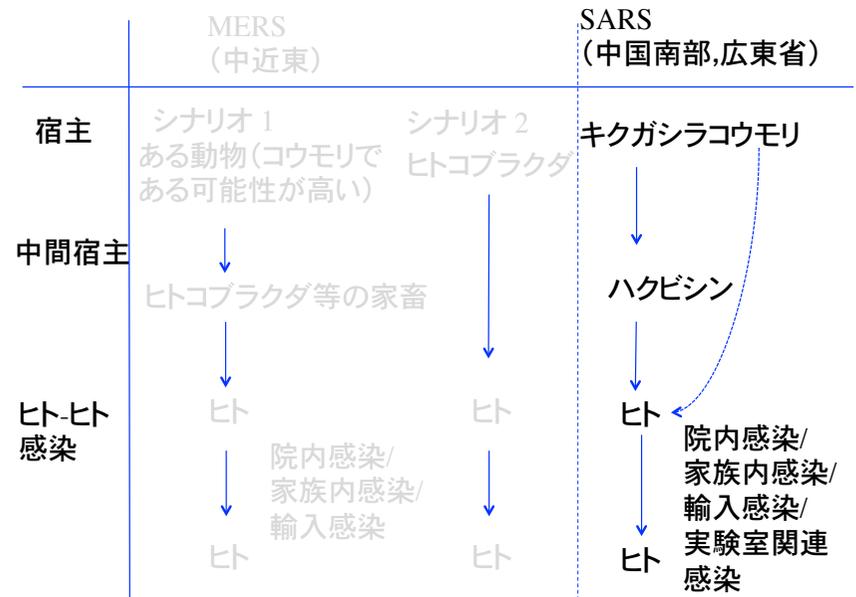
Probable cases of SARS by date of onset (n=5,923*)
Worldwide, 1 November 2002 - 16 June 2003



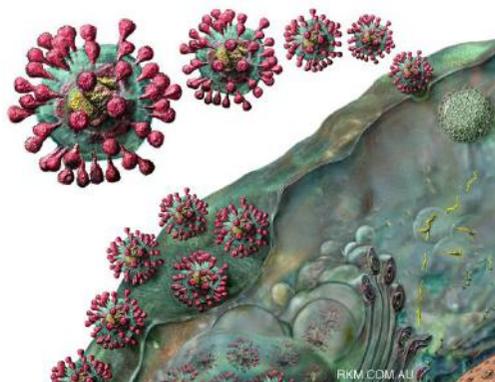
SARS-outbreak identified after the last SARS-outbreak in 2002/2003

- September 2003: Laboratory-associated SARS-outbreak in Singapore (1)
- December 2003: Laboratory-associated SARS-outbreak in Taiwan (1)
- December 2003-January 2004: SARS-outbreak in Guangdong province, China (4)
- April 2004: Laboratory-associated outbreak in Beijing and Anhui province (9 patients, 1 died)





Middle East respiratory syndrome 中東呼吸器症候群



MERS

- ◆ Zaki AM, van Boheemen S, Bestebroer TM, Osterhaus ADME, Fouchier RA. Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. *N Engl J Med* 367:1814-1820, 2012.
- ◆ Drosten, C, et al. Clinical features and virological analysis of a case of Middle East respiratory syndrome coronavirus infection. *Lancet Infect Dis* 13:745, 2013

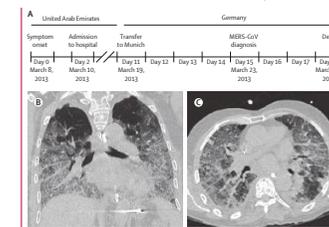
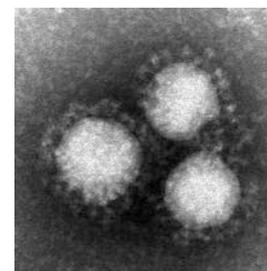


Figure 2. Disease and treatment. (A) Chronology. Frontal (B) and horizontal (C) CT scans done on day 12 of disease, showing intense basally-pronounced congestions indicative of atypical pneumonia and acute respiratory distress syndrome. MERS-CoV=Middle East respiratory syndrome coronavirus.

MERSの特徴(1)

高い致死率

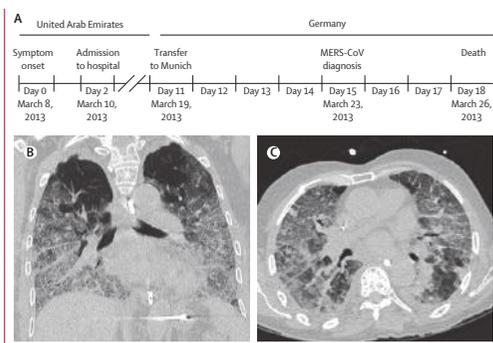


Figure 1. Disease and treatment. (A) Chronology. Frontal (B) and horizontal (C) CT scans done on day 12 of disease, showing intense basally-pronounced congestions indicative of atypical pneumonia and acute respiratory distress syndrome. MERS-CoV=Middle East respiratory syndrome coronavirus.

Drosten, C, et al. Clinical features and virological analysis of a case of Middle East respiratory syndrome coronavirus infection. *Lancet Infect Dis* 13:745, 2013

MERSの特徴(2): 院内感染

Super spreaderの存在

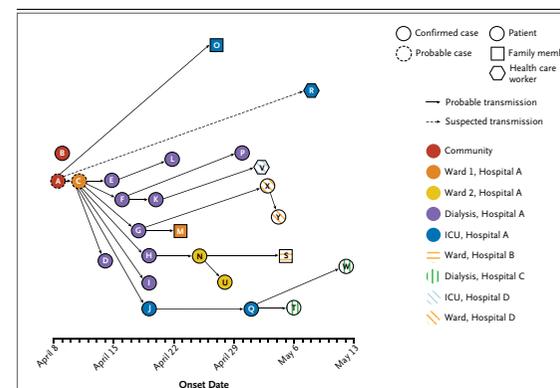
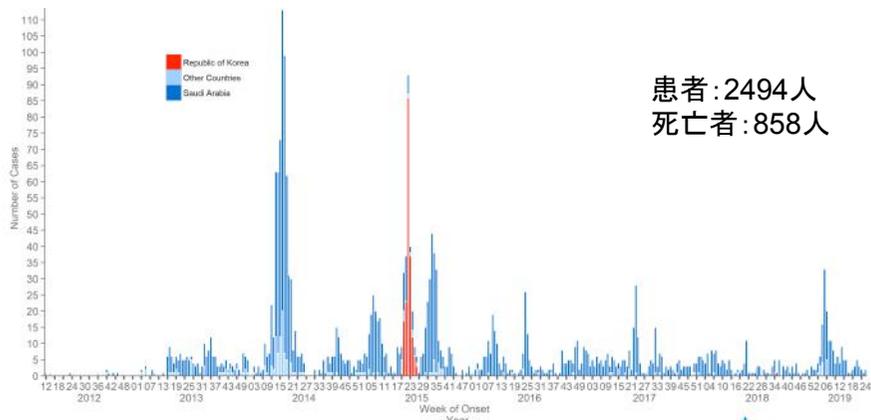


Figure 2. Transmission Map of Outbreak of MERS-CoV Infection. All confirmed cases and the two probable cases linked to transmission events are shown. Putative transmissions are indicated, as well as the date of onset of illness and the settings. The letters within the symbols are the patient identifiers (see Fig. S2 in the Supplementary Appendix).

Assiri, A. et al. Hospital Outbreak of Middle East Respiratory Syndrome Coronavirus. *NEJM* 369:407, 2013

MERS November 2019



患者: 2494人
死亡者: 858人

Other countries: Algeria, Austria, Bahrain, China, Egypt, France, Germany, Greece, Iran, Italy, Jordan, Kuwait, Lebanon, Malaysia, Netherlands, Oman, Philippines, Qatar, Thailand, Tunisia, Turkey, United Arab Emirates, United Kingdom, United States of America, Yemen
Please note that the underlying data is subject to change as the investigations around cases are ongoing. Onset date estimated if not available.



<https://www.who.int/emergencies/mers-cov/MERS-epicurve-July-2019.png?ua=1>
WHO: 11 Oct, 2020 access

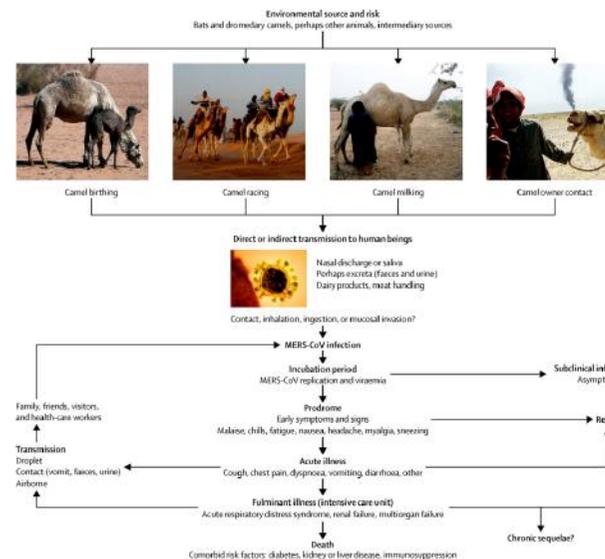
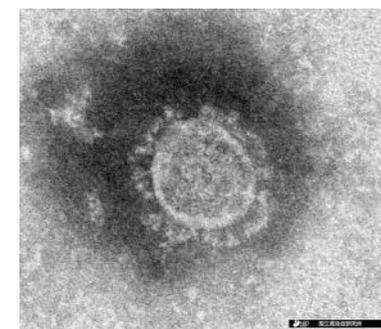


Figure 3 Ecology and transmission of MERS-CoV MERS-CoV might have originally spread from bats to camels and other, as yet unidentified, intermediate hosts. The virus has circulated in camel populations in Africa and the Arabian peninsula for at least 20 y...
The Lancet, 2015, [http://dx.doi.org/10.1016/S0140-6736\(15\)60454-8](http://dx.doi.org/10.1016/S0140-6736(15)60454-8)

	MERS (中近東)	SARS (中国南部, 広東省)
宿主	シナリオ 1 ある動物(コウモリで ある可能性が高い)	シナリオ 2 ヒトコブラクダ
中間宿主	ヒトコブラクダ等の家畜	キクガシラコウモリ ↓ ハクビシン
ヒト-ヒト 感染	ヒト ↓ 院内感染/ 家族内感染/ 輸入感染 ↓ ヒト	ヒト ↓ 院内感染/ 家族内感染/ 輸入感染/ 実験室関連 感染 ↓ ヒト

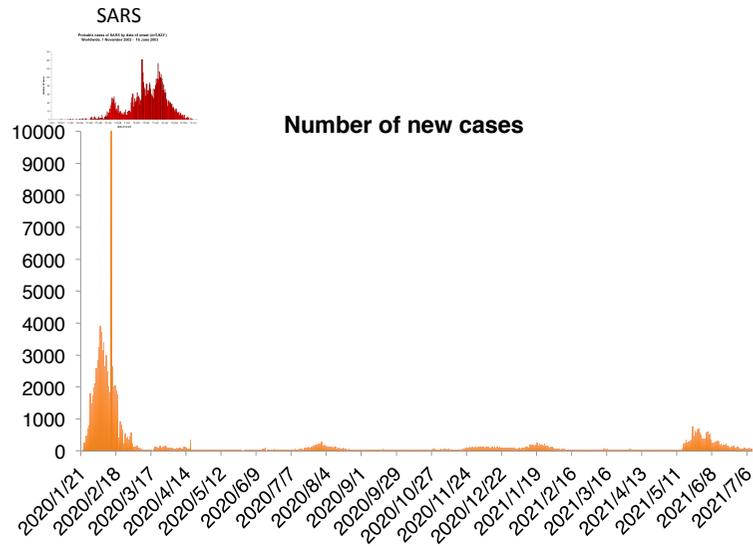
COVID-19

- 新規コロナウイルス
- 中国・湖北省が源
- 動物由来コロナウイルス (SARS-CoV) に性質が類似
- ヒト-ヒト感染
- 世界的流行

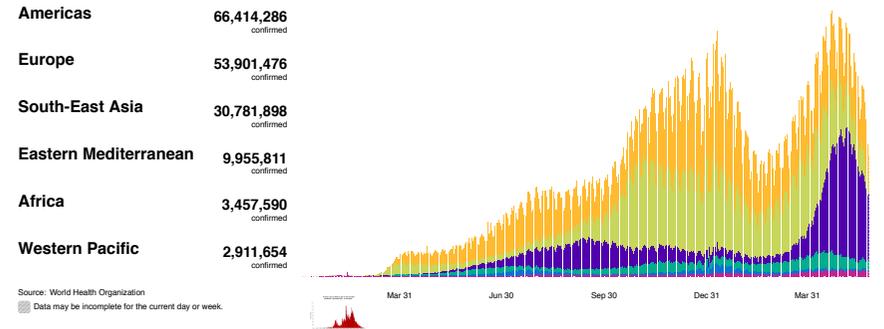


SARS-coronavirus-2 (SARS-CoV-2)

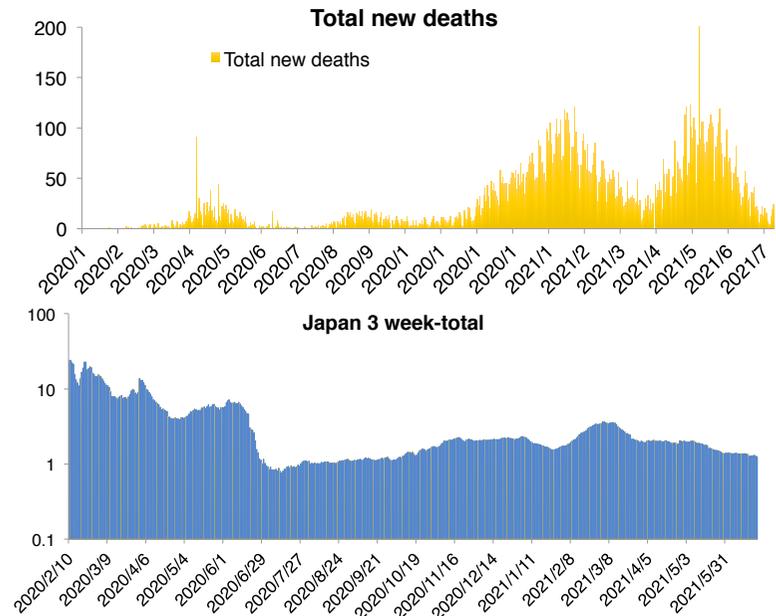
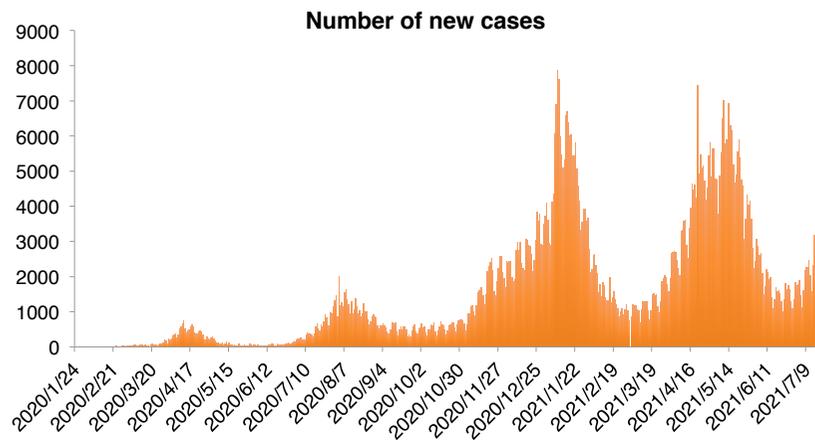
SARSとCOVID-19



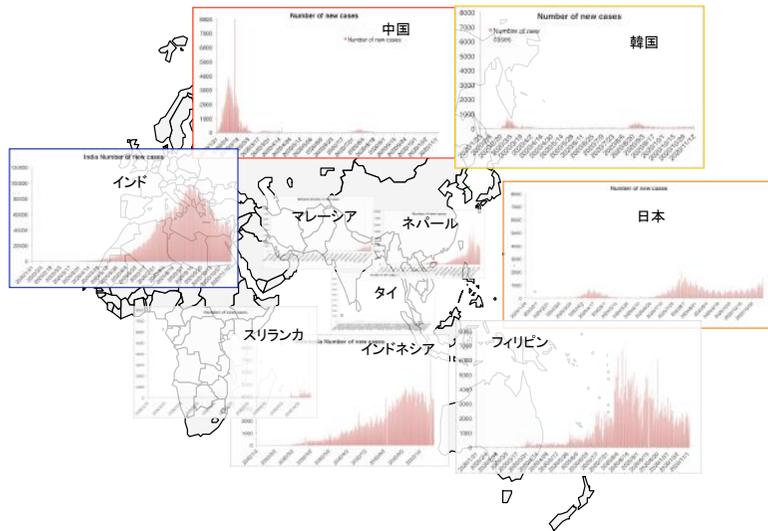
世界での流行状況 (WHO, 2021.6.20)



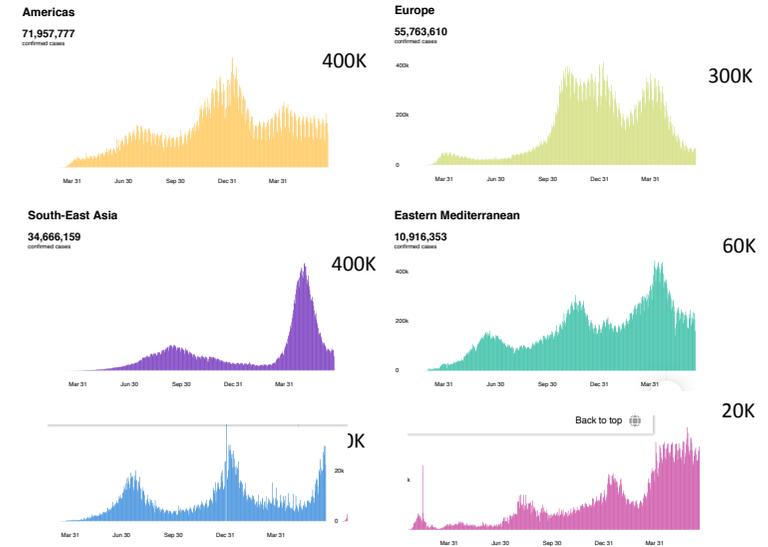
日本におけるCOVID-19流行と致命率の推移



アジアでのCOVID-19流行状況



世界各地域でのCOVID-19流行



COVID-19, SARS-CoV-2伝播性

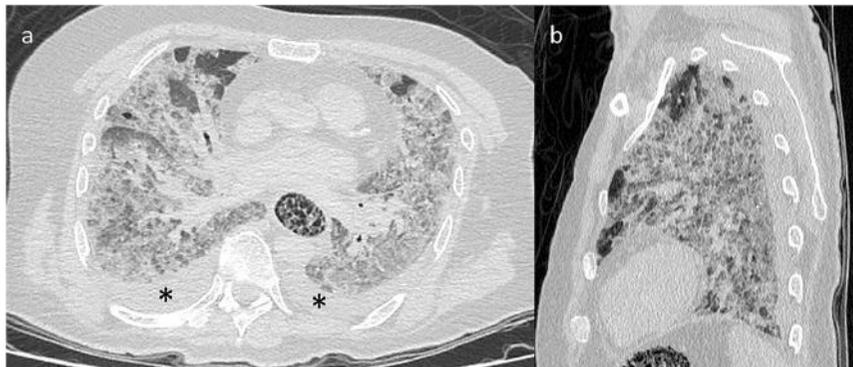
COVID-19ワクチン開発

- 組換えウイルスCOVID-19ワクチン
 - ◆ Chimpanzee Adenovirus vector
 - ◆ VSV vector
 - ◆ 痘瘡ワクチンベクター
 - ◆ 他
- Messenger RNAワクチン
- 成分ワクチン
- DNAワクチン
- 不活化ワクチン
- 生ワクチン

ワクチンとCOVID-19

- COVID-19は単なる呼吸器感染症ではなく、全身感染症：ワクチンにより抗SARS-CoV-2免疫（中和抗体，細胞性免疫）を誘導できれば**発症予防，軽症化の効果**は期待される。
- 感染予防（感染しない）効果は期待できない（COVID-19ワクチンに限らず，あらゆるワクチンの特徴）。
- ただし，ワクチン接種者が感染源になるリスクは低減される。
- 広くワクチン接種が行われれば，根絶も可能（国際連携）

A 75-year-old man was admitted to a COVID-19 testing unit in a French regional hospital early in the pandemic.



MERS,SARS,COVID-19の特徴の比較

	MERS	SARS	COVID-19
流行地	中近東	中国(南部)	中国湖北省(中国中央部)
確認された流行期間	2012年から現在	2002年末から2004年(1月)	2019年12月から現在
病原体	MERS-CoV	SARS-CoV-1	SARS-CoV-2
宿主	ヒトコブラクダ	キクガシラコウモリ	コウモリ?
中間宿主	なし	ハクビシン	センザンコウ(?)
病態	呼吸不全を伴う全身感染症	呼吸不全を伴う全身感染症	呼吸器不全を伴う全身感染症
致死率	約40%	約10%	2-5%
ヒトからヒトへの伝搬	Direct contact/droplet infection/Super spreaderの存在	Direct contact/droplet infection/Super spreaderの存在	Direct contact/droplet infection/Super spreaderの存在
パンデミックに発展する可能性	なし	なし(実はポテンシャルはある?)	あり

Figure 1

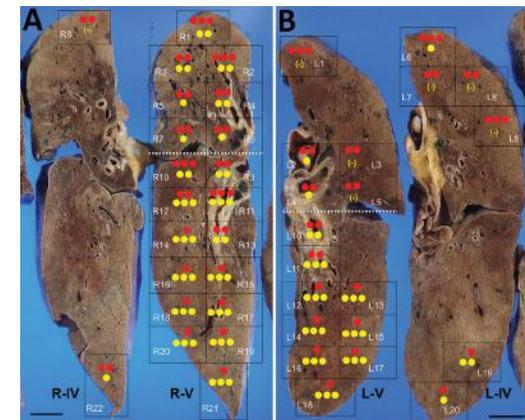


Figure 1. Molecular detection of SARS-CoV-2 and Streptococcus pneumoniae in the lungs of a patient in Japan co-infected with both pathogens. The 42 lung sections were analyzed and the amount of SARS-CoV-2 RNA and S. pneumoniae DNA in each section was evaluated. A) The right lung was cut into 6 (R-I to R-VI); B) the left lung was cut into 7 (L-I to L-VII) coronal slices, from ventral to dorsal. Twenty-two right sections (R1-R22) in R-IV and R-V and 20 left sections (L1-L20) in L-V and L-IV are shown in black boxes. The dotted white line is the boundary between the upper and lower lobes. The SARS-CoV-2 RNA score is indicated by the number of red circles and the S. pneumoniae DNA score is indicated by the number of yellow circles. (-) indicates results under the detection limit. Scale bars indicate 2 cm. SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

Figure 2

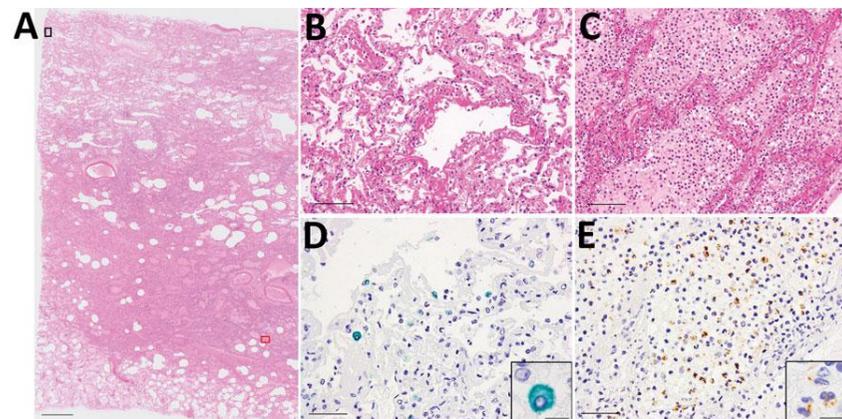


Figure 2. Microscopic findings of the lungs of a patient in Japan co-infected with SARS-CoV-2 and *Streptococcus pneumoniae*. A) Histopathology of lung section R12 (shown in Figure 1). Scale bar indicates 2 mm. B) Magnified image of the black square (top left) in panel A: exudative phase of diffuse alveolar damage (DAD) with hyaline membranes. Scale bar indicates 100 μ m. C) Magnified image of the red square (bottom right) in panel A: edema and bronchopneumonia with massive infiltration of neutrophils in the alveolar spaces. Scale bar indicates 100 μ m. D, E) Magnified images of the same areas of consecutive sections as B and C, respectively, showing SARS-CoV-2 antigen stained green (Vina green) and *S. pneumoniae* antigen stained brown (3,3'-diaminobenzidine) by enzyme-labeled double immunohistochemistry. The SARS-CoV-2 antigens were detected predominantly in the DAD area (D); scale bar indicates 50 μ m). The *S. pneumoniae* antigens were detected predominantly in the bronchopneumonia area (E); scale bar indicates 50 μ m). Insets show magnified images of the staining cells (scale bars indicate 10 μ m).

Tsukamoto T, Nakajima N, Sakurai A, Nakajima M, Sakurai E, Sato Y, et al. Lung Pathology of Mutually Exclusive Co-infection with SARS-CoV-2 and *Streptococcus pneumoniae*. *Emerg Infect Dis.* 2021;27(3):919-923. <https://doi.org/10.3201/eid2703.204024>

患者確認から解除まで

- 検査・検出
- 告知
- 患者調査
- 優先度判定
- 自宅療養・ホテル宿泊療法, 入院調整
- 疫学調査
- ワクチン接種

個々の患者

札幌市でのCOVID-19対策において
働いて理解した問題・課題

医療にアクセスできない患者

- 自宅療養中の患者
- 解除後の患者への無理解（医師・医療機関による）

検査・検出・隔離（3K）を考
える

入院させたくてもできない

COVID-19患者への偏見と差別

「夜の街」という言葉の問題点を考える



まとめ

- COVID-19とSARS
- COVID-19と倫理

疫学調査とCOVID-19流行抑制