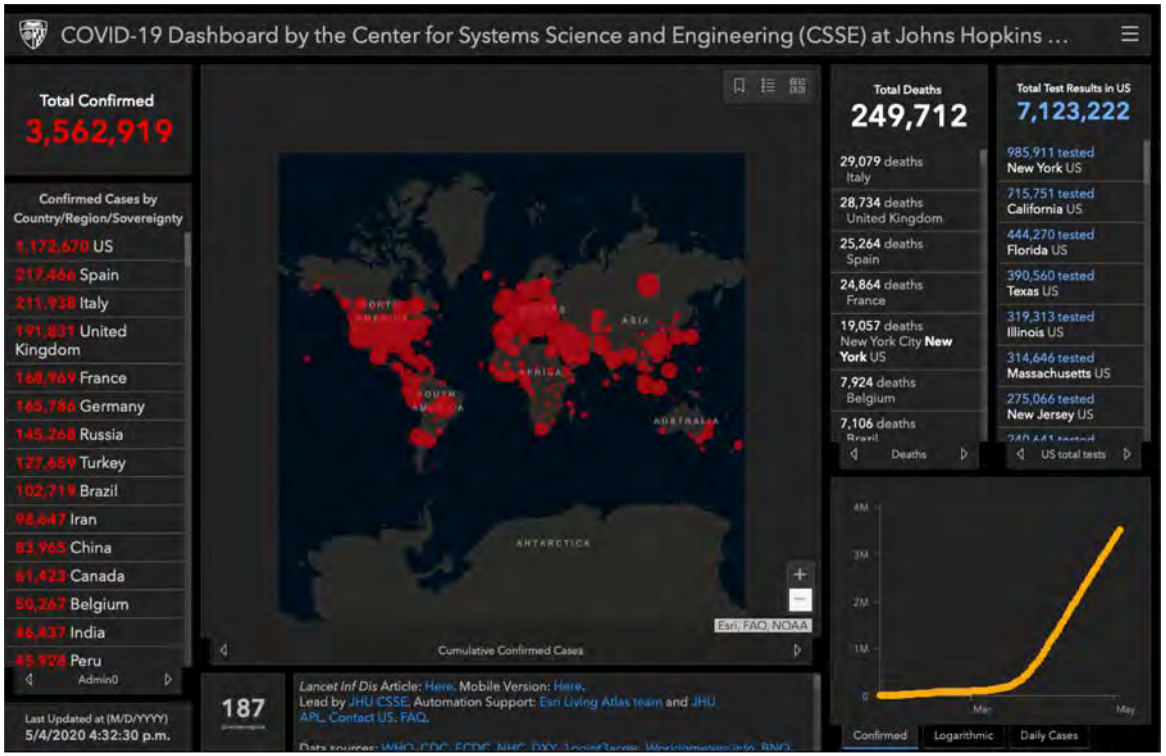
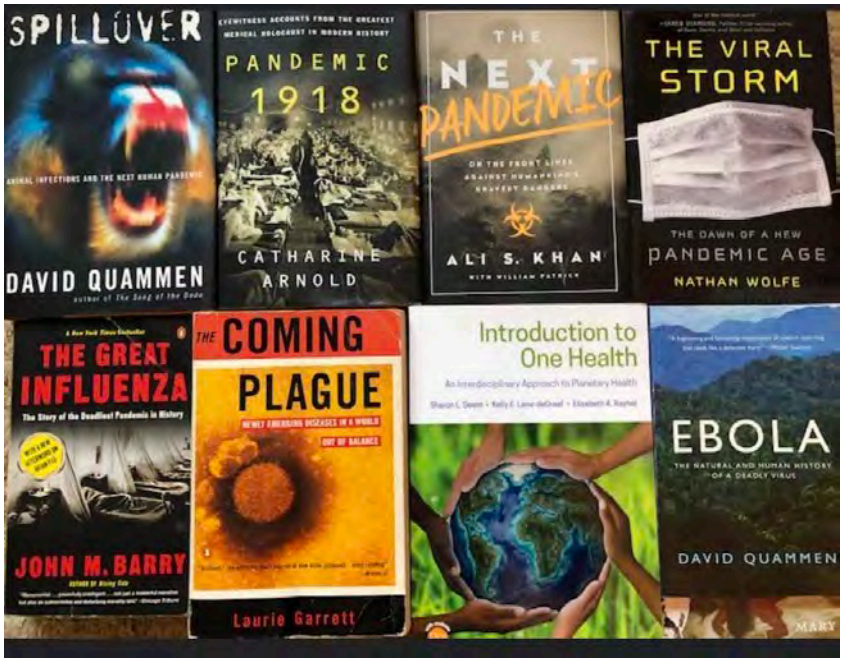
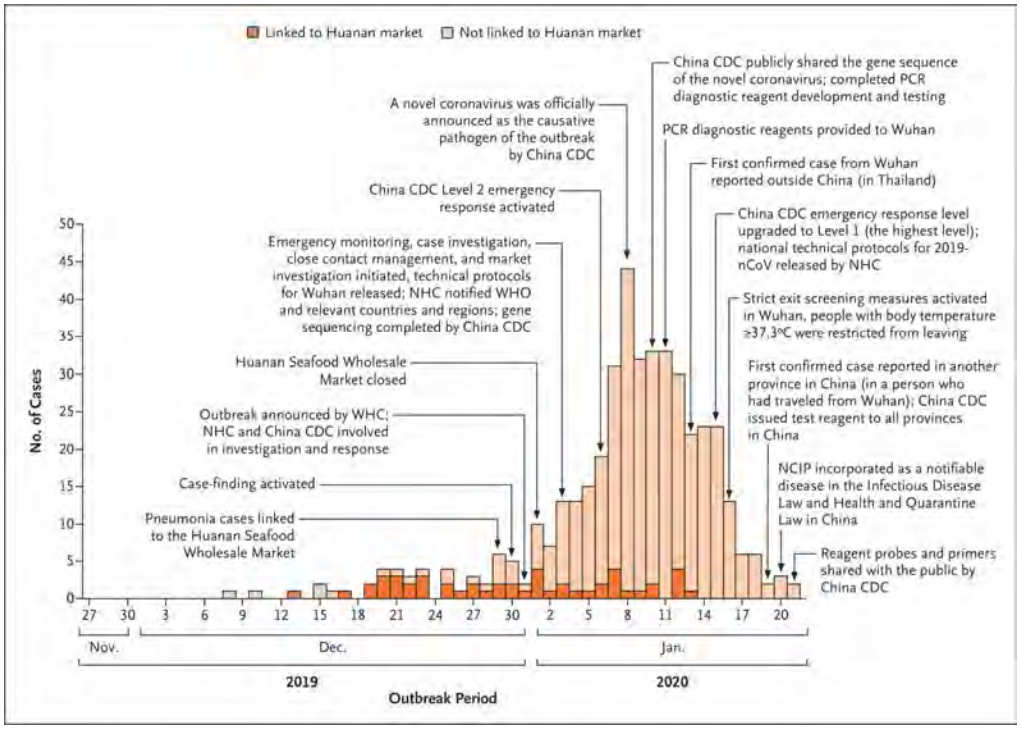
COVID-19 and Beyond - Knowns, Unknowns and Needs

Chris Walzer Wildlife Conservation Society


COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins ...
Total Confirmed
3,562,919
Confirmed Cases by Country/Region/Sovereignty
1,172,670 US
217,466 Spain
211,938 Italy
191,831 United Kingdom
168,969 France
165,786 Germany
145,268 Russia
127,659 Turkey
102,719 Brazil
98,647 Iran
83,965 China
61,423 Canada
50,267 Belgium
46,437 India
45,928 Peru
Admin0
Last Updated at (M/D/YYYY)
5/4/2020 4:32:30 p.m.
Total Deaths
249,712
29,079 deaths Italy
28,734 deaths United Kingdom
25,264 deaths Spain
24,864 deaths France
19,057 deaths New York City New York US
7,924 deaths Belgium
7,106 deaths Brazil
Deaths
Total Test Results in US
7,123,222
985,911 tested New York US
715,751 tested California US
444,270 tested Florida US
390,560 tested Texas US
319,313 tested Illinois US
314,646 tested Massachusetts US
275,066 tested New Jersey US
US total tests
ASIA
AFRICA
AUSTRALIA
ANTARCTICA
Esri, FAO, NOAA
Cumulative Confirmed Cases
187
Lancet Inf Dis Article: Here. Mobile Version: Here.
Lead by JHU CSSE. Automation Support: Esri Living Atlas team and JHU APL. Contact US. FAQ.
4M
3M
2M
1M
0
Mar
May
Confirmed
Logarithmic
Daily Cases


SPILLOVER
DAVID QUAMMEN
PANDEMIC 1918
CATHARINE ARNOLD
THE NEXT PANDEMIC
ALI S. KHAN
THE VIRAL STORM
THE DAWN OF A NEW PANDEMIC AGE
NATHAN WOLFE
THE GREAT INFLUENZA
JOHN M. BARRY
THE COMING PLAGUE
Laurie Garrett
Introduction to One Health
EBOLA
THE NATURAL AND HUMAN HISTORY OF A DEADLY VIRUS
DAVID QUAMMEN

What **do** we know?



Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study

Nanshan Chen*, Min Zhou*, Xuan Dong*, Jieming Qu*, Fengyun Gong, Yang Han, Yang Qiu, Jingli Wang, Ying Liu, Yuan Wei, Jia'an Xia, Ting Yu, Xinxin Zhang, Li Zhang

Summary

Background In December, 2019, a pneumonia associated with the 2019 novel coronavirus (2019-nCoV) emerged in Wuhan, China. We aimed to further clarify the epidemiological and clinical characteristics of 2019-nCoV pneumonia.

Methods In this retrospective, single-centre study, we included all confirmed cases of 2019-nCoV in Wuhan Jinyintan Hospital from Jan 1 to Jan 20, 2020. Cases were confirmed by real-time RT-PCR and were analysed for epidemiological, demographic, clinical, and radiological features and laboratory data. Outcomes were followed up until Jan 25, 2020.

Findings Of the 99 patients with 2019-nCoV pneumonia, 49 (49%) had a history of exposure to the Huanan seafood market. The average age of the patients was 55·5 years (SD 13·1), including 67 men and 32 women. 2019-nCoV was detected in all patients by real-time RT-PCR. 50 (51%) patients had chronic diseases. Patients had clinical manifestations of fever (82 [83%] patients), cough (81 [82%] patients), shortness of breath (31 [31%] patients), muscle ache

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*Contributed equally.

Tuberculosis and Respiratory Department (Prof N Chen MD, X Dong PhD, Y Wei MD, J Xia MD, T Yu MD, Prof L Zhang MD), Infection Disease Department (F Gong MD, J Wang MD), Science and Education Department (Y Han PhD), and

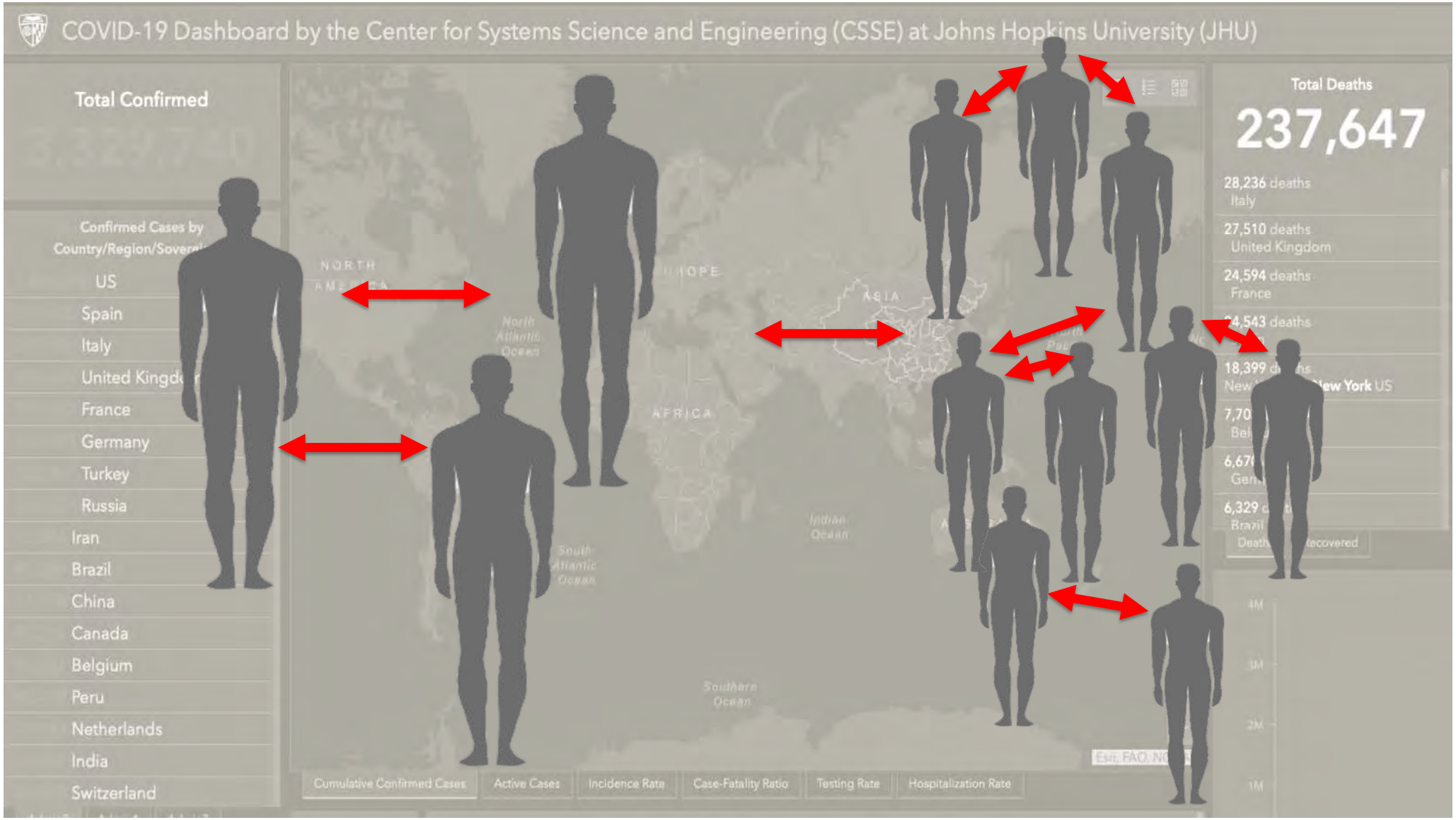
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

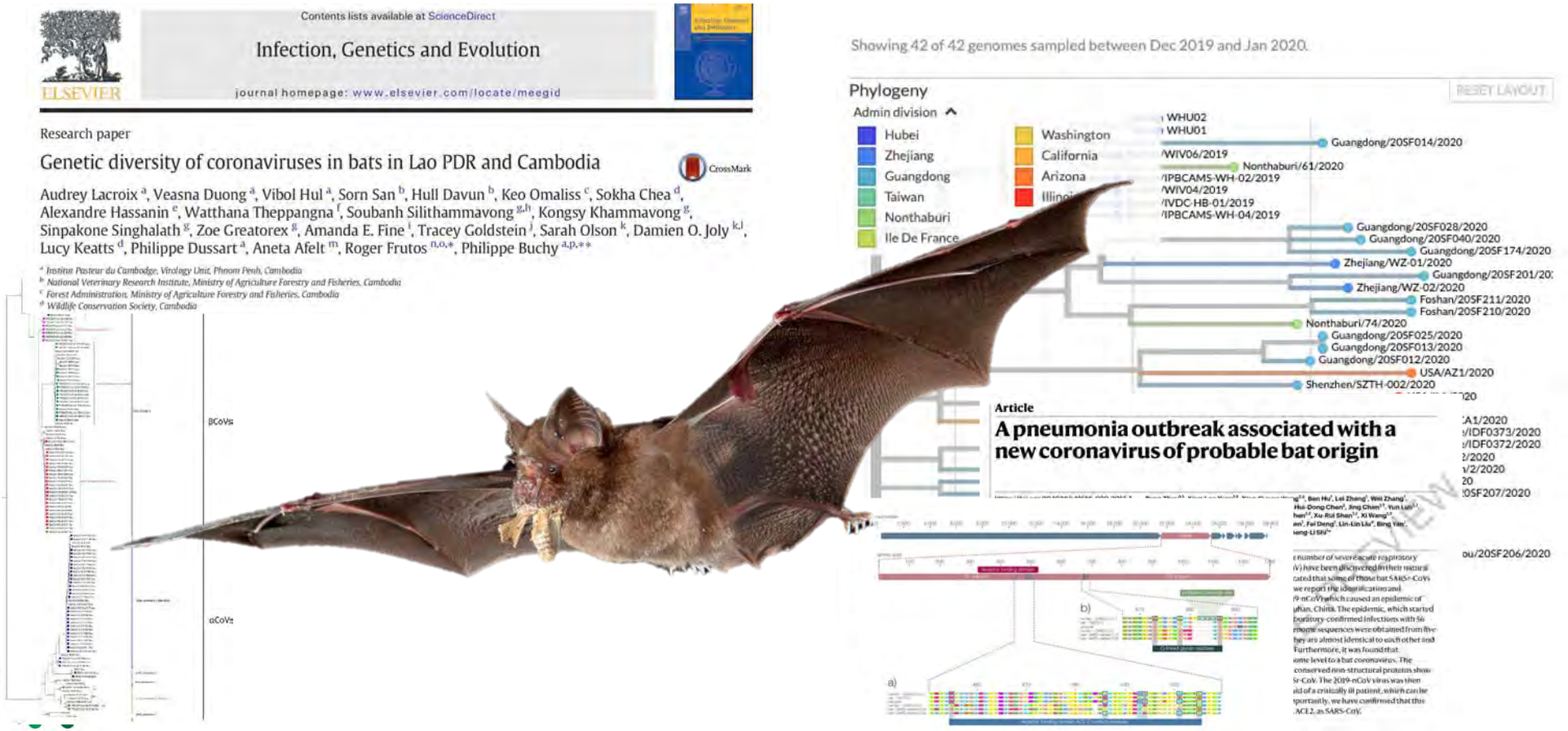
Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia

Qun Li, M.Med., Xuhua Guan, Ph.D., Peng Wu, Ph.D., Xiaoye Wang, M.P.H., Lei Zhou, M.Med., Yeqing Tong, Ph.D., Ruiqi Ren, M.Med., Kathy S.M. Leung, Ph.D., Eric H.Y. Lau, Ph.D., Jessica Y. Wong, Ph.D., Xuesen Xing, Ph.D., Nijuan Xiang, M.Med., Yang Wu, M.Sc., Chao Li, M.P.H., Qi Chen, M.Sc., Dan Li, M.P.H., Tian Liu, B.Med., Jing Zhao, M.Sc., Man Liu, M.Sc., Wenxiao Tu, M.Med., Chuding Chen, M.Sc., Lianmei Jin, M.Med., Rui Yang, M.Med., Qi Wang, M.P.H., Suhua Zhou, M.Med., Rui Wang, M.D., Hui Liu, M.Med., Yingbo Luo, M.Sc., Yuan Liu, M.Med., Ge Shao, B.Med., Huan Li, M.P.H., Zhongfa Tao, M.P.H., Yang Yang, M.Med., Zhiqiang Deng, M.Med., Boxi Liu, M.P.H., Zhitao Ma, M.Med., Yanping Zhang, M.Med., Guoqing Shi, M.P.H., Tommy T.Y. Lam, Ph.D., Joseph T. Wu, Ph.D., George F. Gao, D.Phil., Benjamin J. Cowling, Ph.D., Bo Yang, M.Sc., Gabriel M. Leung, M.D., and Zijian Feng, M.Med.

ABSTRACT


COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)
Total Confirmed
Confirmed Cases by Country/Region/Sovereignty
US
Spain
Italy
United Kingdom
France
Germany
Turkey
Russia
Iran
Brazil
China
Canada
Belgium
Peru
Netherlands
India
Switzerland
NORTH AMERICA
EUROPE
ASIA
AFRICA
North Atlantic Ocean
South Atlantic Ocean
Indian Ocean
Southern Ocean
Total Deaths
237,647
28,236 deaths
Italy
27,510 deaths
United Kingdom
24,594 deaths
France
18,399 deaths
New York US
6,329 deaths
Brazil
Cumulative Confirmed Cases
Active Cases
Incidence Rate
Case-Fatality Ratio
Testing Rate
Hospitalization Rate

What **do** we know?



Contents lists available at ScienceDirect

Infection, Genetics and Evolution

journal homepage: www.elsevier.com/locate/meegid

Research paper

Genetic diversity of coronaviruses in bats in Lao PDR and Cambodia

Audrey Lacroix [a], Veasna Duong [a], Vibol Hul [a], Sorn San [b], Hull Davun [b], Keo Omaliss [c], Sokha Chea [d], Alexandre Hassanin [e], Watthana Theppangna [f], Soubanh Silithammavong [g,h], Kongsy Khammavong [g], Sinpakone Singhalath [g], Zoe Greatorex [g], Amanda E. Fine [i], Tracey Goldstein [j], Sarah Olson [k], Damien O. Joly [k,l], Lucy Keatts [d], Philippe Dussart [a], Aneta Afelt [m], Roger Frutos [n,o,*], Philippe Buchy [a,p,**]

[a] Institut Pasteur du Cambodge, Virology Unit, Phnom Penh, Cambodia
[b] National Veterinary Research Institute, Ministry of Agriculture Forestry and Fisheries, Cambodia
[c] Forest Administration, Ministry of Agriculture Forestry and Fisheries, Cambodia
[d] Wildlife Conservation Society, Cambodia

βCoVs

αCoVs

Showing 42 of 42 genomes sampled between Dec 2019 and Jan 2020.

Phylogeny

RESET LAYOUT

Admin division

Hubei
Zhejiang
Guangdong
Taiwan
Nonthaburi
Ile De France
Washington
California
Arizona

WHU02
WHU01
Guangdong/20SF014/2020
/WIV06/2019
Nonthaburi/61/2020
/IPBCAMS-WH-02/2019
/WIV04/2019
/IVDC-HB-01/2019
/IPBCAMS-WH-04/2019
Guangdong/20SF028/2020
Guangdong/20SF040/2020
Guangdong/20SF174/2020
Zhejiang/WZ-01/2020
Guangdong/20SF201/20
Zhejiang/WZ-02/2020
Foshan/20SF211/2020
Foshan/20SF210/2020
Nonthaburi/74/2020
Guangdong/20SF025/2020
Guangdong/20SF013/2020
Guangdong/20SF012/2020
USA/AZ1/2020
Shenzhen/SZTH-002/2020

Article

A pneumonia outbreak associated with a new coronavirus of probable bat origin

a)
b)

What **do** we know?

- Across 25 high-risk viral families, there are estimated to be **1.7M unknown viruses**
- About **700k of which** likely have the potential to infect humans
- For example, for every known coronavirus, there are thousands of unknown coronaviruses circulating in wildlife

Carroll et al. (2018) Science

INFECTIOUS DISEASES

The Global Virome Project

Expanded viral discovery can improve mitigation

By **Dennis Carroll, Peter Daszak, Nathan D. Wolfe, George F. Gao, Carlos M. Morel, Subhash Morzaria, Ariel Pablos-Méndez, Oyewale Tomori, Jonna A. K. Mazet**

causing the next great pandemic (*1*, *2*). However, if these viruses are our enemy, we do not yet know our enemy very well. Around 263 viruses from 25 viral families are known to infect humans (*3*) (see the figure), and given

Scientists prepare to collect a blood sample from a *Rousettus sp.* fruit bat in Thailand to test for novel viruses. The Global Virome Project aims to identify and characterize the majority of currently unknown viruses in key wildlife groups, including rodents, nonhuman primates, and bats.

Other previous studies had begun to conduct targeted viral discovery in wildlife (*9*), and develop mitigation strategies for the emergence of avian flu, for example. However, the USAID Emerging Pandemic Threats (EPT) PREDICT project is the first global-scale coordinated program designed to conduct viral discovery in wildlife reservoir hosts, and characterize ecological and socioeconomic factors that drive their risk of spillover, to mitigate their emergence in people (*10*).

Working with local partners and governments, wildlife and domestic animals and at-risk human populations in geographic hotspots of disease emergence (*1*) are sampled, and viral discovery conducted. A strategy to identify which novel viruses are most at risk of spillover has been developed (*11*), and further work is conducted on these to characterize them prior to, or in the early stages of, spillover. Metadata on the ecology of wildlife–livestock–human transmission interfaces, and on human behavioral patterns in communities, are concurrently analyzed so that strategies to reduce spillover can be developed (supplementary text). To date,

Downloaded from http://science.science

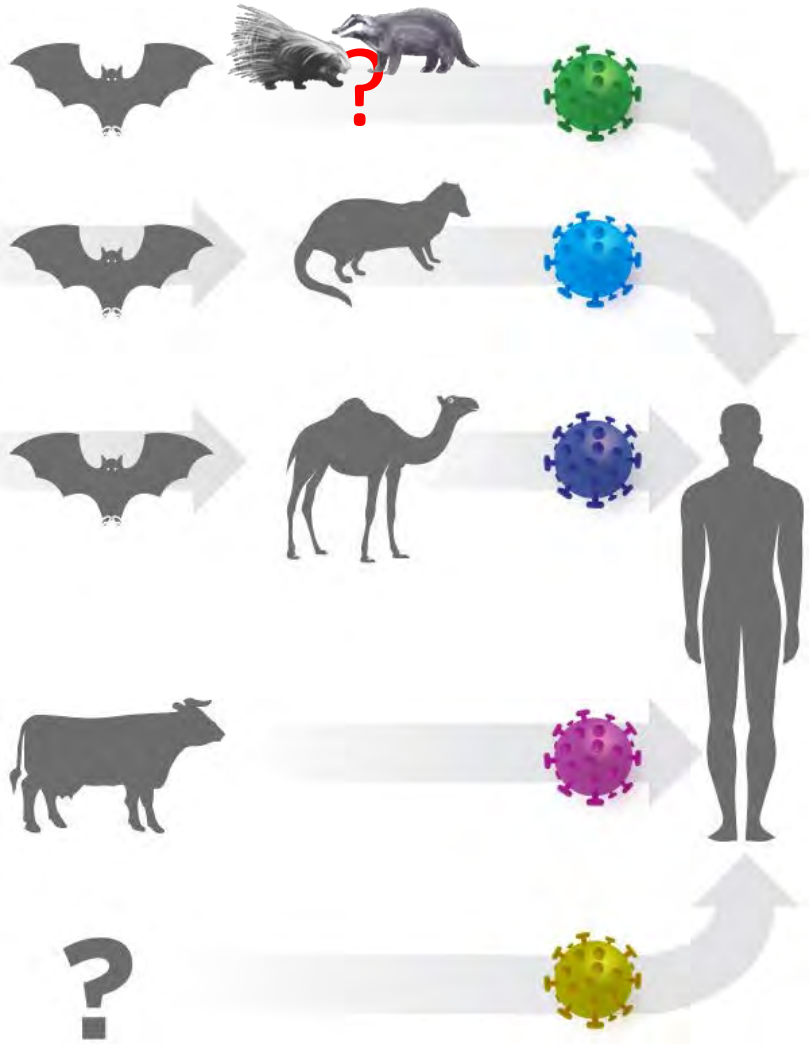
What **do we not** know?

CNN health Food Fitness Wellness Parenting Vital Signs LIVE TV

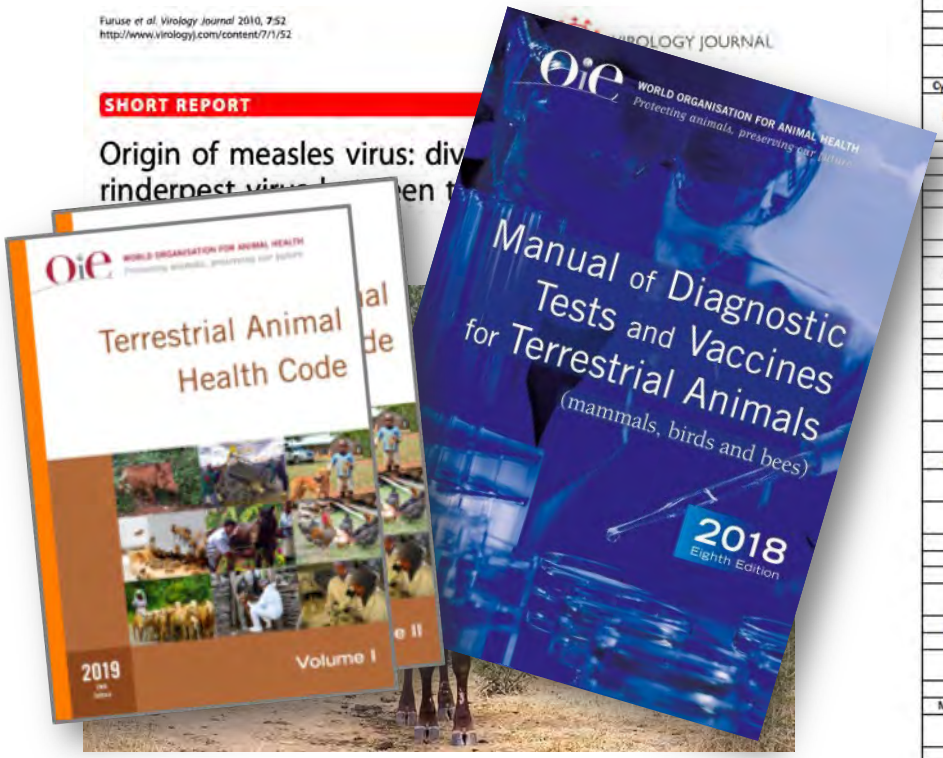
Snakes could be the source of the Wuhan coronavirus outbreak

THE CONVERSATION By Haitao Guo, Guangxiang "George" Luo and Shou-Jiang Gao, The Conversation

Updated 3:41 PM ET, Fri January 24, 2020



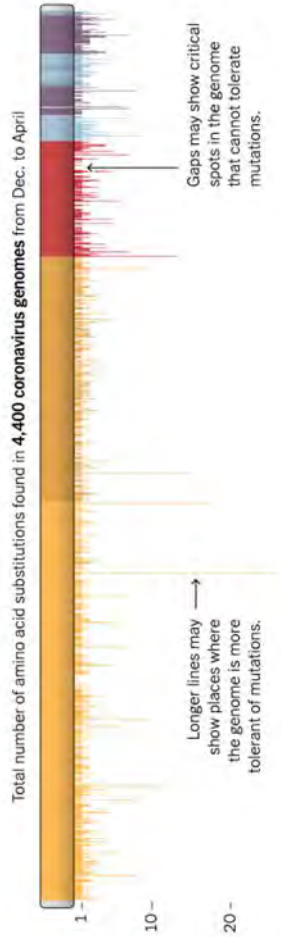
What **do** we know?



European Association of Zoo and Wildlife Veterinarians - Transmissible Diseases Handbook

Table A : Extant knowledge about species sensitivity to SARS-CoV-2 from [17][30–32] N/A= not assessed yet

Species	In Vitro Viral Particle entry	Computer & molecular prediction of ACE2 receptor binding		In vivo experimental infection success *(blank: no data yet)*	Natural transmission (Human > Animal)
		From [17]	From [30,31]		
Horseshoe bat	YES	Likely	Very low (17/25)		
Daubenton's bat	NO	N/A			
Vampire bat	N/A	Likely (4/5)	Very low (13/25)		
Coquerel sifaka	N/A	N/A	High (24/25)		
Blue eyed black lemur	N/A	N/A	High (22/25)		
Cynomolgus monkey	YES	Likely (5/5)		Yes[33]	
Rhesus macaque	N/A	N/A	Very High (25/25)	Yes, and reinfection could not occur at T0+28 days new challenge	
Anubis baboon	N/A	Likely (5/5)	Very High (25/25)		
Orangutan	N/A	Likely (5/5)	Very High (25/25)		
Chimpanzee	N/A	Likely (5/5)	Very High (25/25)		
Gorilla	N/A		Very High (25/25)		
Swine	NO	Likely (5/5)	Low (19/25)	No: Failed to get positive PCR and seroconversion	
Cattle	NO	Likely (4/5)			
African elephant	N/A	Unlikely (3/5)	Low (18/25)		
Camel	N/A	N/A	Medium (21/25)		
Giraffe, Okapi	N/A	N/A	Medium (21/25)		
Hippopotamus	N/A	N/A	Medium (20/25)		
Alpaca	N/A	N/A	Medium (20/25)		
Reindeer	N/A	N/A	High (21/25)		
Giant anteater	N/A	N/A	High (21/25)		
Mouse	NO	Unlikely (2/5)	Very low (16/25)		
Rat	N/A	Unlikely (3/5)	Very low (16/25)		
Chinese hamster	NO	Likely (4/5)	High (22/25)		
Guinea pig	N/A	Unlikely (2/5)			
Dog	YES	Likely (3/5)	Low (19/25)	No positive PCR but seroconversion	Yes
Domestic cat	N/A	Likely (3/5)	Medium (21/25)	Yes + transmission to other cats	Yes
Tiger, Lion	N/A	N/A	Medium (21/25)		Yes
Puma	N/A	N/A	Medium (21/25)		
Ferret	YES	Likely	Very low (17/25)	Yes + transmission to other ferrets[23,24]	
American mink	N/A	N/A	Very low (14/25)		Yes
European mink	N/A	N/A	Very low (17/25)		
Meerkat	N/A	Unlikely (2/5)	Very low (15/25)		
Civet cat	N/A	Likely			
Masked palm civet	N/A	Very low	Very low (13/25)		
Racoon	?	Unlikely (2/5)			
Fossa	N/A	N/A	Very low (16/25)		
Red panda	N/A	N/A	Very low (13/25)		
Sea otter	N/A	N/A	Low (17/25)		
Chicken	?	Unlikely (3/5)		No. Failed to get positive PCR and seroconversion	
Duck	?	?		No. Failed to get positive PCR and seroconversion	



NYT –April 2020

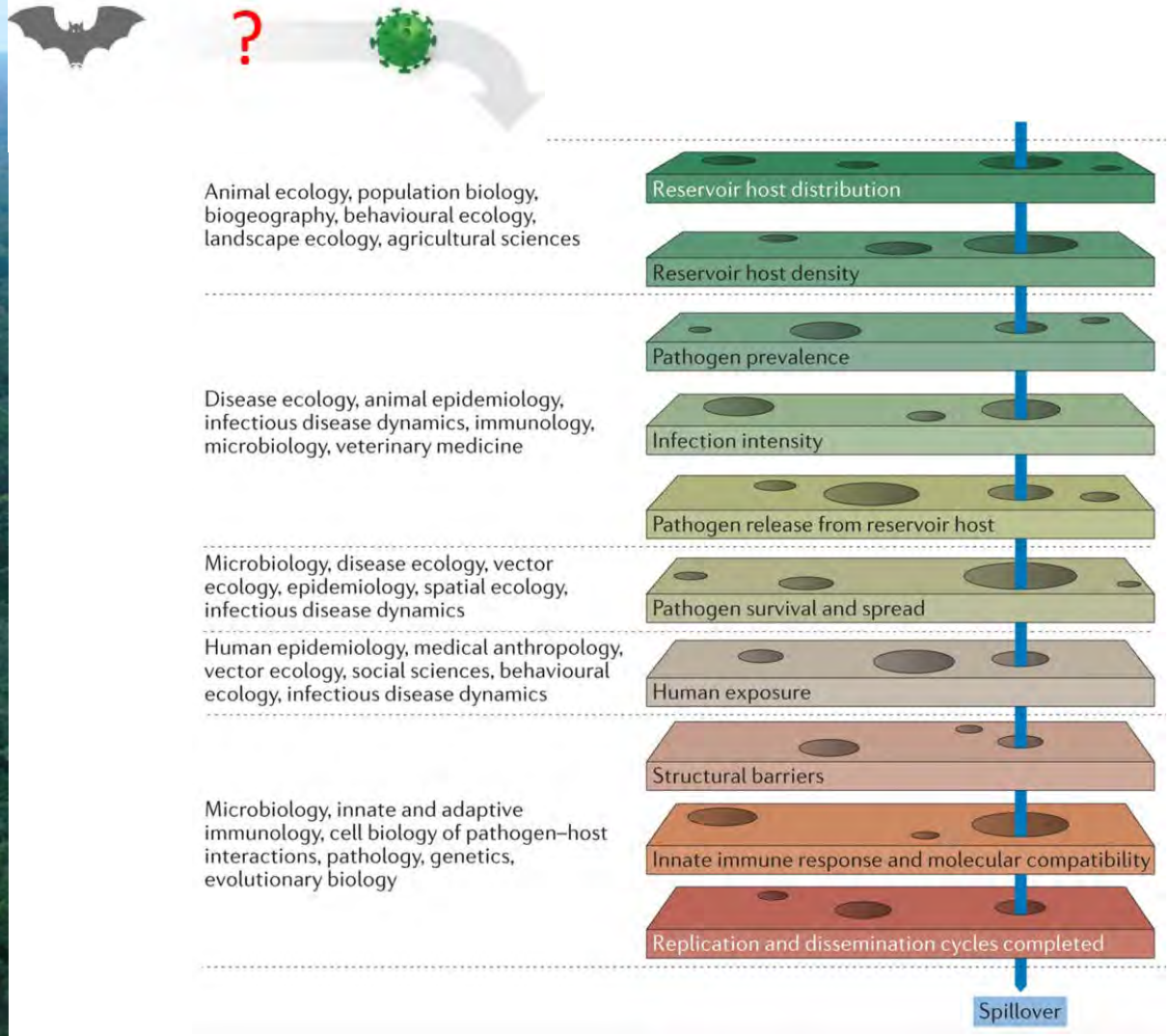
It is not about bat-soup, civets or pangolins

特級四寶丸
$28/盒
龍蝦包心丸
$22/盒
$45/磅
蝦滑
墨魚滑
每磅$65
每磅$65
牛柏葉 $30
手包水餃
手包雲吞
$35/盒
$36/磅
迷你菜肉餃
$15盒
$58/磅
推介
$80/磅
廁師腸$14
日本蜜魚鱗$65

What **do** we know?

- What **do we not** know?

Photo/Xinhua



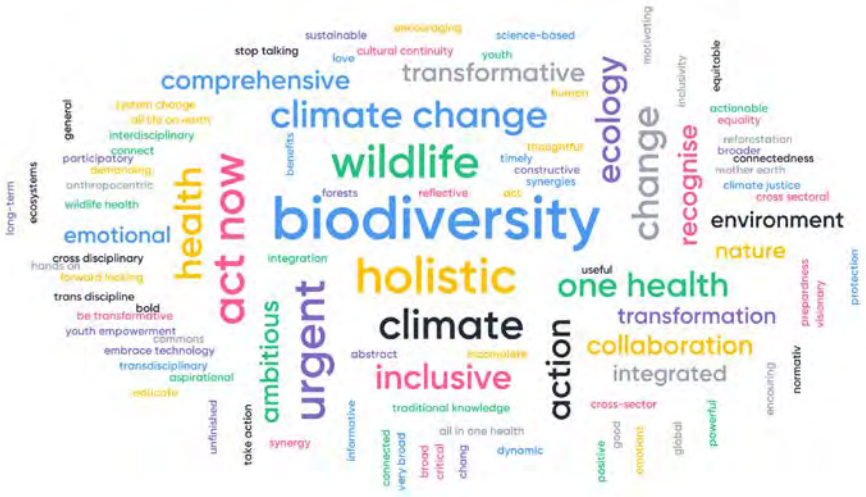
Barriers to spillover. This figure was adapted from Plowright et al. 2017

One Health History

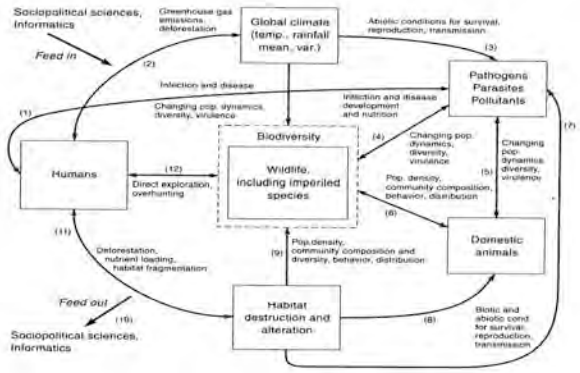
- 2004 **One World, One Health** meetings with human public health, conservation and infectious disease experts were organized by WCS
  - **Manhattan Principles**
- **Berlin Principles 2019**

2019 Berlin Principles on One Health

Which Three Words Best Describe The Berlin Principles on One Health



ONE PLANET, ONE HEALTH, ONE FUTURE



Ostfeld et al. 2002 Mazet et al. JVME 33 2006

www.wcs.org/one-planet-one-health-one-future

Congo Basin – Spillover Frontline

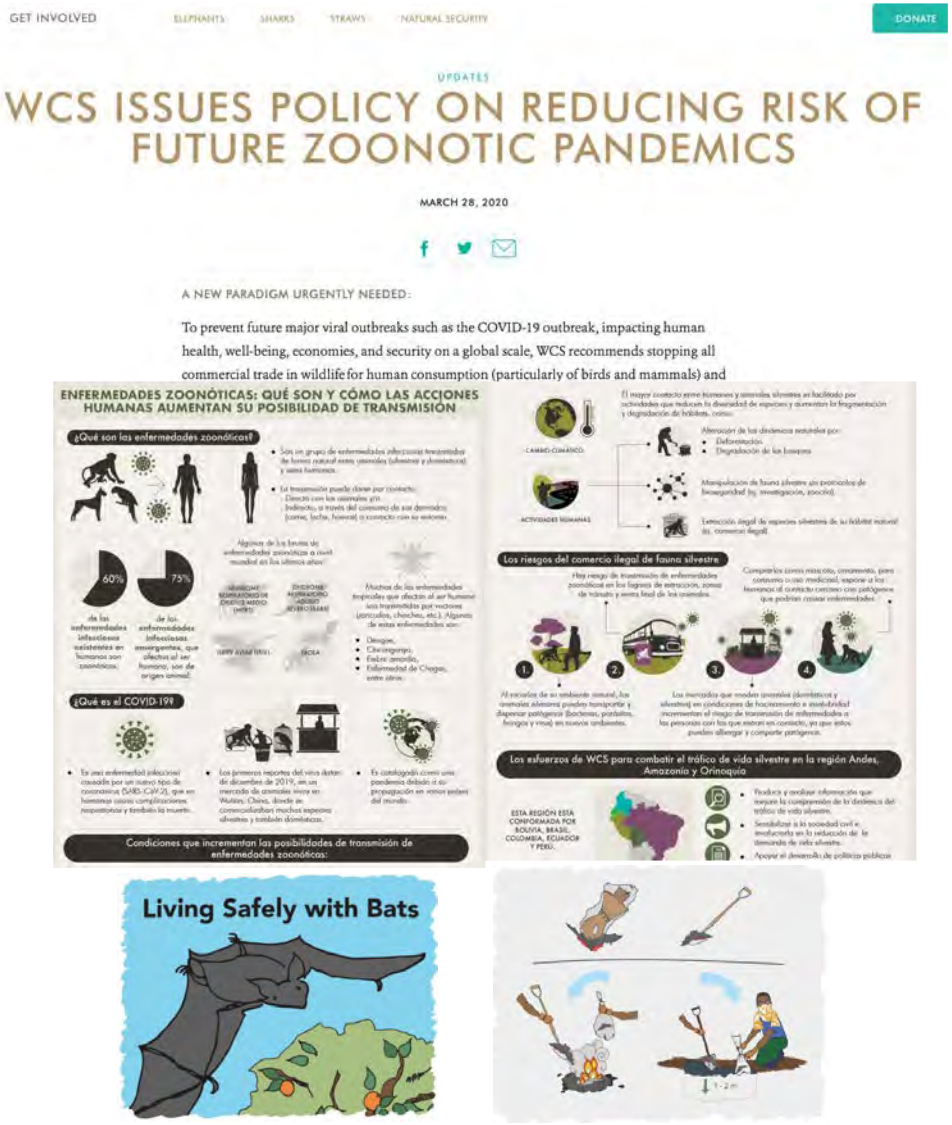
- Long-standing program: 3 main pillars
  - Carcass monitoring [Ebola virus community engagement targeted 6,600 IPLC living in northern RoC]
  - Community outreach and education
  - Research on EBV
- Developing field test kits to better understand causes of great ape mortality

Wildlife Conservation Society

No SIM
3:48 PM
Biomeme
Start Run
Data Management
Protocol Management
Wildlife Conservation Society

What do we need to do now?

- Permanently ban the commercial trade in wildlife for consumption
- Strengthen efforts to combat trafficking of wild animals within countries and across borders
- Work to change dangerous wildlife consumption behaviors, especially in cities



What do we need to do now?

- Mainstream holistic One Health Approaches
  - Devise adaptive, holistic, and forward-looking approaches to the detection, prevention, monitoring, control, and mitigation of emerging/resurging diseases
- Link Economic recovery funding to support One Health
  - Increase cross-sectoral investment in the global human, livestock, wildlife, plant, and ecosystem health infrastructure and international funding mechanisms

We Stand for Wildlife™