

PANDEMICS PAST: USING HISTORICAL PANDEMIC MANAGEMENT STRATEGIES TO HELP SHAPE CORONAVIRUS RESPONSE

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WELCOME TO ZOOM

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PARTICIPANTS WILL BE ABLE TO...

- Identify the modern factors that have created the potential for zoonotic diseases to become pandemics
- Contrast the epidemiologic characteristics of SARS-CoV-1 and SARS-CoV-2 in order to predict why SARS-CoV-2 caused a pandemic while SARS-CoV-1 was a near-miss
- Locate the US's existing pandemic plans (from "Bird Flu" scares), defend community nonpharmaceutical interventions (NPIs) for mitigating the effects of the COVID-19, and contrast US pandemic planning with the current NPI effectiveness

NORTH AMERICAN EPIDEMICS HISTORICAL

- Measles
- Smallpox
- Yellow fever
- Diphtheria
- Typhus
- Cholera
- Malaria
- Influenza

Vaccinations, antibiotics, sanitation, water and food safety monitoring, mosquito control

EMERGENT INFECTIOUS DISEASES

- COVID-19
- Ebola
- Nipah
- Zika
- Chikungunya
- SARS-CoV-1
- MERS-CoV
- Rift Valley Fever
- vCJD (Mad Cow)
- HIV/AIDS
- Psittacosis

NORTH AMERICAN EPIDEMICS MODERN

Sleeping Sickness (encephalitis lethargica)	1915-1926	1.5M	
Polio	1916	7K	
Spanish Flu	1918-1920	50M	Purple = Zoonotic Diseases
Polio	1948-1952	9K	
Asian Flu	1957-1958	1-4M	
Hong Kong flu	1968-1970	1-4M	
HIV/AIDS	1981-ongoing	32M	
Swine flu	2009-2010	285K	Avg flu season 48K deaths
Zika	2015-2016	53	
COVID-19	2019-ongoing	845K	

SPILOVER

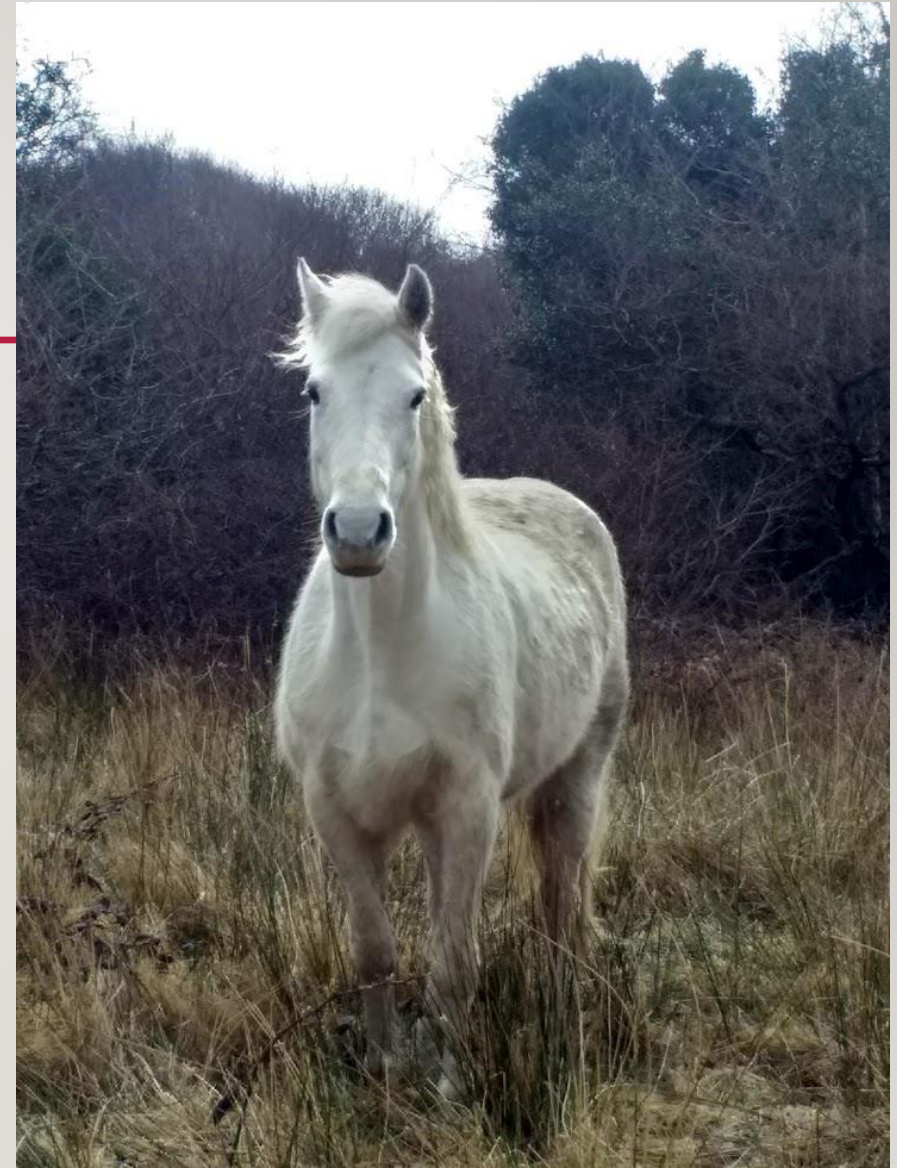
- Spillover is when a pathogen present in a reservoir population infects a novel host
 - Reservoir population is species/environment in which pathogen naturally lives and reproduces
 - Novel host is a species which has not previously been a host for that pathogen

TRANSMISSION OF ZOOONOTIC DISEASES

- Direct contact
 - Slaughter
 - Bites
- Vector – mosquitos, ticks
- Human-to-human
 - Amplifier hosts – pigs, horses

HENDRA VIRUS – EXAMPLE OF AMPLIFIER HOST

- Flying Fox (bats) in Australia are reservoir for Hendra Virus, with multiple outbreaks since first discovered in 1994
- All outbreaks start with spread to horses (“amplifier” hosts) than have been exposed to bat waste
- Humans infected by close contact with infected horses (7 cases, 4 deaths)
- No human to human transmission recorded

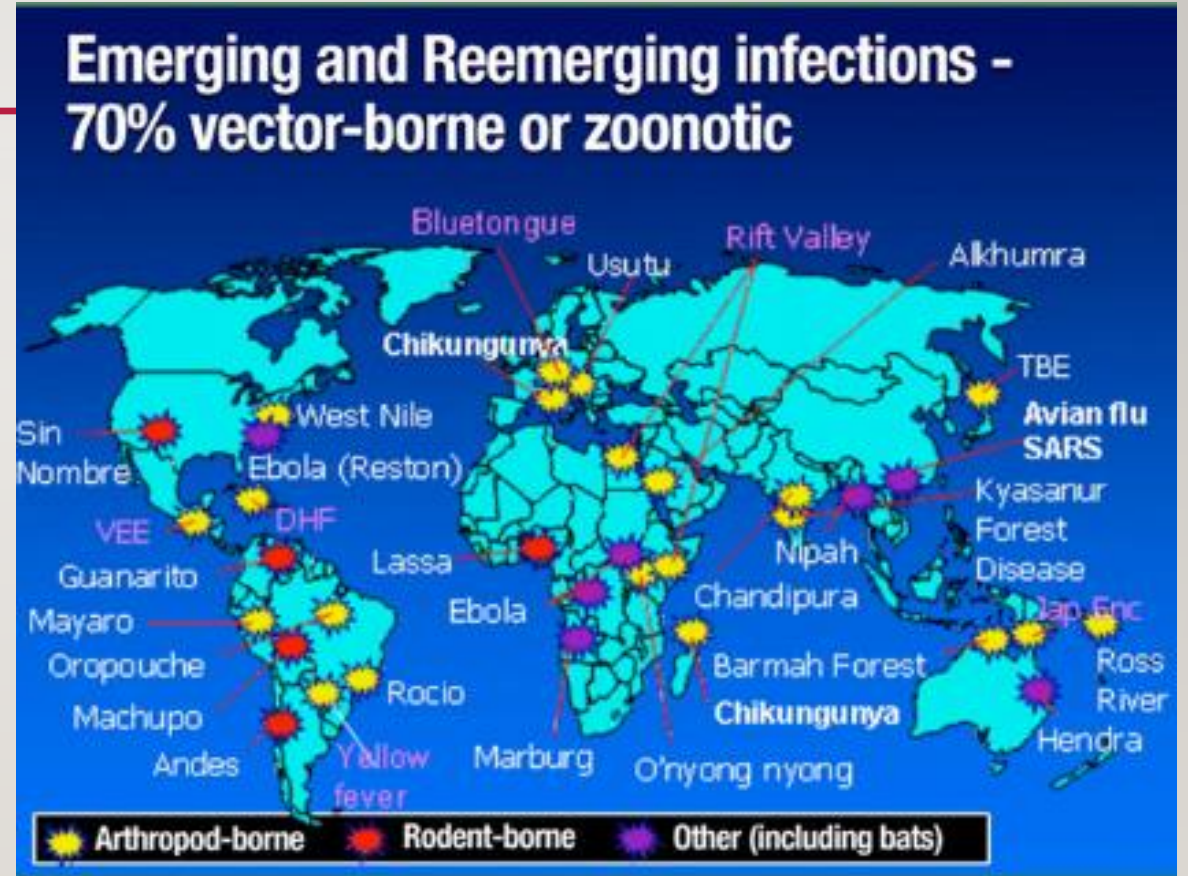


PANDEMIC SPILLOVER

- Increasing contact with wild animals
 - Climate change
 - Deforestation
 - Trade & hunting
 - Population growth
- Increased risk of spread
 - World travel
 - 10x increase in airline travel from China between SARS-CoV-1 in 2003 and SARS-CoV-1 in 2020
 - Population density & urbanization

ONE HEALTH

- Collaboration between scientists and healthcare professionals across human, animal, and environmental domains



PROMED OUTBREAK REPORTS

- onehealthinitiative.com from 8/30-8/31
 - Coronavirus - worldwide
 - St Louis Encephalitis – TX
 - Anthrax – Zimbabwe (elephant)
 - Easter Equine Encephalitis – SC (horse)
 - West Nile Virus – CA, FL
 - Monkeypox – Democratic Republic of Congo

SARS-CoV-1 2003-2004

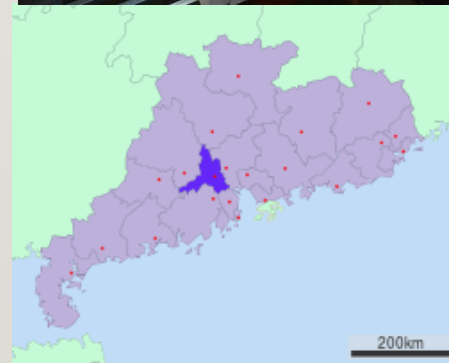
Horseshoe bats in cave in Yunnan Province



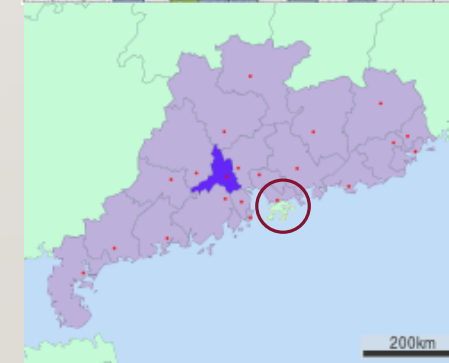
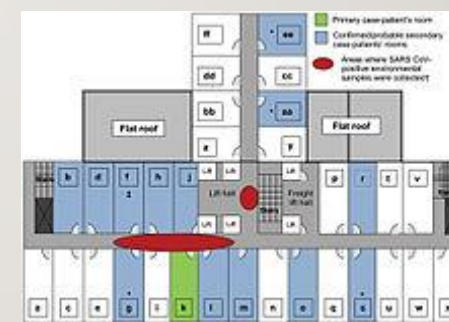
Masked Palm Civets at wildlife market in Guangdong Province



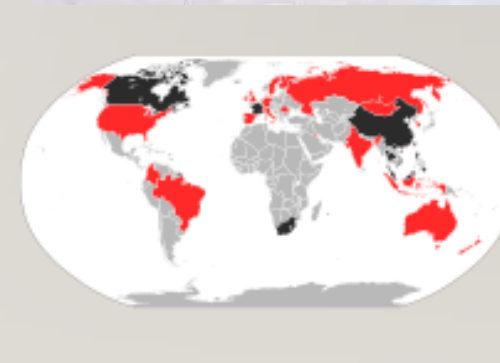
Fishmonger from Guangzhou admitted to hospital, 30 healthcare workers infected



Doctor from Guangzhou hospital attends wedding in Hong Kong, 23 people at hotel infected



Hotel guests spread SARS to Vietnam, Canada, and Singapore. Eventually 29 countries/territories



SARS-CoV-1 AND SARS-CoV-2

- SARS-CoV-1
 - Aggressive mitigation
 - Disappeared by 2005
- SARS-CoV-2
 - Similar R – around 2.5 for both viruses
 - Similar pattern of superspreading events (SARS-CoV-2 may have more community superspreading)

COVID-19: WHY THIS ONE?

SARS-COV-1

- No presymptomatic spread
- High morbidity & mortality
 - Mostly nosocomial
 - Lower community spread
- Lower airway infection

SARS-COV-2

- Presymptomatic virus shedding
 - Maximum transmission on first day of symptoms
- Asymptomatic cases
- Upper airway infection

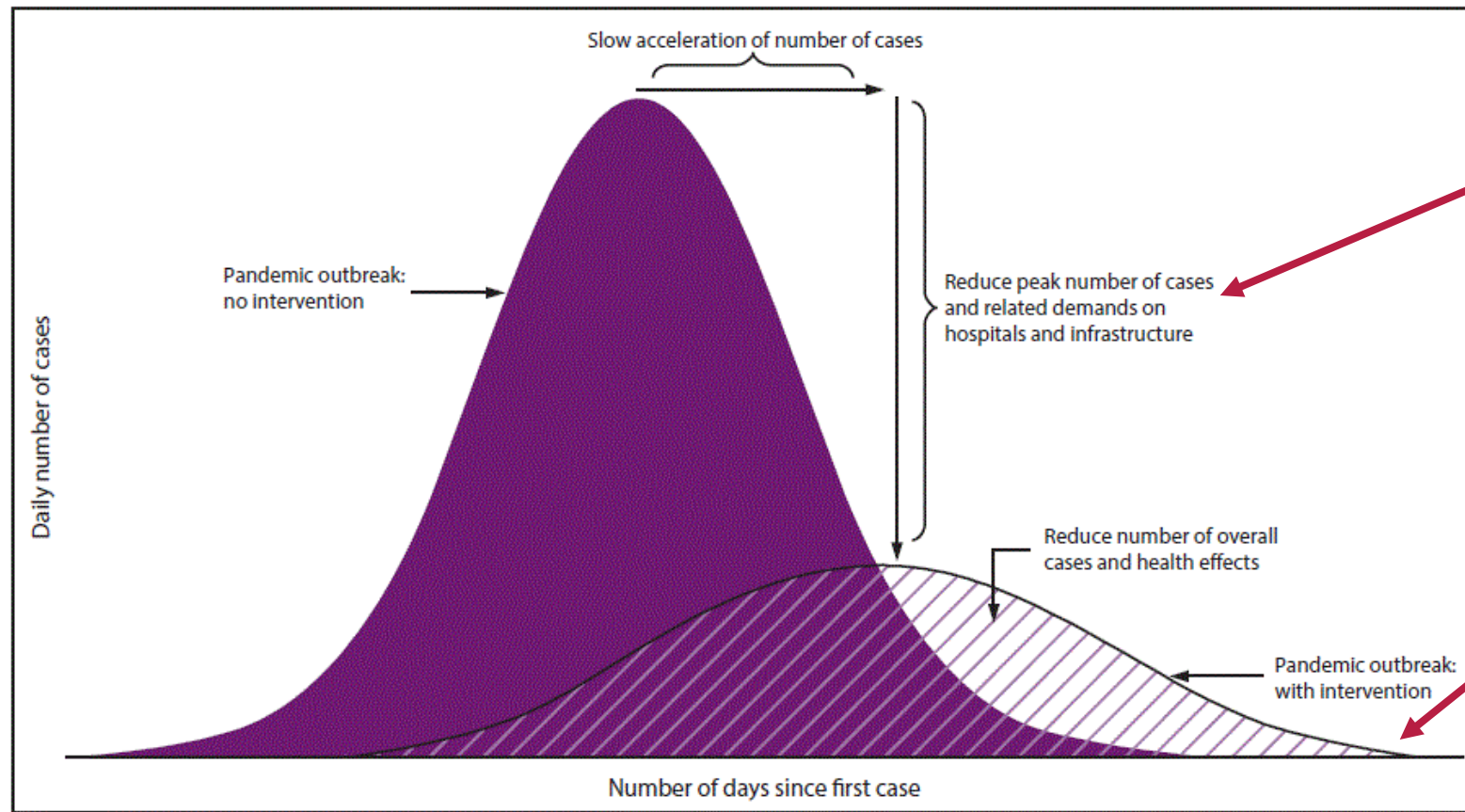
PRESYMPTOMATIC SPREAD

“The downside was the hospital staff took the first big blasts of secondary infection; the upside was that those blasts generally weren’t emitted by people still feeling healthy enough to ride a bus to work. This was an enormously consequential factor in the SARS episode – not just lucky by salvational. With influenza and many other diseases the order is reversed, high infectivity preceding symptoms by a matter of days. **A perverse pattern: the danger, then the warning.**” *Spillover: Animal Infections and the Next Human Pandemic* by David Quammen, 2012

PANDEMIC INFLUENZA PLANNING

- <https://www.cdc.gov/flu/pandemic-resources>
- Community Mitigation Guidelines to Prevent Pandemic Influenza — United States, 2017, MMWR April 21, 2017 66(1)1-34
 - Plans apply to respiratory disease pandemics in general
 - i.e. COVID-19 community mitigation is the same as was planned for influenza
 - Most significant difference is clinical: treatment and vaccine development

GOAL OF COMMUNITY MITIGATION FOR PANDEMIC INFLUENZA



Additional consideration for COVID-19 mitigation in March and April was to get past the end of flu season

End of Influenza epidemic assumption of seasonality and vaccine development

EARLY, TARGETED, LAYERED USE OF NONPHARMACEUTICAL INTERVENTIONS

NPI category*	NPIs	Timing
Personal		
Personal protective measures for everyday use	Voluntary home isolation of ill persons (staying home when ill)	Recommended at all times
	Respiratory etiquette	
	Hand hygiene	
Personal protective measures reserved for pandemics	Voluntary home quarantine of exposed household members (staying home for up to 3 days [†] when a household member is ill)	Reserved for pandemics
	Use of face masks in community settings when ill	

EARLY, TARGETED, LAYERED USE OF NONPHARMACEUTICAL INTERVENTIONS

NPI category*	NPIs	Timing
Community		
School closures and dismissals [§]	Temporary, preemptive, coordinated dismissals of child care facilities and schools for grades K–12 [¶]	Reserved for pandemics
Social distancing measures (examples)	Dividing classes into smaller groups and creating opportunities for distance learning (e.g., via the internet or local television or radio stations)	Reserved for pandemics
	Telecommuting and remote-meeting options in workplaces	
	Mass gathering modifications, postponements, or cancellations	

Flu has significant effects on younger patients



EARLY, TARGETED, LAYERED USE OF NONPHARMACEUTICAL INTERVENTIONS

NPI category*	NPIs	Timing
Environmental		
Environmental surface cleaning measures	Routine cleaning of frequently touched surfaces and objects in homes, child care facilities, schools, and workplaces	Recommended at all times

CONSIDERATIONS

- Ethical considerations
- Feasibility of NPI implementation
- Activation triggers, layering, and duration of NPIs
- Selecting NPIs for groups at risk for severe influenza complications and for those with limited access to care and services
- Public acceptance of NPIs
- Balancing public health benefits and social costs
- Monitoring and evaluation of NPIs

CONCLUSION

World health organization priority diseases for R&D

- COVID-19
- Crimean-Congo haemorrhagic fever (CCHF)
- Ebola virus disease and Marburg virus disease
- Middle East respiratory syndrome coronavirus (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS)
- Lassa fever
- Nipah and henipaviral diseases
- Rift Valley fever (RVF)
- Zika
- Disease X

“The risk of spillover into people and emergence of a disease similar to SARS is possible”

– Hu, B. *et al. PLoS Pathog.* **13**, e1006698 (2017) Center for Emerging Infectious Diseases of Wuhan Institute of Virology, Chinese Academy of Sciences, Wuhan, China

SELF ASSESSMENT

- Name three reasons why spillover has become an increasing concern in modern society
- What is the main factor that prevented SARS from becoming a global pandemic in 2003-2004
- List the non-pharmaceutical interventions (NPI) that have been effective in “flattening the curve” for COVID-19 and list the known barriers to NPI

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- What animal is the likely reservoir for SARS-like coronaviruses in China?
 - Masked Civet Cats
 - Sunda Pangolin
 - Horseshoe Bats
 - Bamboo Rats