Overview of Plague Epidemiology in Asia

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Plague – Part of human history!

- Plague has been responsible for widespread pandemics with high mortality in the history of human civilization
  - “Justinian plague” spread around the Mediterranean Sea in the 6th century
  - "Black Death" started in Europe in the 14th century (Europe, Asia and Africa)
  - The third pandemic started in China in the 19th century and spread throughout the world (Asia, Europe, Africa and America)

- Black death caused an estimated 75–200 million deaths, approximately half of them in Asia and Africa and the other half in Europe
Plague: Reemerging disease in Asia!

- Plague is often classified as a problem of the ancient disease that is not likely to disappear.

- Following the reappearance of plague during the 1990s in several countries, plague has been categorized as a re-emerging disease.

- Many countries have dismantled a surveillance system for plague because of a lack of funds and periodic outbreak absenteeism.

Global distribution of natural plague foci (2016)

Notification of plague to WHO, 1969-2013
Reported plague outbreaks in Asia

- **China**: Reported from time to time (Regular/endemic)
- **India**: Pneumonic plague outbreak in Himachal Pradesh in Feb 2002 and bubonic plague in Uttarkashi in Oct 2004 (Reemerging)
- **Indonesia**: Pasuruan district of East Java in Feb 2007 (Reemerging)
- **Mongolia**: Reported from time to time (Regular/Endemic)
- **Myanmar**: 1994
- **Nepal**: 1968
- **Vietnam**: 2002
Epidemiological characteristics

Réservoirs

- **Wild small mammals** (gerbils and marmots)
- **Marmots** are the only creatures besides humans who can pass pneumonic plague from one to another under normal circumstances

Human behaviour, cultural practices

- Herders, hunters.. usually in handling and/or skinning dead animals (bitten by fleas or direct contact with the animal blood) Bubonic plague+++ 
- Mortality due to plague remains very high because most outbreaks occur in remote places

Surveillance and response capacity

- Absence of any animal surveillance in most of the endemic countries
- Epidemiological silence

Natural disaster and war – Spillover effect

Climate change and microbial adaptation!
Plague in China

- The marmot is believed to have caused the 1911 pneumonic plague epidemic, which killed about 63,000 people in northeast China.
- Marmota plague foci are active in China, and the epidemic boundary is constantly expanding.
- The case-fatality rate for plague in humans was 68.88%; the overall trend slowly decreased over time but fluctuated greatly.
- Most human cases (98.31%) and isolates (82.06%) identified from any source were from the *Marmota himalayana* plague focus.
Plague in China...

- From 1950 to 2019, a total of **267 plague cases in humans** were reported in the Inner Mongolia Autonomous Region with **133 deaths** and **10,710 Y. pestis isolates**.

- Four stages of transformation
  - Plague prevention and control (1950–1959)
  - **Plague eradication** (1960–1979)
  - Plague surveillance (1980–1999)
  - Comprehensive prevention and control stage under the emergency system (2000–2019)

- Bubonic plague is the main plague type of the *M. unguiculatus* plague focus.

- China's northern region of Inner Mongolia reported three cases of **bubonic plague in August 2023**
Plague in Mongolia

- Human plague peaked in the early 1990s and **gradually decreased** and currently only sporadic.
- High number of cases in men can be explained by the **hunting activity** of marmot.
- Roast marmot ("boodog" in Mongolian) is a **popular dish**, some unlucky hunters catch it every year.
- **137 natural foci of plague** are found in 17 aimags (regions) of Mongolia, including on the border with Russia and China.
- Plague mostly occur in **Western and Steppe regions**.
Impact of climate change on marmot plague?

- A density-dependent effect of precipitation and a geographic location-dependent effect of temperature on marmot plague.
- A significantly positive relationship was evident between the risk of plague and precipitation only when the marmot density exceeded a certain threshold.
Why can not we eradicate the plague?

- No human plague does not mean the absence of plague
- The *existence of animal reservoirs* that makes the plague hard to eradicate
- Unless we *exterminate animal reservoirs*, plague is always going to be around
- The Chinese experience clearly demonstrates that the *eradication of plague* is not an achievable target
Plague vaccine development in India

The third pandemic: The first plague case was discovered in September 1896 at a grain merchant's quarters at Bombay's docks.

The plague mortality rate was nearly twice that of cholera.

On 10 January 1897, Haffkine injected himself with 10cc of his preparation - a significantly higher dose than the 3cc he planned to use in wider testing. He experienced a severe fever but recovered after several days.

Haffkine went there to carry out controlled tests. He inoculated 147 prisoners and left 172 untreated. Just two cases and no deaths among the treated.

Between 1897 and 1925, 26 million doses of Haffkine's anti-plague vaccine were sent out from Bombay. Tests of the vaccine's efficacy showed between a 50% and 85% reduction in mortality.