

Watching brief

Title	An overview of the first human case of Bubonic plague detected in Bugat settlement, Gobi-Altai province in Mongolia.
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Date of first report of the outbreak	June 27 th , 2023, in Bugat settlement, Gobi-Altai province [1]
Disease or outbreak	Vector-borne bacterial bubonic plague (<i>Yersinia Pestis</i>)
Origin (country, city, region)	<p>The country affected by this outbreak is Mongolia. The current outbreak is suspected to have originated in Gobi-Altai province [1]. The second case was detected in Ulan Bator and had acquired the infection in the eastern province of Khentii [2]. The western province of Khovd also registered a case of bubonic plague [3].</p> <p>A total of 137 natural bubonic plague foci were detected by the National Centre for Zoonotic Diseases Mongolia in 17 provinces prior to the current outbreak [1].</p>
Suspected Source (specify food source, zoonotic or human origin or other)	The suspected source of this outbreak is infected marmots which were consumed by humans who subsequently developed bubonic plague [1,2].
Date of outbreak beginning	June 27 th 2023
Date outbreak declared over	Officially, no announcement has been made to declare the outbreak over. However, the last case in this outbreak was identified on September 20 th , 2023.
Affected countries & regions	Cases are spread throughout Mongolia and have been confirmed in the capital Ulan Bator, as well as Khovd and Gobi-Altai provinces [4]. Out of the 21 Mongolian Provinces, 17 are provinces at risk of bubonic plague infections [2,5].
Number of cases (specify at what date if ongoing)	There are four total confirmed cases in this ongoing outbreak, from June 27 th to September 20 th , 2023.
Clinical features	People infected by the bubonic plague usually develop symptoms after an incubation period of 1-7 days [6]. One of the most common symptoms of the bubonic plague is one or more swollen lymph nodes, called “buboes”, which, in severe cases, may develop into open sores filled with pus [6]. If left untreated, bubonic plague can spread into the lungs and become pneumonic, a more severe form of the disease [6].

	<p>According to the World Health Organization (WHO), signs and symptoms of bubonic plague include [6]:</p> <ul style="list-style-type: none"> • Fever • Chills • Headaches and body aches • Vomiting • Nausea • Malaise <p>The United States Centres for Disease Control and Prevention (CDC) reports that three main factors should be considered when diagnosing bubonic plague in patients [7]:</p> <ul style="list-style-type: none"> • Rapid development of swollen lymph gland (bubo) • Evidence of a flea bite on the body • Recent travel to, or residence in, a country where plague is endemic
<p>Mode of transmission (dominant mode and other documented modes)</p>	<p>The predominant mode of transmission for this current outbreak, although rare, is ingestion of or contact with the infected marmot carcasses [8]. Bubonic plague is mostly transmitted by the bite of an infected flea, contact with contaminated fomites and bodily fluids, and through respiratory droplets [6], however, no cases in the current outbreak have reported infection acquired via these routes [7].</p>
<p>Demographics of cases</p>	<p>The first case of bubonic plague was identified in a 21-year-old male in the settlement of Bugat, with a total of 40 close contacts isolated [1]. The second case, with unknown age and gender, was diagnosed on August 8th, 2023, with an additional five close contacts identified and isolated [9]. September 1st had the first death reported in the western province of Gobi-Altai which was of a 15-year-old boy. The most recent case was confirmed on September 20th in a 40-year-old woman with fifteen close contacts [5]. Investigations indicate that there may have been a suspicion of pneumonic plague, which can be transmitted between humans [10]. Furthermore, there is no information on whether these cases are epidemiologically linked or not.</p>
<p>Case fatality rate (CFR)</p>	<p>Current outbreak: 1 in 4 cases have resulted in a fatality (CFR = 25%).</p>
<p>Complications</p>	<p>With a CFR globally of 30-60% for bubonic plague and almost 100% for the pneumonic plague [6], undoubtedly the most significant complication is death. However, other significant complications include [7]:</p> <ul style="list-style-type: none"> • Septicaemic plague: excessive blood clotting from the disease causes the tissues of limbs and other parts of the body to necrotise. These parts eventually need amputation [7]. • Meningeal plague [11]: defined as the inflammation of the meninges which protect the brain and spinal cord. This complication is rare, but it can manifest in patients presenting with bubonic plague infection [12]. • Pharyngeal plague [7]: this condition is also rare and occurs when infection spreads into the pharynx [12]. It is a highly contagious form of

	<p>the disease and presents with pharyngitis-like symptoms in its preliminary stages.</p>
<p>Available prevention</p>	<p>Currently, vaccination is not recommended for bubonic plague [8]. An effective prevention method is to minimise contact with fleas and rodents by creating unfavourable living conditions around the household (clearing of brush, junk, cluttered firewood) [13]. Regularly testing environmental samples (marmot meat) can also help to identify the presence of plague and create health alerts for citizens.</p> <p><u>Public Health:</u> Interventions to limit the spread of plague include:</p> <ul style="list-style-type: none"> • Swiftly identifying the source of infection. In this case even though the index case is linked to marmot meat ingestion, the presence of plague-carrying Pallas's pikas, Brandt's voles and susliks are all common to Mongolian ectoparasites [14]. • Surveillance, which is key to halting the spread of the plague. Since hunting and consuming marmots are a way of life for young Mongolian men, it is imperative to implement widespread awareness and allow health authorities to monitor and survey farming practices thoroughly [15]. Thus, this increased surveillance will allow appropriate implementation of hunting legislation. • Protecting the health authorities and health care workers, which is important in achieving optimal disease control. In Mongolia, health staff are underpaid, understaffed and poorly equipped. Due to this, although there are legislations to prohibit the hunting of marmots, it is impossible to impose fines or penalize offenders.
<p>Available treatment</p>	<p>Antibiotics are the most effective treatment method, with early detection of disease a key component of successful treatment [9]. Patients should be administered antibiotics within 24 hours of infection to improve chances of recovery and prevent death [9]. It is recommended that adults be given streptomycin and gentamicin. Children may also receive a reduced dosage of this medication [9].</p>
<p>Comparison with past outbreaks</p>	<p>Since the first case was identified in 1940, sporadic cases of bubonic plague have appeared annually in Mongolia. From 1940 to 2008 there have been a total of 521 confirmed cases [11]. Of these cases, approximately 70% have resulted in fatalities [11]. Around 75.2% of all confirmed cases since 1940 were associated with marmots [14]. In past outbreaks, the main documented transmission mode was through flea bites, however, in the recent outbreak, reports suggest that patients acquired the disease through marmot meat consumption [2], with one case fatality reported in September 2023 [15]. Demographic data indicate that males aged 1-25 years had the highest rate of infection, with 63.2% of all total cases from 1940-2008 due to routine hunting practices [11].</p>

	<p>Outbreaks of bubonic plague with most cases being transmitted by marmots can also be observed in other parts of the region. The neighbouring Autonomous Region of Inner Mongolia had a large outbreak of plague spanning from 1950-1959 with a total of 254 human plague cases registered, described in Table 1 [16,17]. Although rates of infection have decreased, bubonic plague remains endemic in this region. From 1960-2018 the region reported nine new cases with the last reported in 2004 [12]. However, there has been a recent uptick in cases in the Autonomous Region of Inner Mongolia with four cases in 2019, three cases in 2020 and one case in 2021 [12,17,18].</p> <p>Table 1. Inner Mongolia Autonomous Region Plague Cases.</p> <table border="1" data-bbox="488 819 1107 1010"> <thead> <tr> <th>Time Period</th> <th>Cases</th> </tr> </thead> <tbody> <tr> <td>1950-59</td> <td>254</td> </tr> <tr> <td>1960-2018</td> <td>9</td> </tr> <tr> <td>2019</td> <td>4</td> </tr> <tr> <td>2020</td> <td>3</td> </tr> <tr> <td>2021</td> <td>1</td> </tr> </tbody> </table>	Time Period	Cases	1950-59	254	1960-2018	9	2019	4	2020	3	2021	1
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<p>Unusual features</p>	<p>Although sporadic cases are spread throughout Mongolia, most reported cases originate from rural areas in the western provinces [19]. The second confirmed case of the current outbreak was acquired in Khentii, which is on the eastern side of Mongolia where cases are less prevalent [1,14].</p> <p>Most plague infections come from the bite of infected fleas during the hunting and preparation of meat. In this current outbreak, although rare, the consumption of raw or undercooked meat is the suspected mode of transmission in all four cases [8].</p>												
<p>Critical analysis</p>	<p>Bubonic plague infections occur frequently in Mongolia, however, outbreaks have few cases and are short-lived as human-to-human transmission does not occur in bubonic plague cases [6,9,12,19].</p> <p>There have been multiple plague cases and outbreaks reported since the beginning of the 20th century [20]. The western provinces of Mongolia have a higher rate of environmental plague detection as marmots are more densely populated in that region [14,19]. High altitude grasslands and precipitation in the western regions lends itself to ideal living conditions for marmots and exacerbates the spread of natural plague foci between animals, especially during the warmer months [14,19].</p> <p>The current outbreak aligns with epidemiological trends in the country, however, the second case, in the capital of Ulan Bator in the country's east, indicates that plague infections can occur outside of environmental 'hotspots' and surveillance methods need to be expanded to create a more robust warning system for residents [2,19,21].</p>												

	<p>In 2021, the hunting of marmots for domestic and industrial means was illegalised for the next three years in Mongolia to mitigate the risk of bubonic plague infection, however, this did not deter citizens from routinely hunting the animal and consuming its meat [3]. Additionally, protected zones are in place as a prevention strategy against bubonic plague, in response to the 2020 outbreak. Despite this legislation, 430 cases of illegal transportation of marmots were registered in 2023 alone.</p> <p>Authorities need to assess alternate ways of bubonic plague prevention beyond the scope of legislation, as the demand for marmot meat as a delicacy remains high. Additional preventive measures are necessary primarily because studies have shown that marmots carry sixty-one species of fleas which carry the plague, with an average index of fleas on marmots of 95.3 [14].</p> <p>Environmental surveillance through testing of marmots for <i>Yersinia Pestis</i> (<i>Y. pestis</i>) is strong throughout the country, leading to detailed knowledge of the main reservoirs of the pathogen. Human infections in these areas indicate that there is a communication breakdown between community members and authorities, coupled with a disregard of the law. Public health mitigation strategies must include the following:</p> <ul style="list-style-type: none">• Increased supply and awareness of personal protective equipment use and disposal [22].• Rigorous awareness campaigns to improve health literacy regarding the plague.• Improved awareness and training for safe food handling practices.• Improved surveillance in animals to increase early detection to limit animal-to-human transmission.• Strengthening the skill set of health personnel regarding plague clinical features, transmission, and prevention.• Discussion and support from the WHO and other international partners.• Developing better plague data synthesis, collection and sharing.
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<p>Key questions</p>	<ol style="list-style-type: none"> 1. How do authorities improve health literacy regarding the spread of bubonic plague? 2. Can there be community partnerships developed to assist Mongolian authorities in implementing surveillance and monitoring measures? 3. Can local authorities implement and educate community members regarding pest control measures and the importance of keeping houses and villages clean? 4. How much investment is directed by Mongolian authorities towards the prevention of plague outbreaks? 5. How can international partners assist Mongolia in alleviating the plague burden? 6. Can there be a more downstream public health policy introduced in Mongolia regarding the plague?
<p>References</p>	<ol style="list-style-type: none"> 1. Azernews. Azernews. 2023 [cited 2023 Nov 26]. Patient with suspected bubonic plague admitted to hospital in Mongolia. Available from: https://www.azernews.az/region/211643.html 2. Xinhua. www.xinhuanet.com. 2023 [cited 2023 Nov 6]. Three suspected cases of bubonic plague reported in Mongolia’s capital. Available from: https://english.news.cn/asiapacific/20230814/40273b1bfef54279b690d9f73880ed48/c.html 3. Daashma D. The UB Post. 2023 [cited 2023 Nov 26]. Suspected case of bubonic plague registered in Zavkhan Province. Available from: https://theubposts.com/suspected-case-of-bubonic-plague-registered-in-zavkhan-province/ 4. Xinhua. www.xinhuanet.com. 2023 [cited 2023 Nov 6]. Highly toxic pathogenesis of bubonic plague found in W. Mongolia. Available from: https://english.news.cn/20230901/b2f41098fdb949b590ac731cd91bf469/c.html 5. Xinhua. China.org.cn. 2023. Suspected case of bubonic plague reported in west Mongolia. Available from:

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