The Year of the Rat and Public Health

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The Year of the Rat is the first year in the traditional zodiac calendar. According to one version of the myth, the Jade Emperor declared that the order of precedence would be decided by the order of arrival at his party. The rat was tiny in comparison with the other animals, but quite cunning. He tricked the ox into letting him ride on his back. As they approached the finishing line, the rat jumped off and beat the ox “by a whisker,” to become first in the zodiac calendar. Year 2020 will be a “metal rat” in the 60-year cycle of the universe.

Rats have been a major cause of human disease, but in recent decades, they have made a major effort to atone for their past by becoming an important tool in the advancement of medical research and public health. Neurophysiology has relied on the rat brain for research, and the “Atlas of the Rat Brain” with 80,000 citations is probably the most highly cited medical publication of all time.1 Countless millions, probably billions, of rats have made the ultimate sacrifice in medical laboratories around the world to unlock the secrets of biochemistry and pharmacology.

Throughout history, rats have been associated with epidemics of plague, Yersinia pestis infection, causing pneumonic and bubonic plague in small animals and humans. It was spread by fleas from rats and other small animals. One of the earliest articles in this journal gave a comprehensive account of the history of human plague epidemics, dating back more than three millennia.2 The history of the development of theories related to transmission of plague from the rat to humans has been documented by Hardy.3 She has thrown some doubt on the role of rats coming off ships in the chain of causation. Plague has traditionally been linked to rats coming off ships as they come into port, but it is possible that it may have been transmitted by fleas or rodents hitching a ride on grain wagons. Pneumonic plague can certainly be transmitted from human to human, but it is also possible that humans may have carried the fleas. Plagues ravished the world in the Middle Ages, were universally feared, and were able to rapidly devastate populations. In the 14th century, the “black death” or plague swept across Europe causing an estimated 50 to 200 million deaths. In the period 1347 to 1350, it is estimated that one-third of the population of Europe died of plague. The same epidemics occurred in other parts of the world, but are less well documented. In Europe, plague spurned an array of beliefs and superstitions and has left a large legacy of legends and monuments.

Perhaps best known is the story of the “Pied Piper of Hamelin,” set in small town in western Germany and recorded in many stories, poems, paintings, and even music, ballet, and opera.4 The events on which the story was based probably occurred in the 13th century when the town of Hamelin was suffering from a rat infestation. A wandering musician came into town, a piper dressed in multicolored (“pied”) clothing, claiming to be a rat-catcher. The mayor promised to pay him well, if he removed the rats. The piper played his music, the rats came out and he led them into the Weser river where they all drowned. But the mayor refused to pay. The piper was very cross, and while all of the adults were at the church, he played his pipe again and led away all of the children of the village and they disappeared forever. This became a morality tale for children: “keep your promises and pay your debts.” Now a popular tourist destination, the city streets have many small bronzes of rats peeking out from their buildings. Bungelosenstrasse (“street without drums”) is believed to be the last place where the children were seen. Ever since, music or dancing is not allowed on this street. Each year, the city marks June 26 as “Rat Catcher’s Day.”

Plague continues to be a public health problem, and every year, there are thousands of sporadic cases reported. The World Health Organization estimates that 3248 people contracted bubonic plague in Asia, Africa, and the Americas between 2010 and 2015.5 In November 2019, the China Center for Disease Control and Prevention reported that three sporadic cases had been hospitalized in Beijing and there remain several other foci in our region.6

One of the greatest art museums in the world is “The Hermitage,” housed in a number of palaces on the banks of the river Neva in St Petersburg, Russia. Located near a major seaport, the noble residents were frightened of the arrival of the plague and kept many cats to eat any disembarking rats. In the entrance to the Hermitage, with its priceless art collections, is a bronze statue of a cat to celebrate these public health warriors. The museum still employs a “keeper of the

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cats” who watches over the 150 or so cats who can be seen sleeping in warm spots under the paintings and sculptures. The cats have become a feature of the museum and there are several books that have been written about them. Rats also feature as the villains in one of the most popular classical ballets, Tchaikovsky’s “Nutcracker,” which was premiered one week before Christmas in 1892, in the Mariinsky Theatre in St Petersburg.

Aside from plague, rats are involved in the transmission of other human diseases. Leptospirosis is spread by contact with urine from infected animals, usually rats, and remains one of the major zoonoses. It is a continuing public health problem in our region.8,9

Rats love to live near people. They enjoy foods that are left lying around and the many habitat opportunities open to them. They enjoy the opportunities offered to them in our cities, and the continued urbanization of the world means infestations will be a continuing problem. In major cities, rat bites cause significant morbidity and even the presence of rats playing in your ceiling causes psychological problems.10-12

Rats are everywhere, and with climate change, warming and growing populations will continue to increase in cities and in populated rural areas.13 Public health workers, particularly, often have close encounters with rats. When undertaking field trips in remote areas and living in local villages with houses made from bush materials, I (CWB) would travel with a pair of rat traps in my backpack. They were usually put to good use overnight.

Plague has killed hundreds of millions of people in history. It was the potential to be developed into a highly potent biological warfare agent, and during the Cold War, it was listed as a potential agent.14 Attempts at developing a vaccine have so far not been very successful and work continues to develop improved versions.15 There is also potential for rats to feature in new and emerging diseases.15 There have been reports from Europe and the United States of Seoul orthohantavirus infection in pet rats and their owners, and this suggests a potential new public health problem. As there is a large rodent reservoir throughout the world, there is always the possibility of a new infection shifting from animals to humans.15 The urban heat islands (modern cities) represent an example of the numerous potential environmental changes caused by urbanization that can affect distribution and prevalence of zoonotic and vector-borne diseases in cities and suburban areas.16

Plague and rats were part of the profile of international infectious disease that led to the development of the quarantine movement. This became the basis of modern public health. In the tradition of the zodiac, rats are said to be independent and imaginative. Let us hope that 2020 is a year of advancement for public health and that we apply imagination to bring health to all of the people in the Asia-Pacific region.

References