

Microbiology research paper

[Environment](#), [Animals](#)



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Abstract

For many years, human beings have continued to suffer from diseases, both the kind caused by their own bodies as their age degenerated and the kind caused by infectious pathogens. During this time, human beings have constantly developed new ways of eating and living, and actual genetic or physical changes have evolved with the aim of minimizing the impacts of these diseases. This paper seeks to examine the issues of societal/cultural changes, the origins of human diseases and bioterrorism. This includes examining historical societal/cultural changes for human evolution are responsible in transmission of diseases to human beings 14 to 10000 years ago; distant historical original animal reservoirs of disease that humans eventually contracted; the conditions that contribute to the spread of human diseases today and the factors that terrorist groups would need to consider in determining the biological agents to use in attacks.

Question 1: What were the distant historical societal/cultural changes for human evolution that resulted in the transmission of diseases to humans 14-10, 000 years ago? Explain at least two changes.

There are major historical changes for human evolution that led to the transmission of diseases to human beings 14-10000 years ago. These include population dispersal around the world and the subsequent inter-population conflict contact. These two main changes can be traced since the emergence of agriculture and livestock herding around 10000 years ago. For many years of evolution history, human populations lived in diminutive, lightly settled groups. During this Paleolithic period, population size and

density remained low. Following the Neolithic revolution, there was a dramatic increase in population size and density. Thus, the way of life shifted from hunting and gathering to agriculture. Since this restricted movement of people, one would assume that there would be no transmission of diseases. However, in context of the dynamics of infection, the low population density of hunting and gathering societies was not conducive to the reproduction of diseases at endemic levels (Lin & Barnes, 1996). Therefore, the change from nomadic hunting and gathering way of life to sedentary domestication enabled pathogens to adapt to humans as host populations.

First, the reliance on agriculture increased the incidence and the impact of disease sedentism. This conceivably increased the spread of parasitic diseases by contact with human waste. In hunting and gathering groups, the frequent movements of people would lessen their contact with human wastes. However, in sedentary populations, the closeness of habitat zones and waste disposal sites to water points creates a source of contamination. Second, animal domestication created a firm supply of vectors and larger contact to zoonotic diseases. Animal domestication intensified 10000 to 7000 years ago. The zoonotic infections most likely increased because of domesticated animals such as sheep, goats, cattle, fowl and pigs and other unwanted animals such as rodents which created permanent habitats around human dwellings (Roberts, 2010). Therefore, the rise of complex societies and major changes in human civilization and evolution led to the transmission of diseases.

Question 2: What were some distant historical original animal reservoirs of disease that humans eventually contracted? List at least four animals and

the diseases that were thought to be transmitted from those animals to humans.

There were many distant original animal reservoirs of disease that humans eventually contracted. Like mentioned above, the zoonotic infections increased because domestic animals and unwanted domestic animals developed permanent habitats in and around human settlements. At the same time, products of domesticated animals such as hair, milk and skin, as well as the dust raised by the animals could transmit Q fever, anthrax, tuberculosis and brucellosis. For example, Frank Livingstone observed that the agricultural culture of slash-and-burn practiced in West Africa exposed people to *Anopheles gambiae* (Sattenspiel, 2000). This is a mosquito whose bite causes malaria. The presence of domestic animals increased human contact with insect vectors that carried yellow fever, filariasis and trypanosomiasis.

Several diseases have been known to be transmitted from animals to humans. According to Roberts (2010), such diseases are known as zoonoses. These are caused by bacteria, fungi, viruses, protozoa and parasites. One common infection is anthrax which is caused by the *Bacillus anthracis* micro-organism. The mode of spread of anthrax was animal contact with goats, sheep and cattle. The other well known disease is Malaria which enters humans through a feeding bite of the female anopheles mosquito. As such, this is another disease that was transmitted by a protozoon. Anthrax and malaria are thought to be responsible for some of the great plagues in history. Another disease is the bubonic plague which is caused by bacillus. According to Love (2010), the bubonic plague is transmitted to humans by

the black rat's principal flea known as *Xenopsylla cheopis*. Also, rodents are responsible for the spread of Hantavirus, a life-threatening disease.

Question 3: What are conditions today that contribute to the spread of human diseases? Include at least four conditions with examples of how they can/could affect the spread of human diseases.

Several conditions contribute to the spread of diseases among humans. This spread can be attributed to many factors. One factor is the presence of carriers in the population. A carrier is something or someone who harbors the pathogen and spreads it to other individuals. For example, an individual can harbor the HIV virus for years without showing any signs of AIDS.

Therefore, human carriers end up transmitting pathogens to other humans unknowingly. In other cases, the carriers are not human. For example, mosquitoes harbor pathogens that cause malaria. However, it is the mosquito that spreads the disease. The second factor is population patterns. This has to do with where and how people live and interact with other people. This is also coupled by population densities or the number of people who inhabit a certain area. For example, people who live in close proximity in areas such as cities are likely to spread an infection than those who live in the less populated rural areas (Goodyear, 1998). This is because there is less person-to-person contact.

The third factor is hygiene and sanitation. Lack of proper hygiene and sanitation services such as water and sewerage services is responsible for the spread of diseases especially in slum areas. Common diseases that might result from this factor include cholera, typhoid, dysentery and malaria. For example, lack of drainage facilities leads to stagnant pools which form

breeding sites for mosquitoes. Mosquitoes are known to spread malaria. Population dispersal and migration patterns have also been blamed for the spread of diseases. For example, HIV is said to have been spread by a traveler known as Gaetan Dugas who is described as patient zero. Similarly, diseases such as SARS and swine flu have also surfaced in the news as being spread by traveling persons. The fifth factor is climate change. Global warming and climate change have an effect on infectious diseases. According to Naicker (2011), insect vectors are extremely sensitive to climatic temperature variability. Sand flies, ticks and mosquitoes are ectothermic and thus have life cycles which depend on ambient temperatures. Therefore, disease transmission is likely to happen if there are alterations at the extremes of temperature. For example, temperature has a direct impact on mosquitoes. It increases activity, reproduction and therefore increases frequency of blood meals and faster digestion of blood. Therefore, climate changes usually affect the conditions under which pathogens thrive and thus lead to disease transmission.

Question 4: What are the factors that a terrorist group would need to consider in determining what Biological agents to use in an attack?

Biological agents can be described as toxins or pathogens that can debilitate or cause death to people, crops and livestock. Thus, a biological attack is the intentional release of biological substances that can have sickening effects.

There are several factors that a terrorist group would need to consider when determining the biological agent to use in attack. First, they have to be aware of the delivery method that they intend to employ. Delivery methods include aerosols (dispersing biological agents into air), animals (spreading

through animals and insects), food and water contamination and person-to-person contact. Second, they need to be able to identify the various types of biological agents that can be used for an attack. There are lethal agents such as Lassa, Ebola and other viruses which lead to viral hemorrhagic fever, smallpox virus, inhalation anthrax, purified protein toxins and pneumonic plague (Shea & Gottron, 2004). Then there are incapacitating agents which cause Q fever, brucellosis, tularemia, mold toxins and mycoplasmal infections. While lethal agents are fatal, incapacitating agents often cause chronic illnesses. The other factor is the weather effects on biological agents. Sunlight, humidity, wind, temperature gradient and precipitation have effects on biological agents. Another factor is the persistence of biological agents. This has to do with the duration of effectiveness of the agent. Persistence varies greatly between agents and thus terrorists should be able to take this into consideration when choosing the agent.

References

- Goodyear, L. N. (1998) *Factors Affecting the Spread of Disease in Human Populations*. New Jersey: Prentice-Hall.
- Lin, J. & Barnes, K. C. (1996) *Disease in Human Evolution*. National Museum of Natural History Bulletin for Teachers, Vol. 18, No. 3, pp. 1-6.
- Love, S. (2010) *Zoonoses: Animal Diseases Transmissible to Humans*. Primefact 814, March 2010, pp. 1-8.
- Naicker, R. P. (2011) *The Impact of Climate Change and Other Factors on Zoonotic Diseases*. iMedPub Journals, Archives of Clinical Microbiology, 2011, Vol. 2, No. 2, pp. 1-6.
- Roberts, A. (2010, August 8) *The Emergence of Disease in Early World-*

Systems. Retrieved from <http://irows.ucr.edu/papers/irows62/irows62.htm>

Sattenspiel, L. (2000) Tropical Environments, Human Activities, and the Transmission of Infectious Diseases. *Yearbook of Physical Anthropology*, 2000, Vol. 43, pp. 3-31.

Shea, D. A. & Gottron, F. (2004) Small-Scale Terrorist Attacks Using Chemical and Biological Agents. CRS Report for Congress, May 20, 2004, pp. 1-89.