

Background: Zoonotic Diseases

Zoonotic diseases are caused by infections with parasites, bacteria, viruses, fungi, or prions that can be transmitted between animals and humans. Infected animals or humans may serve as carriers of the organism and spread it to others without being sick themselves.

Zoonotic diseases are thought to account for more than 60% of infectious diseases and 75% of emerging infectious diseases in humans. The word “zoo” in *zoonotic* reminds us that the key distinction from other kinds of diseases is the role played by animals in spread of the disease to humans.

Most infectious diseases have a certain degree of species specificity. That is, the disease agent may affect only a few animal species and/or humans.

A key feature of zoonotic diseases is that certain animals serve as a reservoir of disease that can spread to humans. Thus, a key requirement for finding a suitable research paper for simulated peer review is to find a research report that demonstrates that a given disease is actually zoonotic. Often, the early stage of such research comes from detective work, in which circumstances suggest that the disease is zoonotic. For example, if one is bitten by a dog and the person and the dog later become sick with rabies, that strong association suggests that rabies is a zoonotic disease.

But association or correlation are not proof. What kind of evidence serves as proof that a disease is caused by a pathogen transmitted between animals and humans? First, one needs to show that a given suspect organism is necessary for the disease to appear, keeping in mind that a minimal set of conditions and events must occur that are sufficient for the pathogen to be transmitted between animals and humans.

There is no single accepted method to establish a causal relationship between an infective agent and its corresponding infectious disease. Key criteria for establishing that a suspect organism is both a necessary and sufficient cause of a zoonotic disease include:

- A specific exposure to an infected animal creates a specific disease effect in the exposed human.
- The exposure has to occur in time before the effect (for example, disease occurrence).
- Disease rates should decrease after the causal agent has been eliminated or blocked, as by preventing future exposure or vaccination.

The belief that COVID-19 is zoonotic remains uncertain, but genetic sequence data reveals that the closest known viral relative is a coronavirus circulating in horseshoe bats. Experiments show that several animal species are susceptible to COVID-19 infection. Other animals have also been shown to become infected in natural settings when in contact with infected humans. Some infected animals can also transmit the virus to other animals in natural settings. Once a few humans became infected, an explosive human-to-human spread of the disease has created a

world-wide pandemic which will likely persist until a very large percentage of people become immune from surviving infection or effective vaccination.

The COVID-19 outbreak seems to have arisen in Wuhan, China. What was special about this location? This city has “wet markets” that are typically large collections of open-air stalls selling seafood, meat, fruits, and vegetables. Some wet markets sell and slaughter live animals on site, including chickens, fish, and shellfish. The Wuhan markets, for example, had a wild animal section where live and slaughtered species, such as bats and pangolins, were for sale. Typically, such markets are very unsanitary, and splattering of water and blood could readily spread potentially zoonotic organisms to people.



Photo by [Natalie Ng](#) on [Unsplash](#). Note the lack of refrigeration and the close contact of many customers to raw meat.

If such markets are a source for animal pathogens to spread to humans, we can expect a continuing public health problem. Wet markets are found throughout Asia and other parts of the world.

The research report you will review examines the possible animal origin of COVID-19. The purpose of the report is to show how COVID-19 *might have* emerged and why its origin is important to know. The report also reflects the fact that scientific research is not limited to

studies where a hypothesis leads to experimental designs that test whether or not the hypothesis is wrong. While hypothesis testing is the bedrock foundation of science, it is not all of science. The report that you will review organizes what we think we know about COVID-19 and how the authors logically evaluate that information. Such approaches also count as scientific research.