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Cite This:Int. J.of Med. And Clini Tril. 2022, 1, 7-11

Sciforce

International Journal of Medicine And Clinical Trials

Journal homepage: www.sciforce.org

Zoonoses are Dangerous Infectious Diseases

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ARTICLE INFO

Article history:
Received 20220304
Received in revised form 20220304
Accepted 20220314
Available online 20220316

Keywords:
Zoonoses;
Humans;
Environment;
Public Health

ABSTRACT

Zoonoses are a group of infectious diseases, common to humans and individual animal species, that can be transmitted from animals to humans and vice versa. The causative agents of zoonoses are primarily found in animals but can also be transmitted to humans under certain circumstances. Sources of zoonoses can be both domestic and wild animals. Humans can become infected directly through live animals or after consuming contaminated food of animal origin. The severity of the symptoms of the disease in humans can vary from mild symptoms to life-threatening conditions. Zoonoses can be especially dangerous for babies and children, pregnant women, the elderly and people with weakened immune systems. Every year, millions of people get food-borne zoonoses.

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Introduction

The vast majority of human diseases spread between different species of animals [1]. Whereas some of these, for example tapeworms, primarily affect the bodies of those who consume animal products, others can affect everyone, regardless of whether or not they consume animal products themselves. The causes underlying the emergence and the re-emergence of zoonoses are complex. Whereas a detailed overview of these is provided by Ka-Wai Hui , at least four reasons show that the consumption of animal products poses a significant concern. Firstly, the scale of the farmed animals' sector is unprecedented, increasing risk due to the sheer size of the animal population. Secondly, many animals display a high level of genetic uniformity as breeders select for a small number of traits, for example large muscle mass, resulting in a loss of resilience amongst populations and an increased susceptibility to infection. Thirdly, the vast majority of farmed animals are kept in confined spaces, increasing the risks of various infections due to increased contact, stress, and exposure to pathogens. Fourthly, animals are transported faster and over greater distances than ever before, increasing the spread of pathogens and reducing our ability to control it.

Environment

Humans and animals all live in some kind of environment [2]. This environment has many parts. First, there is a physical environment, a landscape with natural resources and climate. Secondly, there is a cultural environment, a society with laws and regulations, a political system, customs and other expressions of culture. The cultural environment is particularly salient for humans but it also has a great impact on animals, not least with regard to regulations for human interference with animals. Thirdly, there is a close psychosocial environment consisting of relatives, friends and co-workers in the human case, and of mates, offspring and human carers in the animal context.

This environment influences our lives in many ways, when seen from a logical point of view. First, there is the direct causal influence. There are fundamental positive causal influences from our physical environment; we get our nourishment from nature and we get the necessary warmth from the sun. The climate has a direct physical impact on our bodies, both positively and negatively. The artefacts of human civilization, constituting the cultural environment, are often important positive factors. Houses, for instance, provide us with shelter and protection. Other products of civilization, however, are detrimental. Chemicals in the water and in the air can and sometimes do have disastrous consequences for humans and animals.

A state of welfare is created, affected or annihilated by different combinations of external conditions. To the effect that such a combination of external conditions contributes positively to a person's or animal's welfare we call it a state of external welfare. The simple terms 'welfare' and 'illfare' will in the following denote the internal state of welfare of a human or an animal.

This characterization must now be supplemented. There is an important domain between external and internal welfare. There are not only external conditions of inner welfare, but also a series of internal conditions. It is not only the external world that affects us. We are also, to a great extent, determined by our own physical and mental constitution: how we are constituted of physical and mental elements, our physical and mental strength, our health and our character, as well as our inclinations and interests. Our inner properties are, certainly, continuously affected by the external environment, but there is an important constitutional basis that the environment cannot affect in any other sense than that it can annihilate it.

Public Health

Public health discussions have come to the fore in the last decades, which is laudable because these discussions are focused on prevention of disease rather than only treatment [3]. But in practice, "public health" discussions are so narrowly focused on human health issues that nonhuman animals are dismissed as unimportant.

The connection between "health," "public," and "animals" is easy to identify—it is the important notion of "zoonotic disease" or "zoonosis," defined generally as a disease that can be transmitted from nonhumans to humans. Cases where humans infect nonhuman animals are referred to as "reverse zoonoses." The root of the word zoonosis is the Greek word zoon , "animal." Because humans are as truly members of the "animals" category, as is any nonhuman, transmission of disease between humans and nonhumans is basic biological reality. Thus, transmission of diseases from, say, birds to humans is no more astonishing than transmission of diseases between two nonhuman species.

It has been estimated that as many as 75% of the new diseases that have affected humans over the past decade have been caused by pathogens originating from nonhuman animals, in one way or another. These include not only newly emerged diseases, but some older ones as well, usually called reemerging zoonotic diseases. Some of these problems have spread by various means over long distances and become global problems. Even though many zoonoses are preventable (rabies is an example), they cause many deaths and otherwise impact millions of people every year. Tragically, they affect most heavily the poorest segment of the human population. In addition, zoonotic diseases can greatly impact production of food from nonhuman animals. This has created obstacles to national and international trade, and thus drawn the attention of powerful governmental and private interests.

Zoonoses

Many zoonoses stem from the ways in which farmed animals are treated by human beings [1]. Cows are herbivorous animals, but many cows used to be fed with ground-up remains of slaughtered sheep and other cows, which led to bovine spongiform encephalopathy (BSE), which has also been called—ironically and derogatorily—'mad cow disease'. The causal agent of BSE, a prion, was subsequently transmitted to humans, causing new variant Creutzfeldt-Jakob Disease (nvCJD). Problems also stem from the ways in which human beings manage animal manure, of which there is no shortage. Manure provides a great vehicle for the spread of many pathogens which could subsequently present human health hazards, for example Cryptosporidium parvum, Vibrio cholerae, Enterococcus spp., Escherichia coli serotype O157:H7 (or other faecal coliform bacteria that are pathogenic), staphylococci, and streptococci.

To fight disease, the farmed animals' sector uses a large quantity of different kinds of drugs. Particular concerns have been expressed over the large-scale use of antibiotics. Many antibiotics are used not because the animals are ill, but simply to prevent disease, or the spread of it, as well as to promote growth (by changing the bacteria in the animals' digestive systems so that more nutrients are absorbed). The Union of Concerned Scientists (UCS), a non-profit organisation based in the USA, has estimated that the amount of antibiotics that are used by the farmed animals' sector in the USA merely to prevent disease is eight times greater than that of antibiotics used to treat human disease. Globally, it has been estimated that about half of all antibiotics that are produced are given to farmed animals.

Although some zoonoses are probably unavoidable, much human suffering resulting from zoonotic diseases could probably have been avoided had humans treated animals better [4]. Consider, for example, the wet markets from which an influenza or SARS epidemic could be launched. In these markets live animals of diverse kinds are kept in large numbers and cruelly close quarters ready for sale and fresh slaughter. The concentration of animals, their overlapping sojourns in the markets (allowing disease to spread through vast numbers of animals) and their interactions with humans (facilitating human infection) make these markets ripe for zoonoses. Once an epidemic starts among animals, it can also spread to those animals reared in less cruel conditions.

If humans did not eat wet market animals, there would be fewer of them (because fewer would be bred), the animals would not suffer from being housed in close quarters and they would not be slaughtered. Consequently, the risk of zoonoses would be greatly diminished. In the case of variant Creutzfeld–Jakob disease, humans would not have become infected had some humans not killed and eaten cows infected with BSE. Moreover, BSE would not spread among cattle if humans did not process off al, including neural matter from BSE-infected cattle, to produce feed for other cattle, a practice that was prompted by the volume of cattle that humans eat. If the plausible hypothesis that HIV resulted from simian immunodeficiency virus is indeed true, then the most likely causal route of transmission was through infected simian blood during the butchering of these animals. The butchering itself was most likely for the purposes of providing non-human primate meat ("bushmeat") for human consumption, a practice that continues today.

Livestock, poultry, fish, and other animals can host a wide range of diseases and infections [5]. As a result, the farmed

animal industry has a fundamental public health dimension. When humans consume or come into contact with sick or contaminated animals or animal products, they can get sick as well. Zoonotic diseases, also called zoonoses, are a sub-category of animal diseases that are transferable from animals to humans (in contrast to diseases that pass only from animals to other non-human animals). Many types of pathogenic agents, including bacteria, viruses, fungi, and parasites, cause zoonotic diseases. Some zoonoses, like Salmonellosis (Salmonella poisoning), Foot and Mouth Disease (FMD), and bovine spongiform encephalopathy (BSE or Mad Cow Disease) have made international headlines. Others, like brucellosis (Bang's Disease), are less familiar but still pose a major global threat to animal and human health and well-being.

The exact costs of zoonotic diseases worldwide are difficult to estimate. Consistent data on zoonoses occurrences is scarce, although the World Health Organization (WHO) is working to fill this gap. It is certain, however, that the consequences of these diseases go beyond public health impacts. Zoonoses can cause "tremendous economic losses to the livestock and poultry industries" when animals must be quarantined, slaughtered, or otherwise disposed of in response to disease outbreaks. These costs can lead, in turn, to "devastating sociologic and economic effects on communities" who depend upon affected industries. Therefore, zoonoses threats must be carefully regulated, not only to protect animal and human welfare but also to safeguard social and economic interests. Preventing, monitoring, and controlling animal diseases, however, is no simple task.

Parasites

Parasites are organisms that depend on a host for feeding and reproduction and belong to various unrelated taxa, primarily protozoa, helminths and arthropods [6]. Complex life cycles have often lead to extreme adaptations; nevertheless parasites may harm their hosts and even cause serious disease and death. Transmission of parasite stages can be environmental, nutritional or vectorborne. Among the most important human protozoan parasites in a global context are Leishmania, Plasmodium (both transmitted by bloodsucking arthropods) and Toxoplasma which is soil- or food-borne. Parasitic worms (helminths) relevant for human health include Echinococcus, Toxocara, hookworms (all soil-borne) and Dirofilaria (transmitted by mosquitoes). Various arthropods (ticks, insects) are involved in the transmission of pathogens due to their blood-feeding behaviour. They are especially involved in transmission cycles between animals and humans (zoonotic infections). Research on parasites and their interactions with the host requires suitable animal models. For parasites with a wide host range or those naturally infecting rodent species available as laboratory animals, established models are available. Others, like the human malaria parasites, require sophisticated and often costly genetic manipulation to allow for infection in nonnatural rodent hosts. Alternatively, surrogate models of closely related helminth species in rodent models are used to study human parasites.

Every organism may host several parasite species. Of all animals, humans have the greatest parasite diversity. While coevolution of the parasite with its host leads to adaptation limiting the damage to the host at the cost of parasite control, in a medical and veterinary context many parasites still cause considerable harm and, due to their infectious nature, can threaten human and animal health. Parasites often have complex life cycles which may involve stage conversion, metabolic and morphological changes during development and a switch from one host to another (heteroxenous development). Parasites frequently produce long-living stages that can persist in the environment for months and even years. While certain parasites are specialised on a single host species (stenoxeny), others are generalists (euryxeny) and can infect unrelated host species. Zoonotic infections are characterised by parasite transmission between humans and non-human vertebrates.

Hoarding

The environmental effects of animal hoarding have been described elsewhere and parallel those observed in object hoarding, with the added contribution that derives from the presence of populations of animals and accumulation of their bodily waste and potential for transmission of zoonotic diseases [7]. The health and safety ramifications should be obvious—piles of feces on floors and coating other surfaces in human living spaces, floors soaked with urine, ammonia and dust-laden atmosphere, extensive clutter and crowding, and/or lack of working toilets, electricity, and plumbing. These conditions are not unlike those reported for severe domestic squalor. There have also been many cases where the corpses of dead animals are left to decay in whatever location they died, or systematically tagged and stored in freezers, attics, and outbuildings. Of course not every situation approaches this extreme, but many do, and most, if not all, share some of these features by definition. An exception may be a "rescuer hoarder" or breeder hoarder, who may have a primarily economic motivation and who does not live with the animals, but keeps them separate from his or her dwelling.

Much of what we know or assume about animal hoarders is derived from the considerably more extensive literature about object hoarding, which indeed was sufficiently robust to identify hoarding as a new disorder in DSM-5. A comparative study of animal vs. object hoarding indicates that both are characterized by intense urges to save the animal or object, and extreme difficulty with parting. Both exhibit lack of insight into the conditions and both have strong beliefs about responsibility and control as well as intense attachment. There are some discrepancies about gender differences in treatment samples vs. community samples of object hoarding, but women are overrepresented in animal hoarding. The lack of insight in animal hoarding may be even more severe than in object hoarding. Due to the sanitary issues that necessarily accompany the collection and maintenance of animate beings in a limited space, animal disease, and/or the presence of animal carcasses, the impact on the environment and public health may be more severe.

Flu

Influenzas (flus) are viral diseases that have regained prominence in recent years [1]. Flu viruses are categorised in A, B, and C types. B and C types are relatively mild and undergo changes through antigenic drift, the normal process of flu viruses' genetic mutation. The A type flu viruses, however, also undergo changes through antigenic shift, which involves a rapid change caused by genetic mixing between different subtypes, resulting in the creation of flus that can be relatively severe as human beings may not have come into contact with these new strains before. Though not many people have been killed by recent outbreaks, flus have had a devastating effect on many people in the 20th century through three pandemics: the 1918 ('Spanish influenza') H1N1 virus, the 1957 ('Asian influenza') H2N2 virus, and the 1968 ('Hong Kong influenza') H3N2 virus pandemics. The first one of these was particularly memorable, as it has been estimated to have killed up to 40 million people in 1918–20, or about 3% of the world population. Research has shown that the emergence of these flus stemmed from human interactions with other animals, raising the question whether viral diseases that have emerged more recently in close connection with animal farming practices might trigger disease in large numbers of people. of all the zoonotic pathogens that may escape from the factory farm, influenza A viruses are probably the most worrisome [8]. There are three general categories of influenza viruses (A, B and C) and there are multiple viral subtypes within each category. Human influenza C causes mild disease and has little potential to cause widespread problems. Influenza B circulates only among humans, causes seasonal flu during the winter months and, again, is relatively mild. Influenza A viruses also cause annual flu but can circulate widely among many animal species in addition to humans. Influenza A viruses are classified by subtype based on two proteins on the surface of the virus: the hemagglutinin protein (H) and the neuraminidase protein (N). There are two ways in which influenza viruses can change their proteins. The first is called 'antigenic drift', described as the natural mutation of genetic material over time, which occurs with both influenza A and B viruses. It is associated with seasonal flu epidemics. The second way a virus can change is by 'antigenic shift'. This is a sudden and major change in the virus and occurs only with influenza A viruses. They undergo antigenic shift by rapid mutation of their genes or by reassortment of genes from different influenza A subtypes. The surface proteins of these viruses are continuously under pressure by the hosts' immune systems to reassort and evolve rapidly. Because of their circulation in a wide spectrum of species, there are many subtypes of influenza A viruses, which have a habit of mixing genes and recombining to produce further strains that have never been encountered by the human population. When these antigenic shifts occur, the majority of people have little or no immune protection against these novel strains of the virus. As a result, a pandemic may emerge. Unlike most other zoonotic pathogens, transmission of influenza from person to person occurs swiftly, largely through the respiratory route, leading to influenza being able to infect a large percentage of the world's population in a matter of months.

Wildlife

Anthropogenic activities have been the likely driving factors behind the emergence of some diseases in wildlife [9]. In some cases, animal species whose status may have been threatened by other factors may now be faced with extinction as the emergent disease spreads through a diminished population. The recent spread of two major fungal epizootic agents, namely Batrachochytrium dendrobatidis and Geomyces destructans in amphibians and bats, respectively, could result in the largest changes to vertebrate populations in recorded history. The discovery of these fungal agents as major causes of wildlife epizootics in the past decade has revolutionized the way that biologists approach the detection and diagnosis of fungal diseases, challenging the prior misconception that fungal infections only occurred "sporadically or in small outbreaks" and were more important to captive wildlife, where captivity was thought to "increase susceptibility to these diseases".

As novel pathogens have been discovered, or known ones recognized in novel hosts, in novel geographic areas, or with increased incidence, wildlife conservationists have been faced with the emergence of fungal diseases that threaten the status of wild animal populations. The factors driving disease in free-ranging wild animal species can no longer be easily differentiated from those affecting captive wildlife. The different factors have been blurred into a continuum of factors through modern globalization, inadvertent movement of disease, disease vectors, or animals themselves, through the trade of animals across geographical barriers and the mixing of potential hosts of disease that may not have been exposed to each other in their native habitats. Many of these anthropogenic actions have expanded the geographic range of some diseases or removed the natural barriers that had prevented their spread, exposing naïve hosts to pathogens to which they were not previously exposed. Concurrently, many of the environmental factors thought to predispose their captive counterparts to infectious diseases have been identified and minimized through modern captive animal science aimed at reducing stress levels, providing better environmental conditions, and through better quarantine, improving disease screening and recognition procedures.

The widespread recognition of other fungal pathogens and their prevalence in wildlife populations has also changed the understanding of their role as agents of contagious potential and concern to human public health. Concern to human health from fungal diseases carried or propagated by wild animals has brought attention to the role of wildlife and interactions with humans in changing environments as indicators of global health and ecosystem stability. Direct zoonotic potential or a shared susceptibility to disease where wildlife have a high prevalence of infection is worthy of direct public concern, but fungal pathogens where the infection potential is limited to wild animals still carry an inherent cost to the health of an ecosystem

and carry indirect impacts to human society that may be difficult to quantify.

Conclusion

As pathogenic organisms that can be the cause of zoonoses, organisms of microscopic size such as viruses, bacteria, parasites, fungi or other unconventional pathogens such as prions are most commonly cited. The main symptoms of zoonoses caused by these bacteria are: fever, diarrhea, abdominal pain, weakness and nausea. According to the World Health Organization, about 75% of new diseases that have affected humans in the last ten years are caused by pathogenic organisms derived from animals or products of animal origin. Many of these diseases have the potential to spread in different ways and over long distances and can very easily become a global problem. Some zoonoses, such as rabies, brucellosis, leishmaniasis and echinococcosis, occur continuously in a number of countries, especially in developing countries where they affect the poorest sections of the human population, causing a large number of diseases, which can affect millions each year of which a large number have fatal outcome. Certain zoonoses affect the efficient production of food of animal origin and create barriers to international trade in animals and products of animal origin, and can therefore be said to have an important impact on socio-economic development.

References

1. Deckers, J. (2016.): „Animal (De)liberation - Should the Consumption of Animal Products be Banned", Ubiquity Press Ltd., London, UK, pp. 17. - 21.
2. Nordenfelt, L. (2006.): „Animal and Human Health and Welfare - A Comparative Philosophical Analysis", CABI, Wallingford, UK, pp.159. - 160.
3. Waldau, P. (2011.): „Animal Rights - What Everyone Needs to Know", Oxford University Press, Inc., New York, USA, pp. 119. - 120.
4. Benatar, D. (2011.): „Animals, the environment and global health" in Benatar, S.; Brock, G. (eds): „Global Health and Global Health Ethics", Cambridge University Press, Cambridge, UK, pp. 211. - 212.
5. Couvillion, L. (2017.): „Zoonotic Diseases and Food Safety" in Steier, G.; Patel, K. K. (eds): „International Farm Animal, Wildlife and Food Safety Law", Springer International Publishing AG, Cham, Switzerland, pp. 631. - 632.
6. Walochnik, J., Auer, H.; Joachim, A. (2017.): „Parasitic Infections in Humans and Animals" in Jensen-Jarolim, E. (ed): „Comparative Medicine - Disorders Linking Humans with Their Animals", Springer International Publishing AG, Cham, Switzerland, pp. 178.
7. Patronek, G.; Nathanson, J. N. (2016.): „Understanding Animal Neglect and Hoarding" in Levitt, L.; Patronek, G.; Grisso, T. (eds): „Animal Maltreatment - Forensic Mental Health Issues And Evaluations", Oxford University Press, New York, USA, pp. 171. - 174.
8. Akhtar, A. (2012.): „Animals and Public Health - Why Treating Animals Better is Critical to Human Welfare", Palgrave Macmillan, Basingstoke, UK, pp. 103. - 104.
9. Padilla, L. R. (2011.): „Emerging Fungal Diseases of Wild Animal Species" in Olsen, L. A.; Choffnes, E. R.; Relman, D. A.; Pray. L. (rapporteurs): „Fungal Diseases - An Emerging Threat to Human, Animal, and Plant Health - Workshop Summary", National Academies Press, National Academy of Sciences, Washington, USA, pp. 297. - 298.