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Is animal agriculture increasing the risk of disease and pandemics?

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Zoonoses are diseases transmitted between humans and vertebrates. These are relatively rare but potentially devastating events. About 60% of human infections are estimated to have originated from animals[1], and this phenomenon is becoming more frequent[2]. 75% of new and emerging diseases are zoonotic[3], and most pandemics are caused by zoonoses[4].

Zoonotic diseases can emerge when a genetic change happens which allows pathogens to 'jump' from animals to humans. Some pathogens may even combine genetic material with each other, allowing them to transfer advantageous mutations and the ability to infect animals and humans. This is thought to have occurred for the 2006 'swine flu' pandemic, caused by an H1N1 virus which features a mix of genetic sequences from various human, avian and swine influenza viruses[5]. Increasing demand for animal agriculture may be increasing the risk of new zoonoses forming.

Tens of billions of animals are killed every year for human consumption. How does animal agriculture meet our excessive demand for animal products and profits? How do its practices impact on global disease spread?

Disease becomes more likely when large numbers of genetically similar animals of the same species are kept extremely close together[4].

Even “free-range” hens may be kept with ~13 birds per square metre in the UK[7]. In the US, they simply have to be outside[8]. Livestock are prevented from moving around to prevent wasting of energy that could be spent on growth. Animals have also been selectively bred with genes that make them better products, causing much of livestock to be genetically similar in favour of bigger chicken breasts, or increased milk production[4].

Low genetic diversity in any population increases its overall susceptibility to certain diseases[9], and when animals are kept close together[10], especially in poor welfare conditions where they cannot escape the waste of other animals[11], or are frequently injured, an ideal breeding ground is presented for pathogens to spread and mutate quickly.

One way that the industry has compensated for this is through mixing antibiotics into animal feed and water supplies, leading to overuse[4+12].

Antibiotics are antimicrobial agents produced naturally by bacteria to reduce the competition presented by other bacteria and it is natural for bacteria to develop resistance through genetic changes for this reason[4]. However, our use of antibiotics in modern medicine presents the need to prevent this from happening too often. We are now accustomed to the various campaigns to reduce antibiotic abuse in human healthcare, yet animal agriculture accounted for a third of UK antibiotic use in 2016[13]. Fortunately, many measures are now being taken to reduce the overuse of antibiotics in animals, but while global demand for animal products continues to rise[4], the demand for antibiotics will too.

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Domesticated animals now account for 60% of the land vertebrate biomass of the planet, while wild animals only make up 4%[14].

Humans are the other 36%. This loss of bio-diversity is thought to increase the risk of new zoonoses in a few ways, though this concept is not yet fully understood[4]. One such example is in the spread of zoonotic viruses by mosquitos and ticks – where native vertebrate diversity is high, they feed from a greater variety of hosts, of which only a few are good reservoirs for the virus, leading to fewer infections[15].

Paradoxically, the Increasing demand for land for resource-intensive livestock is in turn increasing wild animal-human interface, which also increases the risk of zoonoses jumping species to humans[4].

Our growing demand for land and resources forces us to further encroach on wild habitats. Cattle in particular require vast amounts of land and crops, which is driving deforestation in places like the Amazon[16]. While habitats decline, wild animals are forced closer to human and livestock populations. This increases contact between livestock, wild animals, and humans.

Many zoonoses are already found in animal agriculture as foodborne diseases, such as salmonella, listeria and campylobacter.

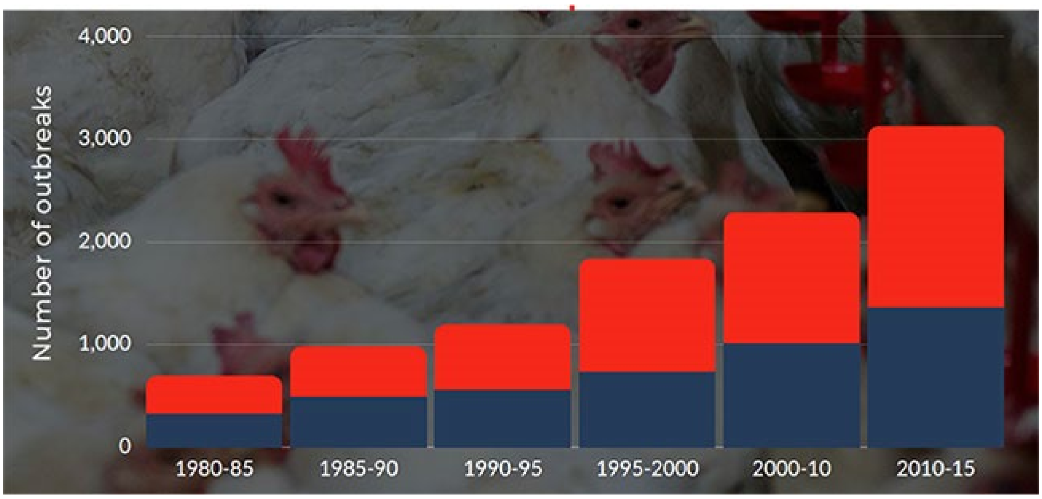
Animals are a major source of foodborne pathogens, even in plants after contamination with animal waste[4]. Animal- sourced foods formed 35% of the global burden of foodborne disease in 2010[17], and 2018-19 saw the largest-ever outbreak of listeriosis after 1000 laboratory-confirmed cases in South Africa and over 200 deaths as a consequence.

So, is animal agriculture increasing the risk of disease and pandemics? The UN seems to think so[4].

In their 2020 report, ‘preventing the next pandemic’, increasing human demand for animal protein was listed as the first of 7 drivers of pandemics and as a contributing factor to other drivers listed, such as unsustainable agricultural intensification and climate change.

It should be noted that in in lesser-economically developed regions with poor food security, animal products serve as an important source of nutrition that goes some way towards maintaining a healthy immune system and thus reducing the burden of disease[4]. Therefore, the answer is not as simple as everyone simply dropping animal products from the diet right now.

However, as we are now well aware, diseases do not respect borders and pandemics are worldwide. If we hope to prevent disease in future, it will take global change in practices, and when both farming livestock and interacting with wild animals appears to increase the risk of disease, it seems ever-more likely that this will have to involve reducing our consumption of animal products.



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Time period

The number of outbreaks caused by zoonoses is rising, including relative to outbreaks caused by human-specific pathogens.

The total height of the bars represents the total number of outbreaks of disease; red area show the proportion of outbreaks that were caused by zoonoses as opposed to pathogens limited to humans (blue area). Adapted from Smith et al., 2014[23].

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