

The issue of Zoonosis

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Introduction:

The Covid -19 Pandemic has been the greatest leveller in modern history. The Pandemic has affected all peoples – the first world and the developing world irrespective of healthcare infrastructure; the affluent as well as the poor; the educated as well as the unschooled.

Scientists and Technological brains who felt they had an answer to all of humanity's healthcare and food problems found themselves floundering to take the right decisions when combating this virus which spread so rapidly defying and ridiculing the modern world. Even reputed Institutions like the World Health Organisation (WHO) were brought under the scanner. Governments that boasted of the best practices found themselves inadequate, forcing them to isolate people from each other and impose harsh restrictions, often causing more fatalities than the disease itself. Countries locked their borders. China, the first epicentre of the pandemic with wet markets was criticised by all.

The big question remained..... How could our technologically advanced world have missed this outbreak?

This brings us to the issue of zoonosis.

Zoonosis (translated from the Greek 'animal disease'), is an infectious disease caused by a pathogen that has jumped from an animal (usually a vertebrate) to a human. The first infected human transmits the infectious agent to others. The pathogens involved in causing Zoonotic diseases may be bacterial, viral or parasitic, or may involve unconventional agents and can spread to humans through direct contact or through food, water or the environment.

Historical background:

The association of man and animals has been observed for ages - In the beginning for the purposes of domestication and food and then later for their potential to cause disease. Science and Medicine have always struggled to keep pace with new manifestations of disease and on ways to prevent illness. Edward Jenner, as early as 1796 found the relationship between cowpox, in building of immunity for smallpox in man. Louis Pasteur in 1885 was successfully able to make a vaccine to immunise humans against rabies.

Though science progressed rapidly since then, we still had uncontrolled outbreaks of disease.

Zoonotic disease can be spread through

Direct contact with the saliva, blood, urine, mucous, faeces, or other body fluids of an infected animal inadvertently by petting or touching animals, and bites or scratches.

Indirect contact with areas where animals live and roam, or objects or surfaces that have been contaminated with germs like aquarium tank water, pet habitats, chicken coops, barns, plants, and soil, as well as pet food and water dishes.

Vectors being bitten by a tick, or an insect like a mosquito or a flea.

Food borne or water borne by eating or drinking something unsafe, such as unpasteurized milk, undercooked meat or eggs, or raw fruits and vegetables that are contaminated with faeces from an infected animal.

Zoonotic diseases are generally classified according to aetiological agents:

Bacterial – including anthrax, brucellosis, plague, leptospirosis, salmonella and lyme disease

Viral – including Covid-19, rabies, arbovirus, yellow fever, influenza and Zika

Rickettsial - including Q-fever

Protozoal – including toxoplasma, giardia and leishmania,

Helminthic – including roundworm, tapeworm and hookworm

Fungal – including cryptococcus

Ectoparasites – including scabies and myiasis

They could also be classified according to the mode of transmission or according to reservoir.

Scale of Epidemics

Epidemics of zoonotic origin have regularly perplexed humans. Statistics have demonstrated that over 60% of existing human infectious disease have animal origin. In the 14th Century, the plague called “**black death**” (bubonic / pneumonic plague) killed over 75 million people, caused by the bacterium *Yersinia pestis* and transmitted from rat to man via rat flea, and then man to man via aerosols. In 1918, **The Spanish flu** caused by H1N1 influenza A virus infected 500 million people. India too, in 1994, was ravaged by plague after an earthquake.

Very recently we had **SARS** (Severe Acute Respiratory Syndrome) with a fatality rate of 9.5% and **MERS** (Middle East Respiratory Syndrome) with a fatality rate of over 34%. Close on its heels came the **Ebola** virus in 2014 passed on from bats or monkeys killing over 11,000 people. **HIV** is believed to have spilled over from chimpanzees to human since it bears a close resemblance to the Simian Immunodeficiency Virus.

Zoonotic diseases have been increasing globally. In 2004, the World Health Organization defined **emerging** zoonoses as those “newly recognized or newly evolved, or that have occurred previously but show an increase in incidence or expansion in geographical, host or vector range”

75% of emerging diseases are zoonotic, with viral diseases being most common. Emerging infections usually prove more threatening because humans have little information about their origin and many of their epidemiological features remain unknown. Many of these have the potential to travel a long distance and affect the world often leaving health authorities unprepared.

There is a lot of talk today about the ‘Spillover’ of pathogens from animal to humans. This is usually a result of an imbalance or a disturbance in the existing relationship between humans and their environment. Some of the recent zoonosis of deadly new or ‘novel’ viruses can be attributed to human being’s foray into the unknown and previously undisturbed forests and habitation exposing humans to new plants, animals and new pathogens.

In last century, viruses of HIV and Ebola started spilling over from animals (chimpanzees and bats, respectively) to humans in the jungles of African continent and can be linked to the consumption of wild meat. The HIV is very similar to SIV or Simian Immunodeficiency Virus, found in the Chimpanzees. It is presumed in the first half of twentieth century, while preparing the meat of a chimpanzee infected with SIV, the hunter had an open wound through which the virus entered his body. It would take the virus half of a century of mutation though to reach its present form of HIV and it is still mutating. The Ebola Virus follows almost the same trajectory of zoonosis like HIV.

We believe that SARS-CoV-2, the virus responsible for present Covid – 19 pandemic went through a similar inter-species spillover.

Origin of the SARS-CoV-2 virus.

Given this background let us try and understand **the Coronavirus and Covid-19 (Coronavirus infectious Disease 2019)**.

Coronavirus belongs to a large family of viruses found in humans and animals. Coronaviruses are known to be evolved in animals and then jump to humans via an intermediate host. Many cases of common cold are due to coronaviruses.

There have been two large scale outbreaks of coronavirus in recent years which are well known. We had SARS in 2002 and MERS in the year 2012. Palm civet cat and racoon dogs were identified as intermediate hosts in SARS and in MERS camels were identified as the intermediary host.

Our current Pandemic disease is called Covid-19 (Coronavirus infectious Disease 2019) and is caused by the virus SARS-CoV-2 (**Severe Acute Respiratory syndrome coronavirus 2**).

The COVID-19 virus has a close similarity of the sequences to that of severe acute respiratory syndrome-related coronaviruses (SARSr-CoV) and the virus uses ACE2 (angiotensin-converting enzyme 2) which is present on the surface of many cell types, as the entry receptor like SARS-CoV.

The SARS-CoV-2 virus is believed to have originated in bats in Wuhan, China. Official hypothesis and the WHO has it, that most probably a bat, or a pangolin that came in contact with food mixed with bat saliva, carried a deadly virus that went through an inter-species spillover and started infecting human beings resulting in first an epidemic and then the current pandemic.

However, there is also a very strong lobby advocating that SARS-CoV-2 is a man-made virus which spilled over during collaborative studies being done in 'Gain of function' research – Government funded research aimed at **increasing the virulence and lethality of pathogens and viruses**.

Understanding the origins of a Pandemic

It is important to map the sequence of events leading to a pandemic, especially those of zoonotic origins. Every pandemic begins with an aggressive disturbance of our environment resulting in human interventions and subsequently encroachments into forested areas. This leads to climate variability, which we are witnessing so often today, and to changes in animal and insect vector distribution. The environment is now conducive to spillovers of pathogens between animal species and humans through the vectors or on account of consumption of meat. With Urbanisation, growth of agriculture, industry and technology comes the influx of migrant populations with increase of population densities making this a suitable incubator for an epidemic.

This epidemic, if not controlled, is easily spread to other countries due to ease of human travel and export of goods and animals giving rise to a pandemic.

Global Initiatives to curb the Pandemic

Being a global crisis, it is important that there is a concerted centralized global response in controlling the pandemic. With the lessons learnt from the Covid-19 Pandemic we know that any effort to stem the spread of a novel disease has to be a joint intervention between all concerned – the local population, the health and agriculture ministries, veterinary and animal health authorities and the government.

The One Health Initiative is an interdisciplinary movement to create collaborations between animal, human, and environmental health organizations. The "One health" approach by the WHO, defined as "an approach to designing and implementing programs, policies, legislation, and research in which multiple sectors communicate and work together to achieve better public health outcomes" has relevance in better disease control. In 2017 WHO incorporated key areas corresponding to three of the significant global health challenges: Food security, Zoonoses control and Antimicrobial resistance.

The World Health Organization, the Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (OIE) have published the Tripartite Zoonotic Guide (TZG) to addressing zoonotic diseases in countries. The Tripartite guide has updated and expanded the 2008 Guide to cover prevention, preparedness, detection and response to zoonotic threats at the animal-human-environment interface in all countries and regions, and to include examples of best practices and options based on the experiences of countries. Although focused on zoonotic diseases, the 2019 Guide is flexible enough to cover other health threats like antimicrobial resistance and food safety.

In the TZG, taking a multisectoral, 'One Health' approach means that all relevant sectors and disciplines across the human – animal – environment interface are involved to address health in a way that is more effective, efficient, or sustainable ensuring balance and equity among all the partners.

Key factors in sustainability of the initiatives include:

- **political will** at the highest level and a commitment and engagement from all relevant sectors;
- **human and financial resources** from domestic sources which need to be sufficient and equitably distributed.
- **strong governance** which has the support of the people.
- **strong and effective health systems** within the individual sectors.
- **routine and effective coordination and communication** among all relevant sectors for planning and implementation;

- **recognizing successes** with documented evidence of improved outcomes so others can also benefit from their experience.

Guidelines for prevention of future outbreaks

The lesson of this Pandemic urges us to use our expertise to Prevent future outbreaks. Experts opine that, given the evolving ecosystems and varied cultures, we will never be able to completely predict or prevent future outbreaks. Prevention methods for zoonotic diseases will differ for each pathogen. Good hygiene practices and standards for clean drinking water and waste removal are recognized as effective in reducing risk at the community and personal levels. Safe and appropriate guidelines for animal care in the agricultural sector help to reduce the potential for foodborne zoonotic disease outbreaks through food. Education campaigns to promote handwashing after contact with animals and other behavioural adjustments can reduce community spread of zoonotic diseases when they occur.

The WHO, the 'World Organisation for Animal Health' (OIE), and the 'United Nations Environment Programme' (UNEP), call on national competent authorities to take immediate actions to regulate and/or suspend the trade in live caught wild animals of mammalian species for food or breeding purposes and improve the standards of hygiene and sanitation in traditional food markets to reduce the risk of transmission of zoonotic diseases.

Authorities are advised to conduct risk assessments to control the risks of transmission of zoonotic microorganisms from farmed wild animals and caught wild animals that are intended to be placed on the market for human consumption. Regulations should address the traceability of farmed wild animals.

There is a need to strengthen animal health surveillance systems for zoonotic pathogens to include both domestic and wild animals, adequately train health inspectors and develop and implement food safety information campaigns for market traders, consumers and the wide general public.

Areas of concern, which remain:

In spite of the best efforts globally, there will always be areas of concern.

Unregulated and non-hygienic wet markets may continue as potential spreaders and ready ground for spillovers. Poor access to hygiene in the developing world is another reality and an area of concern. The irrational use of antibiotics in animals bred for food is widespread and increases the potential for drug-resistant strains of zoonotic pathogens capable of spreading quickly in animal and human populations.

There is always the grave risk of modified and dangerous zoonotic microorganisms being **used as biological weapons**. Sadly, perhaps the most frightening, the non-disclosure or reluctance by governments in this age, to come clean on the outbreak in early stages of the epidemic is something that we will have to contend with.

In the recent past, we have witnessed the effects of climate changes resulting in floods and fires and creating imbalances in the environment exposing newer organisms.

I would like to conclude by stating that in spite of all challenges, humans have demonstrated their ability to overcome the most adverse conditions. It is our belief that Diseases and Pandemics will in no way deter us in building a safer and a healthier world.

Thank you....

Further reading:

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