THE NEXT PANDEMIC: WHEN AND HOW WILL IT COME

Ankit Gautam
Nagpur Veterinary College, Nagpur
Corresponding Author e-mail: mohangautam93@gmail.com

ABSTRACT

Pandemics have shaped human history, and the question is not if but when the next one will emerge. This article explores the potential sources of future pandemics, including zoonotic spill overs, climate change, laboratory leaks, and bioterrorism. Factors such as deforestation, factory farming, and illegal wildlife trade increase human exposure to novel pathogens, while rising global temperatures may awaken ancient microbes or shift disease patterns. The threat of antimicrobial resistance (AMR) is also growing, turning once-treatable infections into deadly threats. Preventing the next pandemic requires early detection, a One Health approach, accelerated vaccine development, global collaboration, and public awareness. Humanity has faced pandemics before and survived but proactive measures are essential to avoid another devastating global outbreak.

INTRODUCTION

COVID-19 was neither the first pandemic nor the last. But when will the next one come? How will we deal with it? Will it be just as devastating? These questions arise whenever we think about future pandemics.

Throughout history, humanity has faced numerous pandemics, each deadlier than the last. From the Spanish flu of 1918 to COVID-19 in 2020, every outbreak has shaken the world. When COVID-19 struck, societies built over millennia came close to collapse. The world was brought to its knees by an invisible enemy, and we were helpless.

But as the saying goes, "A man does what he can." And that's what we did. We fought, adapted, and overcame. Yet, we must win every time, while a pathogen needs only one victory to cause devastation.

Where will the next pandemic come from? Will climate change create new threats? Will a virus jump from animals to humans? Or could a lab accident spark a global crisis? Understanding these possibilities is the first step in prevention.

IDENTIFYING THE SOURCES OF THE NEXT PANDEMIC

1.) Animal-to-Human Spill over (Zoonotic Diseases):

Over 70% of infectious diseases in humans originate from animals. Pathogens evolve rapidly, and recent outbreaks like COVID-19, Ebola, SARS, and MERS resulted from interspecies transmission. These zoonotic diseases will continue to emerge, potentially deadlier than before.

But why is this happening at such an accelerated rate now? Humans and animals have always coexisted, yet the risk is rising due to several factors:

I. **Deforestation:**

- As forests are cleared for urbanization and infrastructure, animals move closer to human populations, increasing human-wildlife contact and the risk of zoonotic spill over.
- Biodiversity loss disrupts ecosystems, reducing natural buffers against disease spread. The "dilution effect" suggests that a bio diverse ecosystem lowers the prevalence of pathogens by limiting the dominance of high-risk hosts.
- Deforestation alters vector dynamics. For example, in the Amazon, deforestation created ideal breeding conditions for mosquitoes, fuelling the spread of vector-borne diseases.

II. **Factory farming:**

- Animals in factory farms are packed tightly weakening their immune system due to stress, poor nutrition and lack of space. This creates an ideal environment for pathogens to grow and evolve.
- Factory farms are often built on encroached land near wildlife which exposes the farm animals to other wildlife diseases.

III. **Illegal wildlife trade:**

- Illegal wildlife trade involves transport of diverse wildlife species to large distances in cramped conditions. This creates a

melting pot for pathogens to jump between species, mutate, or amplify before reaching humans.

- Pangolins have been found to carry corona virus similar to SARS CoV 2 .
- Hunting, butchering, and handling wild animals expose people to blood, bodily fluids, and tissues that may contain pathogens.

2.) Climate Change:

Climate change has always shaped our planet, but industrialization has accelerated it beyond natural balance. In the past decade alone, global temperatures have risen by 0.6°C—seemingly small, but significant for fragile ecosystems.

i. **Rising temperatures:** With global temperatures rising, ancient microbes frozen in Arctic and Antarctic permafrost for thousands of years could wake up. These long-dormant pathogens might evolve, adapt, and potentially spread, posing unknown threats to humans and wildlife. Could the next pandemic come from the melting ice? Time will tell!

ii. **Environmental changes**: Recent environmental shift such as reduced rainfall, droughts, rising temperatures, and food shortages have altered the migration patterns of many birds and animals. Additionally, poaching has disrupted natural ecosystems. These changes increase the risk of disease transmission, as migrating species come into contact with new hosts and environments, creating opportunities for pathogens to spread.

Previously uninhabitable regions may become suitable for the growth of certain pathogens due to environmental changes. Factors like rising temperatures, altered rainfall patterns, droughts, and habitat destruction can transform local climates, creating favourable conditions for disease-carrying organisms. As a result, new pathogens may emerge and spread, increasing the risk of future pandemics.

3.) Lab Leaks and Bioterrorism:

Up until now, most pandemics have been natural, but the same cannot be guaranteed for the future. The next pandemic may not emerge from animals or nature but it could originate from a laboratory in your city or be intentionally unleashed by an extremist terrorist organization.

i. **Lab Leaks**: Many labs worldwide are working on disarming the pathogens and genetically modify them to be able to use them for human welfare but during this process the opposite can happen too. Manual genetic changes can lead to the emergence of better contagious, dangerous pathogens which if leaked from the labs due to even a minor negligence can cause havoc in the world.

In 1977, a strain of H1N1 influenza re-emerged after being absent for decades, with strong evidence pointing to a lab release. This happened then and can also happen in future.

ii. **Bioterrorism**: Terrorism is one of the foremost problems humanity have been trying to solve for last several decades but with modern technology and advancements the terrorists have also become advanced ,they are aware of the potential of these microorganisms which can collapse a well-built society in weeks and they are working towards it too. It's not difficult to say that with enough resources it would not be impossible for terrorists to create a new pandemic similar or more devastating then recent COVID outbreak.

The 2001 anthrax attacks in the U.S. demonstrated how biological agents could be weaponized, while smallpox a virus eradicated from the natural world still remains a potential bioterror threat .

4.) Antimicrobial Resistance (AMR): While we brace for the next viral plague, a quieter, deadlier threat is already here: Antimicrobial Resistance (AMR). It's a slow-motion pandemic, turning once-curable infections into silent killers as antibiotics fail.

- In India, a 2022 ICMR study across 22 hospitals found common germs like E. coli and Klebsiella shrugging off key drugs at rates of 50-80%.
- Globally, the WHO warns that by 2050, AMR could claim 10 million lives yearly, more than cancer today as routine infections become untreatable. Imagine a scraped knee or a simple surgery ending in death. This isn't sci-fi; it's our future until or unless we acknowledge this problem.

PREVENTNG THE NEXT PANDEMIC

1.) Early Detection and Surveillance: Catching a disease before it explodes is everything. Stronger

global monitoring—like radar for viruses—can spot trouble early, giving us a head start to fight back. Think labs, AI, and wildlife checks working 24/7.

2.) One Health Approach: Over 70% of new threats (Ebola, SARS) jump from animals. Borders mean nothing to germs, so doctors, vets, and ecologists must team up. By watching humans, wildlife, and nature together, we stop the next bug at its source—before it's in your backyard.

3.) Vaccine & Drug Development: If all the preventive measures fails then the vaccines and drugs would be our only hope. The focus should be on funding and developing more advanced research facility so that even if any disease is able to penetrate the armour of our preventive measure we would be able to fight it quickly.

4.) **Global Collaboration & Policy Changes**: Pandemics don't know any borders and in this world of extensive globalisation it's not difficult for diseases to cross the border or even continents.so countries and various international surveillance and research organizations should work closely and cooperate to fight with our full strength.

5.) **Public Awareness & Preparedness**: No preventive measures will work if the public is not aware about spotting risks. Workshops should be organized in schools, colleges, and society to aware the population about the potential risks and how to prevent them like hand washing, mask, etc.

Conclusion

Pandemics are not a matter of if but when. With rising zoonotic spill overs, climate change, antibiotic resistance, and the risk of lab leaks or bioterrorism, the next global outbreak could be even deadlier than those before it. However, preparedness is our best defence.

Strengthening early detection systems, investing in research, promoting the One Health approach, and enforcing stricter regulations on biosecurity are crucial steps. Governments, scientists, and the public must work together to prevent, contain, and mitigate future pandemics.

History has shown that we humans can adapt and overcome challenges. But the call of the hour is to take actions.

REFERENCE

Jones KE, Patel NG, Levy MA, et al. Global trends in emerging infectious diseases. Nature. 2008;451(7181):990-993.

Woolhouse M, Scott F, Hudson Z, et al. Human viruses: Discovery and emergence. Philos Trans R Soc Lond B Biol Sci. 2012;367(1604):2864-2871.

Daszak P, Cunningham AA, Hyatt AD. Emerging infectious diseases of wildlife – Threats to biodiversity and human health. Science. 2000;287(5452):443-449.

Gibb R, Redding DW, Chin KQ, et al. Zoonotic host diversity increases in human-dominated ecosystems. Nature. 2020;584(7821):398-402.

Karesh WB, Dobson A, Lloyd-Smith JO, et al. Ecology of zoonoses: Natural and unnatural histories. Lancet. 2012;380(9857):1936-1945.

Hoffmann M, Kleine-Weber H, Schroeder S, et al. SARS-CoV-2 cell entry depends on ACE2 and TMPRSS2. Cell. 2020;181(2):271-280.e8.

Santos J, Nakagawa J, Van Nguyen L, et al. Illegal wildlife trade and emerging infectious diseases: Risks and policy perspectives. Front Vet Sci. 2020;7:582867.

IPCC. Climate Change 2022: Impacts, Adaptation and Vulnerability. Intergovernmental Panel on Climate Change Report. 2022.

Mahmoudi S, Tazikeh-Lemeski E, Oliaei S, et al. Drug repurposing strategies against COVID-19. J Med Virol. 2021;93(2):775-785.

WHO. Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report. World Health Organization. 2022.