

Review Article

Pros and Cons of Infectious Outbreak and Pandemic Driven Ruralisation

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Science and Technology, Jorhat, Assam, 785006, India**Received:** September 24, 2022; **Accepted:** October 28,
2022; **Published:** November 04, 2022**Abstract**

Infectious diseases played a major role and have influenced modern society, culture, and farming practices. The threat posed by emerging zoonoses to the world's economy, health and safety is tremendous and the way Covid-19 pandemic have disrupted the civilisation is a complete failure and exposes the vulnerabilities of twenty first century. The frequency of Emerging Infectious Diseases (EIDs) and there is increased burden of economic loss. The emergence of these diseases is frequently caused by interactions between human, wild animals, and domestic animals as well as by rapidly changing environmental conditions. As pandemic redefines the living style there is different patterns of adaptation of the human beings. This article examines the driving forces responsible for emerging infectious pandemic and its impact on lives and livelihood of people. The preventive measures to tackle with EIDs are explained and how new norms are to be adopted for better co habiting with other species.

Keywords: Infectious disease; Zoonotic disease; Covid-19; Urbanisation; Ruralisation

Introduction

The world has drastically changed with the origin of mysterious disease from the city of Wuhan, China in late December of 2019. There are numerous outbreaks in the twenty first century, Severe Acute Respiratory Syndrome outbreak in the year 2003, Swine flu pandemic in the year 2009, Middle East Respiratory Syndrome outbreak in 2012, Ebola virus disease epidemic in West Africa in 2013-2016, Zika virus disease epidemic in 2015, Nipah Virus outbreak and recent outbreak of Monkey pox virus exposes the danger of ever increasing emerging infectious and zoonotic diseases [1]. There is devastating impact on the lives and livelihood. In the recent times, there is a tremendous growth in digital, technology, global air traffic and change in land pattern usage. Deforestation, urbanisation, biodiversity loss, intensive agriculture and livestock farming, globalisation and climate change are believed to be major driving forces behind increase in emerging infectious and zoonotic diseases. Effect of ongoing pandemic Covid-19 has been disruptive in terms of economic activities, restriction in movement and loss of human lives. From closure of schools to halt in business activities, loss of uncountable jobs, migration, Covid-19 has caused an unprecedented challenge. People who are working in healthcare sectors must endure endless tasks and very long working days. Still, we are in midst of Covid-19 and future is uncertain and the people are adapting to the new norms. Urban population constitutes 80.5 per cent in developed countries and in developing countries 51.1 per cent of total population [2]. There is unequal distribution of resources and disparity in terms of access to facilities and amenities for the urban poor. Covid-19 has affected different strata of society in varied way. This article examines the various factors attributing to emerging infectious and zoonotic diseases, pattern of occurrence, its impact on different sectors and how it is shaping human settlement.

Drivers of Infectious and Zoonotic Diseases

Climate Change

Climate change affects different human pathogenic diseases [3]. Many Emerging Infectious Diseases have their origin in wildlife, and the emergence of such diseases is often due to interplay between human, wild animals, and domestic animals as well as due to rapidly changing climatic conditions [4]. Deforestation, urbanization, construction of new roadways, have all contributed to the ecological events and the relocation of wild animals which are reservoirs for some viruses or bacteria away from human populations results in crossover, mutation and adaptation in different species and emergence of zoonotic diseases [6]. Decrease in biodiversity appears to increase the risk of human exposure to both new and established infectious pathogens [7]. Biodiversity loss and increasing rates of animal trafficking and close contact with wild animal plays a major role in spill over of infectious pathogens. As a result of climate change induced flood and draught there is displacement and migration of livestock and people and increased risk of epidemics. In endemic regions where animals serve as reservoirs, intermediate hosts, and climatic change induce the spread of vectors, humans contract the disease. Temperature, humidity, water bodies, the introduction of new vector species, climate change, rising levels of anthropogenic activity, and the presence of zoonotic diseases in previously unrecognised endemic areas are all significant factors that aids in the establishment of new zoonotic diseases in areas that were previously thought to be free of the disease.

Intensive Agriculture and Livestock Farming

The risk of zoonoses is enhanced by intensive farming methods, the development of agricultural lands being habited by wildlife and close contact with wild animals. Intensive livestock farming is conducive to zoonotic disease emergence. Industrial food animal

production creates distinct ecosystems, which are not always acknowledged as such but may encourage the evolution of zoonotic infections and cross species transmission. Several crucial factors come together in factory farms, creating the perfect environment for the creation of infectious viruses and pandemics. Farm animals are genetically identical as a result of generations of selective breeding for traits that appeal to human consumption and business margins, such as chickens developing larger breasts or cows giving more milk. A virus must typically change in order to account for genetic variances in individuals, which reduces capacity to spread between hosts. However, viruses can easily spread and evolve into more aggressive forms when there are thousands of genetically identical animals [8].

International Travel, Trade and Globalisation

International travel and Globalisation: Global travel has increased significantly. Travel and migration of people plays a significant role in the emergence and spread of infectious disease [9]. As a result of tourism and business travel there is introduction of epidemic diseases to places which were not prevalent earlier. There is also risk of exposure to different microbes and to act as carrier of infectious diseases. Pet travel to and from endemic countries also introduces zoonotic diseases.

Global trade and supply chain: The way by which food is transported from the farm to the table can have a significant impact on the economy, the environment, and on our health. Animals imported for commercial trading pose a serious threat to public health [10]. One of the major factors responsible for zoonotic disease emergence is the trade in wildlife and particularly bush meat. Trade and transportation of animals to different cities where there is a greater potential for human-to-human transmission may increase the probability of zoonotic disease outbreaks dramatically [4]. Transport of frozen meat and dairy products have increased substantially and it is also aiding in pathogen survival and emergence.

Pattern of Zoonotic Disease Occurrence

Zoonotic diseases played an important role on human civilization throughout history and have influenced modern society, culture, and farming practices. A Zoonosis is any disease or infection that is naturally transmissible from vertebrate animals to humans [11]. More than 6 out of every 10 known infectious diseases in zoonotic in nature, and 3 out of every 4 new or emerging infectious diseases in human come from animals as estimated [12]. They are caused by a variety of arthropods, helminths, protozoa, bacteria, and viruses, and they can result in significant pathological conditions in affected animals, as well as have a negative impact on affected humans. Approximately 60% of human diseases are zoonotic and at least 75% of the emerging pathogens of human infections are of animal origin. Emerging zoonoses are an immense and growing threat to global health, economy, and safety and example of ongoing SARS-CoV-2 pandemic is a testimony of that. Multiple studies suggest that the frequency of EIDs and their economic burden are in the increasing trend. Zoonotic diseases spread via direct contact, indirect contact, vectors, food, and water. Even before the current pandemic, it was estimated that zoonoses are responsible for 2.5 billion cases of human illness and claims 2.7 million human lives every year. Zoonotic diseases pose critical threats to global health security. India ranks 4th in highest zoonotic disease burden with wide spread disease occurrence. Recent

Emerging Zoonotic diseases include Plague, Nipah virus outbreaks, Ebola Haemorrhagic fever, Zika virus, African Swine fever, Noro Virus, and SARS-CoV-2 virus (Covid-19). If we look back into the history major zoonotic disease have occurred through the years. One of the worst human illnesses of all time was the plague. The Justinian Plague, the first epidemic, started in the Byzantine Empire in the middle of the 6th century. The pandemic claimed the lives of up to 25 million individuals during a 200-year span. The second pandemic, sometimes known as the Great Plague or the Black Death, struck Europe in the 14th century [13]. The Great Plague originated in China and spread through Asia and Europe along well-known trade routes, ultimately eradicating millions of people and eradicating 60% of the population of Europe. Beginning in China in the late 19th century, the third epidemic, often known as the Modern Plague, eventually claimed 10 million lives globally [14]. Bovine Tuberculosis caused significant death in 19th century in Europe and North America. Over 65,000 people died in Great Britain between 1912 to 1937 alone due to this infection. The 1918 Spanish flu was the most severe pandemic in recent history. It was caused by an H1N1 virus having avian origin. It is estimated that about 500 million people or one-third of the world's population became infected with this virus [16,17]. The number of deaths was estimated to be at least 50 million worldwide. In February 1957, a new influenza A (H2N2) virus emerged in East Asia, triggering "Asian Flu" and was first reported in Singapore in February 1957, Hong Kong in April 1957, and in coastal cities in the United States in summer 1957 and 1.1 million people lost lives worldwide. A novel H3 hemagglutinin and two genes from an avian influenza virus, as well as the N2 neuraminidase from the 1957 H2N2 virus, were present in the influenza A (H3N2) virus that produced the 1968 pandemic and it was first noticed in the US. One million deaths were thought to have occurred worldwide [12]. Although scientists believe severe acute respiratory syndrome (SARS) began in China as early as November 2002, the first case of the SARS was recorded in Guangdong, China, in February 2003. It eventually expanded to nations in North America, South America, Europe, and Asia after a few months. It caused 8,098 infections and 774 fatalities worldwide [15]. A novel H1N1 strain that started in Mexico and then spread to the rest of the world is what led to the 2009 swine flu pandemic. Swine flu killed 1,51,700 - 5,75,400 individuals worldwide in a single year, infecting up to 1.4 billion people. Between 2014 and 2016, Ebola ravaged West Africa with 28,600 reported cases and 11,325 deaths. The first case was reported from Guinea in December 2013, and then the disease quickly spread to Liberia and Sierra Leone. Subsequently there is report of incidence of emerging ZD in different countries Nipah Virus, Noro Virus is few to be named. On July 23, 2022, Monkeypox was declared a Public Health Emergency of International Concern (PHEIC) by WHO. As of 23rd September 2022, total of 64153 monkey pox cases is reported.

Effect of Zoonotic Disease in Supply Chain

Zoonotic diseases put additional burdens on the livestock sector and multiple sectors suffer economic losses. As a result of ZD there is indirect loss due to decrease in milk yield, draught capacity, low quality of wool and skin produce and other by products which is not even calculated. Import of meat, dairy and animal's produce is banned and there is huge economic loss. When there is occurrence of any ZD or Emerging Infectious diseases whole chain of producers, consumers and suppliers is affected. A recent example is of occurrence

of African swine fever in North East India, where pigs are culled and there is a loss to the tune of 117 crore in the year 2021 in the state of Assam. It destroys the whole infrastructure developed and takes years to build up the progress reached and ultimately loss of many years of hard work. Human-animal interfaces pose disease risk, an estimated 99% of all human cases of recurring zoonoses come from domesticated animals and their products and within human-dominated environments, either through direct transmission or via food and water systems or vectors [18-21]. However, the danger of disease transmission might potentially accumulate in supply chains where wild animal specimens frequently mix with domestic animals in confined spaces or under ill management in filthy environments [21].

Effect of Zoonotic Disease in Food Industry

Various factors, such as pathogen behavior, rapid population growth, and increased international trade in foods and farm animals from nations where appropriate microbiological safety procedures are not being followed or adhered to, have contributed to the increase in the risk of food-borne zoonotic illness. Due to improved packaging and transportation, pathogens can survive for longer period can infect humans and can also leak to environment. A change from low to high protein diets, such as those based on meat and fish products, has also raised the likelihood of food-borne zoonotic diseases occurrence. Additionally, the accelerated movement of people makes it easier for viruses to spread. These elements have intensified the degree of foodborne illness. Many emerging infectious diseases origin is zoonotic in nature. While wild animal reservoirs have received a lot of attention, most zoonotic diseases that are currently a threat to human health either originate in or are spread to human populations by domesticated animals bred for food. Thus, the natural habitats and populations of wild animals and the anthropogenically regulated habitats and populations of domesticated species make up the ecological background of developing infectious illness. Systems of intensive food animal production and the value chains that go along with them are prevalent in industrialized nations and are becoming more significant in emerging nations. These systems are distinguished by the intensive confinement, high throughput, and quick turnover of huge numbers of animals. Public health, socioeconomic progress, and international trade are constantly threatened by Food-Borne Zoonotic Diseases (FBZD). Food infected with harmful germs like bacteria, parasites and viruses and their toxins can cause more than 200 documented ailments in humans. The World Health Organization launched a project to determine the Food-borne illness burden worldwide 31 food-borne illnesses reported by zoonotic pathogens caused projected about 600 million illnesses and 4,20,000 fatalities from FBZD zoonotic dangers in 2010 [11]. Food-borne zoonotic diseases cost India about Rs. 1,78,100 crore or around 0.5% of the Gross Domestic Product (GDP) every year [23]. It is estimated that the current FBZD burden in India represents about 100 million cases per year. This corresponds to one in 12 people falling ill, which could be an underestimate as not all the cases are reported or recorded, and detailed information on the economic costs of food-borne diseases are largely missing. Unestimated economic loss due to zoonoses will be in billion dollars. There is economic loss due to reduced productivity, import restrictions. Brucellosis alone has contributed to loss of 30-million-man days and economic loss of Rs. 24 crores a year

in India.

Impact of Covid-19 in Urban and Rural Areas

Covid-19 pandemic has hit urban areas and rural areas differently. Urban areas connected globally were exposed to the pandemic first. In urban areas, poor people with crowded living and deplorable working conditions have suffered worse health outcomes. Gradually, Covid-19 started spreading to rural areas; older and less healthy populations often suffered with limited healthcare capacity. Migrant labor force constitutes a major percentage of urban poor. Migrant population constitutes 3.5 % of the total world's population [22] and India has highest migrant population (17.5 million) in the world. As Covid-19 has disrupted economic activities, people started going back to their own countries and native places. Not only the poor have returned to their origin but also the affluent have started relocating to remote places in search for a safe dwelling. Remote working policy and trauma and fear of abandonment will play a major role in migrant workers and a major percentage will not return to the cities. Urban and rich people are in search of a secure place and will start relocating to remote areas. Working remotely has become a new normal and this will increase migration to rural areas. These factors together will contribute to reverse migration trend. There will be obvious impact on the economy, education, and health sectors. Urban structure is characterized by diverse and dense population, huge disparity in income, access to hospitality and entertainment, global experience in education and ease of communication. A city provides well developed infrastructure and ultra-luxury to a section of people but a parallel hardship is borne by the urban poor and slum dwellers. Most of the cities are developed only focusing on economy and growth, no attention is paid about the necessities of the urban poor. Urban poor are exposed to toxic air, lives in congestion with poor housing conditions, clogged drainage, poor health facilities and are prone to infectious and communicable diseases like tuberculosis. Covid-19 has visibly exposed the lacunae and the urban poor were affected very badly. Due to lockdown and social distance measures followed they lost livelihood and had no access to standard living with necessities. With no savings in hand, desperation to return to their natives is well documented. Similar fate was observed with migrant workers engaged in construction and small industries, working in foreign countries. When Covid-19 started spreading at global level, affluent people started isolating themselves in safe places and many relocated to remote places. This has become a pattern and people will prefer settling in rural areas. When reverse migration is taking place there will be changes in demographic, housing pattern, business activities and operation. As the people has started moving out of big cities there will be less demand for owning houses, renting properties, public transport, and retail chain supply. People will look out for amenities, open spaces and demand for staycation will increase. People will like to move to sub urban and infrastructure can be developed accordingly.

Cities and village thrive in different capacities. Business activities, Hospitality industry, Industrial hub, educational activities, and Hospital tourism are the main driving forces in urban areas. Agriculture and livestock rearing are the main activities of villages. Urban areas and rural areas have their own sets of advantages and disadvantages while dealing with Covid-19 pandemics. Rural areas have served as a safe dwelling place during Covid-19 times, supplying essential agricultural goods but due to lack of advanced hospital

and support care, elders faced hardship and inadequate internet connectivity remotely working class had difficulties.

Building Rural Economy and Reruralisation

Every crisis has opened opportunities and given an impetus to become resilient. As a result of pandemic, it will change the consumption and production pattern, many new norms like working remotely, many will opt to return to a rural living experience. They will prefer to reduce their debt, acquire a quiet and nicer home and living close to nature. This population migration will lead to a profound shift in economies, real estate prices, and give a boost to rural small-scale businesses. These factors will shift in economic activities and strategic development of rural areas. The situation can be exploited to reduce migration to urban areas which is already overcrowded and development of circular and green economy. Haphazard and overexploitation of natural resources should be minimized to avert another calamity. Many factors will play crucial role in reruralisation. Internet connectivity will play a major role, access to uncongested and a reliable fast network will determine the success of reverse migration. Various other factors namely transport system, accessibility to education, health facilities and amenities will also be the determining factors in reruralisation. A planned development, keeping in mind about accessibility to internet, transportation, education and health facilities will be the determinant factors in success of reruralisation. Digital transformation will create opportunities for business and a boost in terms of connectivity to rural people to have access to quality education and health care. These developments will avoid remigration of working group to cities. But for migrant laborer careful planning is required to engage them in productive work. Most of the migrant laborers do not have lands or gainful employment. So, business avenues which can engage them like diversified farming, assisted livestock farming in revenue generation and a policy for gainful employment for a long-term effect is needed. Engaging them in rural based industries and activities related to staycation and tourism industry will provide them their livelihood. Incentivized industrialization for non-polluting industries can play an important role for the landless laborer.

As a result of pandemics there is shift in mindset of people, lifestyle and spending pattern. It has opened a new avenue for restructuring rural economy and a comprehensive plan is needed to make it successful. Emphasis should be on development of circular economy by optimal use of natural resources and involving local community. Tourist will prefer to go to secluded places overcrowded places and tourism can be developed in rural areas. This can be exploited to develop staycation home which will play an important role in boosting rural economy by engagement of community and to form a hub for rural development by involving allied industries like handicraft, organic farming etc. For this, a well-connected motorable road will have to be built up for promoting rural living and sustainable development. As there will be room for rural estate development, building of eco friendly houses and green energy like solar energy should be promoted so that both economy and nature remains complementary instead of congested development like cities. Development of manufacturing hub and production factories based on non-polluting renewable type of energy will aid to economy upliftment. Amenities like theatre hall for a small capacity, basic healthcare and educational institute has to be build up for an inclusive

and to aid in stress free living.

Restructuring Urban Areas

Cities mostly thrive on business activities like manufacturing hub, hospitality industry, leisure and entertainment industry, educational hub *etc.* As Covid-19 has started spreading globally business and leisure activities has come into a halt. Restriction in movement has caused reduced travel for business and hospitality industry was affected. Around 2 billion (61 per cent of world's employed population) are informal workforce and are vulnerable [24]. As the people engaged in informal sectors are urban poor and are living in congested houses, unhygienic conditions, deplorable working conditions, limited access to health and necessities due emphasis should be given on developing a policy to safeguard the interest of these poor. They were mostly affected during Covid-19 pandemic without any income and to remain confined in a limited space without access to basic necessities. They were compelled to return to their native places even walking several thousand kilometers by foot. Many will be back to cities due to lack of work in villages and a comprehensive policy is the need of the hour. Care should be taken so that they are paid minimum wages, access to health care and basic amenities, and a policy to take care of minimum needs. Decongestion and redevelopment of cities to have more open spaces and contactless digital service should be prioritized.

There is no doubt that rural living gives limited access to ultra-luxury and amenities but optimal care has to be taken while developing rural areas to avoid any haphazard end and focus should be on sustainable development. It will prevent further migration to cities as well as providing a quality life to the people opting for rural living.

There is an estimated international migration of 280.6 million at mid-year 2020. Immigration will be mostly concentrated to urban areas. Keeping in mind about the changing nature of immigration and emigration pattern rethinking about cities has to be redesigned. Due care need to be taken for rebuilding cities to provide a congestion free living and to reduce pollution. A comprehensive policy for improving the living conditions of migrant laborer and urban poor has to be made so that an inclusive society can be developed. This will not only provide a better living condition but will also prevent disaster like fire and prevent spread of infectious and communicable diseases.

Conclusion

According to public health experts, understanding how this epidemic began can aid in preventing the next one. A thorough awareness of the different methods that viruses spread from animals to people, including farming, herding, selling animals, eating bush meat, and conducting scientific study in the field or in labs. Additionally, identifying the virus's human origin advances our knowledge of how viruses' function, specifically how they jump and adapts to other species. Governments are already being urged by experts to invest heavily in the detection of potential epidemic dangers. The severe economic costs associated with severe health crises have been made clear by this epidemic [26-28]. The severity at which Covid-19 has affected the world is undoubtedly the worst event of the 21st Century. Handling of Covid-19 shows that the world is least prepared to face a pandemic. Each country engages

itself for advancement in technology like robotics, space exploration, preparedness to protect their borders but when it comes to pandemics there is no definite plan. Pandemics are not new to the humankind. Every century one major pandemic has affected the human lives. The last pandemic that affected one third of world population was Spanish flu in 1918 and almost 50 million people were killed by the Spanish flu. Now, the world is in midst of Covid-19 pandemic which has affected 619 million, 6.5 million people have lost their lives and has caused tremendous economic disruption. As contrast to earlier days there is international organization WHO, which oversees the disease prevention and control of pandemics. Initial step to deal with the pandemic is to know the origin of disease, nature of the disease and treatment available. The first focus is containment of disease transmission, treatment of infected persons and to focus on availability of medicines. A general guideline is formulated and is implemented and updated as per the prevailing situation. A pandemic is wiped out in due course or becomes endemic over a period. But there is loss of many lives, disruption in educational, general activities and a major economic halt. The infrastructure, technology and business activities have to be rebuilt. One major Pandemic has hit the world in every century and each pandemic has hit the world in a devastating manner. Although the world is developed to a great extent compared to before but now when the world is in midst of Covid-19 pandemic it bares that the world is least prepared to face a pandemic. It is observed that the countries prepare for war keeping update itself with advanced equipment, updates itself with modern technology and many infrastructural developments. But when the pandemics have occurred it exposes the world that the world is least prepared to face a pandemic. As each pandemic is unique in its characteristics but what is common is it is caused by an infectious agent, mostly involves an intermediate host, and attacks the vulnerable first [29-32]. By keeping in mind these factors, a strategy can be formulated at national and international level so that the world is well equipped to face or avert another pandemic. Mostly pandemics like Spanish Flu, SARS there is involvement of Influenza virus. There can be an International and Country Specific Epidemiology Studies on emerging, re-emerging influenza virus and mutation in disease causing microorganisms. There should be continuous monitoring and a reporting mechanism to address any change in pattern of disease-causing microorganisms focusing specifically from pandemic point of view. It will help to factors involved and immediate intervention to avert major events. As it is seen there is involvement of intermediate host like pigs, bats, flies *etc* due importance should be given in disease management of domesticated animals, control of transmission of disease from wild animals to human. A definite mechanism to address these lacunae is need of the hour and international co-ordination is required. As there is bureaucracy and barrier in knowledge and information dissemination a channel should be created or improvised. In this way people at bottom level will have information how to protect environment and their health. If we look at the public health expenditure it is around 5 per cent of GDP except the high-income countries which is very low keeping in mind the importance of health. By and large it is seen that awareness and importance of public health and hygiene is a neglected area. Each microorganism has varied level of affinity for age groups and population. Few populations are resistant to certain diseases for e.g. People with Blood Group O are protected from dying from severe malaria. There needs to be a definite plan

for identifying the risk factors associated with different population and age groups and a strategy needs to be carried out. Awareness of Health and promotion of healthy habits. Digital transformation for enhanced connectivity and ease of operation of execution of plans [33-34]. Even after a century exact origin of Spanish flu is not found. But the devastation caused by Covid-19 is of same intensity and has the world fared better in handling Covid-19 crisis than Spanish flu? Will it ever be possible to find the source of origin of Covid-19? The only way is to prepare ourselves to face the crisis in a vigilant way with a better health and green world.

As we are in midst of Covid-19 pandemic the data being generated should be used to optimum. Good quality data should be segregated from different sources. Quality data obtained can be put into use for studying employment pattern, critical requirement of manpower in different business activities, migration pattern and distribution of labor force. This can play a crucial role in rebuilding rural and urban areas for a balanced development and as well as for an optimal planning in use of manpower and resources. Focus should be on developing circular and green economy. Internet connectivity, motorable road and access to basic necessities should be the main criteria for rebuilding cities and rural areas. This opportunity of restructuring and reorganization should be done in an optimal way to prevent another disaster and occurrence of natural calamities.

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