BLOCK 4
PANDEMIC DISEASES AND SPREAD

UNIT 10 DISEASE BECOMING PANDEMIC– HOW?*

Structure

10.0 OBJECTIVES

After studying this unit, you should be able to:

- Differentiate between Epidemic, Pandemic and Endemic;
- Discuss the origin and significance of Pandemics; and
- Explain the consequences of Pandemics on health, economy and socio-political issues.

10.1 INTRODUCTION

Infectious diseases spread more easily among humans since the shift from hunter-gatherer to agrarian societies (Dobson and Carper, 1996). Trade between communities has increased contact between people and animals, leading to more zoonotic infections. The subsequent growth of cities, the expansion of trade routes, greater travel, and the impact of human population growth on ecosystems all contributed to the creation and spread of infectious illnesses, increasing the likelihood of outbreaks, epidemics, and even pandemics (Lindahl & Grace, 2015).

Humans have been affected by new illnesses from animal viruses. Raised contact with animals through hunting, animal farming, the trading of goods derived from animals, wet markets, or the trade in exotic pets significantly increased the likelihood of disease transfer across species (Bengis*et al*., 2004). There are 5 phases involved in the transmission of diseases across

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species (Wolfe, Dunavan & Diamond, 2007):

i) The pathogen only affects animals in their natural environment.

ii) The pathogen adapts for human transmission, but not for long-term transfer.

iii) The pathogen undergoes only a few cycles of secondary transmission between humans.

iv) Although protracted periods of secondary human-to-human transmission do not include animal hosts, the illness exists in animals.

v) Only people are affected by the illness.

The likelihood of zoonotic transmission (transmission of infectious disease between species i.e., humans to animals or vice versa)is probably modulated by the pathogen-carrying animal species, the type of human connection with that animal, and the frequency of these encounters. Furthermore, it is hypothesised that changes in temperature and land use are significant factors in the spread of pathogens from wildlife to people (El-Sayed & Kamel, 2020; White & Razgour, 2020). Therefore, it is necessary to establish monitoring programmes that can rapidly detect pathogens that may transmit zoonotic diseases at the interface between animals and humans.

By extending the habitats of several common zoonotic disease-carrying vectors (e.g., *Aedes albopictus* mosquitos, ticks), climate changes also impact the transmission of diseases (such as Dengue, Chikungunya, Zika, Japanese encephalitis, West Nile viruses, and *Borrelia burgdorferi*) (Caminade, McIntyre & Jones, 2019). Epidemics can occur when vector-borne diseases are introduced to non-endemic regions. The spread of disease-carrying vectors is also impacted by the changing land use owing to the rising human population (Kilpatrick & Randolph, 2012). Vector control is typically needed to stop the drivers of transmission to manage vector-borne zoonotic pathogens.

In this Unit, we will describe the key terms and compare *epidemics, pandemics, and endemics*. We will examine the pandemic's origin and implications. It has been observed that Animal-to-human *Zoonotic* transmission has caused most global pandemics. The Zoonotic adaptation progresses from animal-only transmission (stage 1) to human-only transmission (stage 5). Here, the Stage 1 gearbox is animal-only. This discussion will focus on pandemics' effects on health, economy, and society. It is to be noted that the Pandemics can cause short-term and long-term economic impacts. In this context, secondary to fear-induced behavioural changes,and economic growth shocks are negative. However, disease and mortality-induced labour force declines produce shocks. Besides, we will explain how epidemics and pandemics can cause conflicts, weakened nations, population displacement, and societal stress and discrimination.

10.2 EPIDEMIC

The Centers for Disease Control and Prevention (CDC) defines an epidemic as a sudden increase in the number of disease cases in a specific area.

Examples of epidemics include smallpox, measles, polio, yellow fever, and smallpox. An epidemic disease doesn't need to be communicable (Centers for Disease Control and Prevention [CDC], 2012).

An epidemic is when a disease suddenly has a high prevalence. The rise and fall of an infectious disease depends on how easily it spreads from one person to another. When an epidemic has passed, the number of susceptible people in the afflicted host population is so minimal that spreading the illness again won't cause a fresh epidemic. Herd immunity refers to the phenomenon wherein the host population is resistant to the epidemic disease because the parasite population cannot replicate itself in such a host population.

However, the host population often returns to a vulnerable state after an epidemic due to:

i) The decline in personal immunity

ii) The removal of immune individuals by death

iii) Birth-related surge of vulnerable people

The general populace gradually reverts to vulnerability. The interval between successive epidemic peaks varies from illness to disease and is not constant. The term "epidemic" was expanded to describe outbreaks of any chronic illness or condition (e.g., heart disease or obesity) by the late 20th century (Britannica, n.d.).

Figure 10.1: Epidemic Disease
Source: Gallagher, 2022

10.3 PANDEMIC

When a disease spreads exponentially, the World Health Organisation (WHO) proclaims it to be a pandemic (Figure 10.2). This shows that the growth rate is explosive and that new instances are being reported every day. The virus's classification as a pandemic has nothing to do with its virology, population immunity, or the severity of the illness. It denotes that a virus has spread far, affecting several nations and populations (Columbia University, 2021).

A pandemic is an outbreak of an infectious disease with a high prevalence that spreads across a large geographic region and often affects a sizeable section of the global population over many months. It can result in significant economic, social, and political instability and a higher number of deaths and illnesses across a large geographic region. Epidemics, which are outbreaksof disease isolated to a specific geographic area, such as a single nation, give birth to pandemics. Pandemics, especially those involving influenza, sometimes occur in waves, so that a post-pandemic phase, marked by decreased disease activity, may be followed by another period of acute disease prevalence.

Figure 10.2: Pandemic Disease
Source: Gallagher, 2022

Influenza is an example of an infectious disease that may spread quickly among people living in various parts of the world, sometimes in only a few days. Several variables, including illness-causing agent's increasing level of infectiousness, transferring the disease from person to person, and contemporary modes of mobility like air travel, contribute to the spread of a disease. The bulk of extremely contagious diseases in humans are brought on

by ailments that first appear in animals (Rogers, 2020).

The chances of pandemics have grown in the past century due to global travel, urbanisation, changes in land use, and exploitation of the environment. These tendencies will probably persist and get worse.

10.4 ENDEMIC

Figure 10.3: Endemic Disease
Source: Gallagher (2022)

When a disease epidemic is persistent and localised to a single area, it is said to be endemic (Figure 10.3). As a result, disease rates and transmission are predictable. For instance, malaria is endemic in several nations and regions (Columbia University, 2021).

According to an epidemiologist, endemic infection rates do not increase or decrease. Itshows that the fraction of susceptible persons balance out the virus's "basic reproduction number", or the number of people a carrier would infect if the population were susceptible to infection. Common colds are endemic, likewise, as polio, malaria, and Lassa disease. So was smallpox before it was eradicated by vaccinations (Katzourakis, 2022).

Check Your Progress 1

Note: a) Use the space given below for your answers.

b) Check your answer with those given at the end of the Unit.

1) List the phases involved in the transmission of diseases across species.

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2) Differentiate between epidemic, pandemic and endemic diseases.

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10.5 ORIGIN OF PANDEMICS

Most pandemics result from the "zoonotic" transfer of infections from animals to humans (Murphy, 1998; Woolhouse and Gowtage-Sequeria, 2005), and the upcoming pandemic would also be a zoonosis. Both, domesticated animals (such as farmed pigs or poultry) and wildlife can transmit zoonoses to humans. As humans domesticated animals, they encountered a greater risk of exposure to diseases that later played a significant role in history. Potentially high-risk zoonoses, such as avian influenzas, continue to develop from livestock production systems (Van

Boeckel, *et al*., 2012; Wolfe, Dunavan and Diamond, 2007).Human populations have been affected by the emergence of viruses including Ebola, which have evolved from wildlife reservoirs due to activities such as hunting, consumption of wild animals (such as bushmeat), wildlife trade and other forms of interaction with fauna (Pikeet. al., 2010; Wolfe, Dunavan &Diamond, 2007).

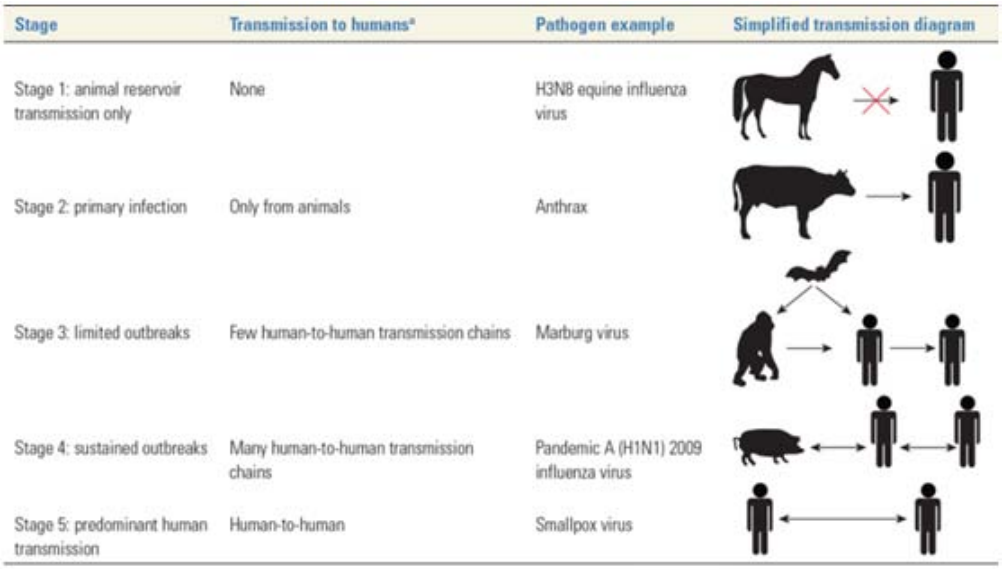

Figure 10.4: Pathogen Adaptation

Source: Wolfe, Dunavan and Diamond, 2007

The capacity of various zoonotic pathogens to persist inside of and propagate across human hosts varies. As seen in Figure 10.4, the degree of zoonotic adaptability ranges along a continuum, from transmission solely within animal populations (stage 1) to transmission only within human populations (stage 5). The majority of zoonotic viruses are not well adapted to humans (stages 2-3), appear sporadic through spillover processes, and may cause limited outbreaks, sometimes known as stuttering chains (Pike, et. al., 2010; Wolfe, et. al., 2005). By giving viruses the chance to improve their ability to propagate among people, these "viral chatter" incidents raise the probability of a pandemic. The most dangerous pathogens are those that have passed stage 3, as they are well-adapted to humans and may create lengthy transmission chains between people (directly or indirectly through vectors), and their global distribution is not restricted by the habitat range of an animal reservoir.

10.6 SIGNIFICANCE OF PANDEMICS

A pandemic can disrupt social, political, and economic order and result in abrupt, widespread sickness and fatality. The Black Death, the Spanish Flu, the Human Immuno-deficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS), and other well-known pandemics have all affected the world.As the definition of a pandemic is inherently tied to geography, it entails a diverse array of distinct threats to public health, each characterised by its severity, frequency and other disease-specific attributes. The best level of readiness and reactivity is required for each type of incident. The wide range of pathogens and their interactions with people drive the multiplicity of

pandemic dangers. Pathogens differ such as the dynamics and mode of disease transmission, the severity, and the differentiability of the accompanying morbidities. These and other elements affect how quickly cases are discovered and contained as well as whether an outbreak spreads (Fraser, *et. al*., 2004). Because of this, pathogens with pandemic potential also differ in terms of their potential health, economic, and socio-political repercussions and the resources, capacities, and mitigation techniques needed.

It is essential to distinguish between various major categories of pandemic threats.On one end of the spectrum are pathogens with a significant potential to trigger genuinely global and severe pandemics. Pandemic influenza viruses are included in this category. These diseases spread easily between humans and can go unnoticed for a long time without symptoms, which makes it hard to diagnose them early. A mild worldwide danger is posed by a second group of pathogens. Although some pathogens (such as the Nipah virus and the H5N1 and H7N9 influenzas) have not shown sustained human-to-human transmission, mutations and adaptation may enable them to spread more effectively in the future. A genuinely global pandemic is not likely to occur because of athird category of infections (such as Ebola, Marburg, or Lassa), although this danger is constrained by the slow rate of transmission or high likelihood of discovery and control.

Offering the most significant threat, influenza has been a semi-regular occurrence since at least the 16th century and has the potential to be the most severe among all known pandemic infections(Morens, *et. al*., 2010). The deadly 1918 influenza epidemic claimed the lives of between 20 and 100 million people worldwide, sparing just a few nations (Johnson and Mueller, 2002). Since there were no vaccinations, antibiotics, or anti-virals available at the time to prevent transmission or mortality, it was severe, which is partly because of the period's poor health technology (Murray, *et. al*., 2006).

Low-and-middle-income countries (LMICs) had significantly higher mortality rates during the 1918 pandemic than high-income countries (HICs), which is probably because of factors such as higher levels of co-morbid conditions and malnutrition, a lack of access to supportive medical care, and higher rates of disease transmission (Brundage and Shanks, 2008; Murray, *et. al*., 2006). With their relatively weaker medical capabilities, restricted access to contemporary medical procedures and heightened interconnectivity among population centres, LMICs would likely experience an even more significant mortality gap compared to HICs in a similar catastrophic incident today.

10.7 CONSEQUENCES OF PANDEMICS

Pandemics can result in both, immediate health effects and long-term health issues.Besides economic repercussions across many sectors, pandemics have also had significant social and political effects.

i) Health Impacts

Pandemic effects on human health can be disastrous. Younger and adult individuals (20–59 Years), more economically engaged populations can

be disproportionately affected by pandemics (Charuet. al., 2011). Because younger individuals have weaker immunity than older people (60< years), which considerably increases the years of life lost, the morbidity and mortality age distributions during influenza pandemics (as opposed to periodic outbreaks of influenza) shift to younger groups (Viboud*et. al.,* 2010). In addition, many infectious diseases can have long-lasting impacts that, in the event of a pandemic, could become more prevalent or pervasive.

Morbidity and death rates may risemuch more because of pandemics' indirect health effects. The lack of access to regular care because of immobility, fear, or other reasons is a major cause of indirect health effects, as isthe diversion or exhaustion of resources for its provision. The concern might lead to some "worried well" individuals seeking unneeded care, adding to the strain on the healthcare system (Falcone & Detty, 2015).

During a pandemic, the number of healthcare professionals decreases as a result of disease, fatalities and fear-induced absenteeism. Healthcare personnel suffer severe effects from viral hemorrhagic fevers like Ebola because they are frequently exposed to infected materials. Even if healthcare providers do not pass away, this may affect how well they treat patients. Up to 40% of healthcare professionals may be unable to report for work at the peak of a severe influenza pandemic because they are unwell, need to care for sick family members, need to care for children because of school closures, or are terrified (Falcone & Detty, 2015; U.S. Homeland Security Council, 2006).

ii) Economic Impacts

Both acute, short-term fiscal shocks and longer-term harm to economic growth can be brought on by pandemics. Early-stage public health initiatives (such as locating contacts, enforcing quarantines, and isolating infected individuals) to contain or restrict outbreaks include large human resources and manpower expenses (Achonu, Laporte & Gardam, 2005). As the outbreak expands, there may be a requirement to build new facilities for handling a rising number of infectious cases. This, coupled with a growing demand for essential supplies such as medical equipment, personal protective gear and medications, can lead to a substantial rise in healthcare system costs (Hersteinet al., 2016).

Reduced tax revenues could worsen fiscal pressures arising from heightened expenditures, particularly in LMICs, where tax systems are less robust and government fiscal limitations are more pronounced. In a mild or moderate pandemic, HICs not directly affected can mitigate economic shocks by boosting official development assistance (ODA) to impacted nations, including direct budgetary support. However, in a severe pandemic, when HICs grapple with similar fiscal challenges and may be hesitant or unable to extend aid, LMICs might experience more substantial budget shortfalls. This could potentially result in a compromised public health response or reductions in government expenditures. However, compared to the indirect harm to economic

activity and development, the direct financial effects of pandemics are often minimal. Labour force reductions brought on by illness and mortality are a direct source of negative economic growth shocks, whereas behavioural changes brought on by fear are a secondary reason. Fear can cause a variety of behavioural changes. As an analysis of the economic impacts of the 2014 West Africa Ebola epidemic noted, "Fear of association with others . . . reduces labour force participation, closes places of employment, disrupts transportation, motivates some governments to close land borders and restrict entry of citizens from affected countries, and motivates private decision-makers to disrupt trade, travel, and commerce by cancelling scheduled commercial flights and reducing shipping and cargo services" (World Bank, 2014). Besides the direct morbidity and death impacts of the pandemic, these effects decrease labour force participation and restrict local and regional commerce.

The quantification of the indirect economic consequences of pandemics has predominantly relied on computable general equilibrium simulations, with comparatively fewer advancements in the empirical literature. According to World Bank economic projections, a serious pandemic may cause a 5 per cent decline in the global Gross Domestic Product (GDP) (Burns, Mensbrugghe & Timmer, 2006). The reduction in demand caused by aversive behaviour(such as the avoidance of travel, restaurants and public spaces, as well as prophylactic workplace absenteeism) exceeds the economic impact of direct morbidity-and mortality-associated absenteeism.

In the event of a severe pandemic, every sector of the economy, including agriculture, manufacturing and services, is susceptible to disruptions. This could result in shortages, swift price hikes for essential goods and economic challenges for households, private enterprises and governments.

iii) Social and Political Impacts

Epidemics and pandemics can lead to conflicts between governments and people, reduce state capability, cause population relocation, and increase social tension and prejudice, according to evidence. (Price-Smith, 2009)

Large mortality shocks and the ensuing demographic changes have been the primary causes of the enormous social and political turmoil that has accompanied severe pre-modern pandemics. Most significantly, the fatalities brought on by introducing smallpox and other illnesses to the Americans directly contributed to the dissolution of many indigenous civilizations and undermined the institutions and military might of the native peoples, making them more open to European invasion (Diamond, 2009). Because advances in treatment and prevention have lessened the potential mortality shock, subsequent pandemics have not had the same drastic impact on social and political stability.

There is evidence to support the notion that pandemics and epidemics can exacerbate already present political tensions and ignite unrest,

especially in fragile governments with a history of violence and weak institutions. Persistent breakouts might causelonger-lasting and more difficult political conflicts in nations with high levels of political division, recent civil wars, or weak institutions.

Pandemics may affect state capacity in the long run (Price-Smith, 2001). The HIV/AIDS epidemic is one such illustration. Extremely high HIV/AIDS prevalence rates in African armies during the 1990s and early 2000s had a negative impact on military capability, preparedness, and absenteeism (Elbe, 2002). Similar outcomes might reduce a state's ability to control instability during shorter, more severe pandemics. The possibility of civil war and other violent conflicts may increase if security forces deteriorate (Fearon & Laitin, 2003).

Infectious illness epidemics on a large scale have immediate and indirect societal effects. For instance, a large-scale public panic during a disease outbreak may trigger a quick population shift. Even though there were few confirmed cases of plague in Surat, India, in 1994, fear forced 500,000 people—roughly 20 per cent of the city's population—including a disproportionately high number of doctors, to leave their homes (Barrett &Brown, 2008). Rapid population shifts may unsettle, and migrants are more likely to have health problems because of poor living conditions, inadequate nutrition, and other stresses (Toole & Waldman, 1990). A second danger of an outbreak spreading is migration.

Finally, infectious illness epidemics have the potential to stigmatise and blame already vulnerable social groups for the disease and its effects, such as populations of ethnic minorities (Personet al., 2004).

Check Your Progress 2

Note: a) Use the space given below for your answers.

b) Check your answer with those given at the end of the Unit.

1) What is the significance of Pandemics?

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2) How does the pandemic affect different sectors?

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10.8 CONCLUSION

An epidemic is an unanticipated rise in the number of disease cases in a particular region.When a disease spreads exponentially across several countries, continents or the world is called a Pandemic.When a disease epidemic is persistent and localised to a single area, it is said to be endemic. Most pandemics result from the "zoonotic" transfer of infections from animals to humans.The degree of zoonotic adaptability ranges along a continuum, from transmission solely within animal populations (stage 1) to transmission only within human populations (stage 5).

The wide range of pathogens and their interactions with people drive the multiplicity of pandemic dangers.Younger and adult individuals (20-59 years) have weaker immunity than older people (60< years), which considerably increases the years of life lost, the morbidity and mortality age distributions during influenza pandemics shift to younger groups; Morbidity and death rates may risemuch more because of pandemics' indirect health effects.Both acute, short-term fiscal shocks and longer-term harm to economic growth can be brought on by pandemics.Labour force reductions brought on by illness and mortality are a direct source of negative economic growth shocks, whereas behavioural changes brought on by fear are a secondary reason. Epidemics and pandemics can have serious social and political repercussions, including conflicts between governments and people, a reduction in state capability, population relocation, and an increase in social tension and prejudice.

In this Unit, we have described the key terms and compared *epidemics, pandemics, and endemics*. We have examined the pandemic's origin and implications. It has been observed that Animal-to-human *Zoonotic* transmission has caused most global pandemics. The Zoonotic adaptation progresses from animal-only transmission (stage 1) to human-only transmission (stage 5). Here, the Stage 1 gearbox is animal-only. This discussion has focused on the pandemic's effects on health, economy, and society. It is to be noted that the Pandemics can cause short-term and long-term economic impacts. In this context, secondary to fear-induced behavioural changes, and economic growth shocks are negative. However, disease and mortality-induced labour force declines produce shocks. Besides, we have explained how epidemics and pandemics can cause conflicts, weakened nations, population displacement, and societal stress and discrimination.

Endemic: An endemic disease refers to a situation where a disease epidemic persists and is limited to a particular region. The spread of the disease is facilitated by this factor, making it possible to predict the rates. As an example, it should be noted that malaria is considered endemic in multiple nations and regions.

Epidemic:

10.9 GLOSSARY

Centre for Disease Control and Prevention : A federal government organisation in the United States whose goal is to safeguard the public's health by preventing and managing disease, injury, and disability. The Centers for Disease Control and Prevention advocate for safe, healthy surroundings and healthy activities. It monitors health trends, looks for the root of disease outbreaks & issues, and reacts to fresh risks to public health. To help prevent and control disease, the Centers for Disease Control and Prevention collaborate with state health departments and other organisations across the nation and the globe.

Endemic : An endemic disease refers to a situation where a disease epidemic persists and is limited to a particular region. The spread of the disease is facilitated by this factor, making it possible to predict the rates. As an example, it should be noted that malaria is considered endemic in multiple nations and regions.

Epidemic : When there is an epidemic, it means that there has been an unforeseen surge in the number of people affected by a disease in a specific geographic location. Some examples of epidemics throughout history include diseases such as smallpox, measles, polio, yellow fever, and, notably, smallpox again. The communicability of an epidemic disease is not a necessary requirement. An epidemic state is declared when the rates of a disease or any particular health-related activity, like smoking, are considerably higher than the norm observed in a community or region.

Epidemiologist : A scientist or medical professional with expertise in the patterns of disease transmission is known as an epidemiologist. For instance, epidemiologists research the causes and prognosis of lung disease.

Infection : Invasion and growth of microorganisms that are not ordinarily present in the body, including bacteria, viruses, and parasites. An infection may be subclinical and exhibit no symptoms, or it may be clinically evident and exhibit symptoms. An infection may move via the blood or lymphatic vessels to become systemic(bodywide) or it may

stay localised. Infections are not thought to be caused by microbes that exist naturally in the body. For instance, infections are not caused by bacteria that are naturally present in the mouth and intestinal.

Influenza : Influenza, often known as the flu or grippe, is an acute viral infection of the upper or lower respiratory tract characterised by fever, chills, a widespread sense of weakness and muscular pain, as well as variable degrees of discomfort in the head and abdomen.

Pandemic : It can be described as an epidemic that spreads widely, affecting not only a specific region but also extending globally, crossing international borders, and impacting a significant population.The traditional definition does not encompass factors such as population immunity, virology, or the severity of the sickness. Due to the international spread and the significant impact on human populations, it can be argued that seasonal infections result in annual pandemics in both the temperate southern and northern hemispheres. On the other hand, seasonal epidemics are not classified or considered as pandemics.

Pathogens : An organism that infects its host with disease is referred to as a pathogen, and the severity of the disease symptoms is referred to as virulence. Pathogens include viruses, bacteria, unicellular and multi-cellular eukaryotes, as well as other taxonomically diverse organisms. Pathogens, such as bacteria that are targeted by specialised viruses known as phages, impact every living thing.

World Health Organization : An organisation of the United Nations, founded in 1948, that works on numerous technical initiatives and programmes to improve global public health and prevent or control infectious illnesses. WHO establishes guidelines for the management of illnesses, medical treatment, and medications. Geneva, Switzerland serves as the location of the headquarters.

Zoonotic Disease : A zoonosis is a contagious disease that can spread from one species of animal to another, even from humans (or from humans to animals). Zoonotic diseases are brought on by pathogenic

microorganisms such as bacteria, fungi, parasites, and viruses. These microorganisms can cause a wide range of ailments in humans and animals, from minor illnesses to severe illness and even death. Depending on the zoonotic disease, animals might occasionally seem healthy even when they are harbouring pathogens that can make people sick.

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10.11 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:
   - For details, refer to Sections 10.1 and 10.5
2) Your answer should include the following points:
   - For details, refer to Sections 10.2, 10.3 and 10.4

Check Your Progress 2

1) Your answer should include the following points:
   - For details, refer to Section 10.6
2) Your answer should include the following points:
   - For details, refer to Section 10.7

UNIT 11 PANDEMIC PHASES*

Structure

11.0 OBJECTIVES

After studying this Unit, you should be able to:

- Explain the different phases of pandemics, and how phases change;
- Discuss the recommendations before, during, and after a pandemic;
- Elucidate the history of pandemics; and
- Highlight various case studies.

11.1 INTRODUCTION

In 1999, the World Health Organization (WHO) created its pandemic phases, which were updated in 2005. The phases offer a universal framework to

* ***Contributed by:*** Dr Shyamli Singh, Assistant Professor, Environment Management and Climate Change, Indian Institute of Public Administration, New Delhi

assist nations in pandemic preparedness and response planning and are relevant to the whole planet. For ease of integration of new guidelines and methodologies into already-existing national preparedness and response plans, the WHO has kept the use of a six-phased strategy in this iteration. Pandemic phases have been grouped and described in a redesigned way that is clearer, more accurate, and based on observable events. Phases 1-3 pertain to readiness, including actions for building capacity and reaction planning, whereas Phases 4-6 unmistakably indicate the need for response and mitigation measures (Figure 11.1) (National Library of Medicine, n.d.).

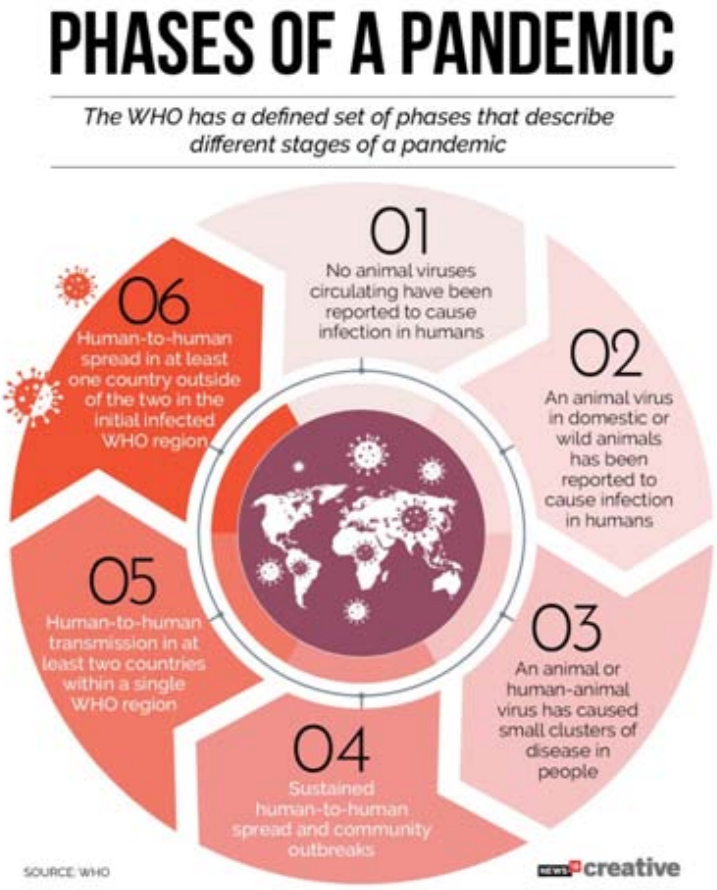

Figure 11.1: Phases of Pandemic
Source: Forbes India, 2020

In this unit, we will discuss the pandemic phases and transitions. In this context, the World Health Organization prepares for and responds to pandemics in six steps. The first three phases focus on capacity building and planning for readiness. Besides, phases four through six necessitate response and mitigation. However, pandemic danger may rise in later stages, but it's unclear in the first three. We will highlight the recommendations for pre-pandemic, during-pandemic, and post-pandemic phases, and pandemic history. The suggestions will include five preparedness and reaction parts. In this regard, especially during the pandemic phase, the recommendations are based on preparation, coordination, situation monitoring, minimising sickness transmission, health care continuity, and communication. The reference to past pandemics in this Unit will include the black death, yellow fever, and swine flu. Lastly, we will discuss and examine various case studies.

11.2 PHASES OF PANDEMIC

11.2.1 Phase 1: Evolution of Influenza Viruses and Human Infection Risk

In the natural world, influenza viruses are constantly spreading among animals, particularly birds. Although such viruses might potentially evolve into pandemic strains, in **Phase 1** there have been no viruses found to infect people and cause diseases.

11.2.2 Phase 2: Human Infection by Animal Influenza

A known human infection by an animal influenza virus in **Phase 2** is what qualifies it as a possible pandemic danger. This virus may be present in domesticated or wild animals.

11.2.3 Phase 3: Human Transmission of Animal Influenza

In **Phase 3**, rare human cases or small clusters of illness have been reported because of an animal or human-animal influenza reassortant virus, but there hasn't been enough human-to-human transmission to support widespread outbreaks. Limited human-to-human transmission may happen in particular situations, such as when an infected individual comes into close contact with an unprotected carer. However, a negligible amount of transmission in such constrained conditions does not necessarily mean that the virus has attained the threshold of human-to-human transmissibility required to trigger a pandemic.

11.2.4 Phase 4: Elevated Pandemic Risk with Human Transmission

A confirmed human-to-human transmission of an animal or human-animal influenza reassortant virus that can lead to "community-level outbreaks" is what defines **Phase 4**. An important upward change in the likelihood of a pandemic is marked by the capacity to induce persistent disease outbreaks in a population. To jointly assess the situation and determine if the launch of a quick pandemic containment operation is necessary, every nation that suspects or has verified such an occurrence should promptly engage with WHO. Phase 4 shows a large rise in pandemic risk, but it does not always suggest that a pandemic is inevitable.

11.2.5 Phase 5: Cross-Border Spread Signals Imminent Pandemic

Phase 5 is defined by the virus spreading from person to person in at least two nations in a single WHO region (Figure 11.2) (World Health Organisation [WHO], 2009). Even if most nations won't be affected at this point, the announcement of Phase 5 is a clear indication that a pandemic is on the horizon and that there is little time left to organise, communicate, and put the planned mitigation measures into action.

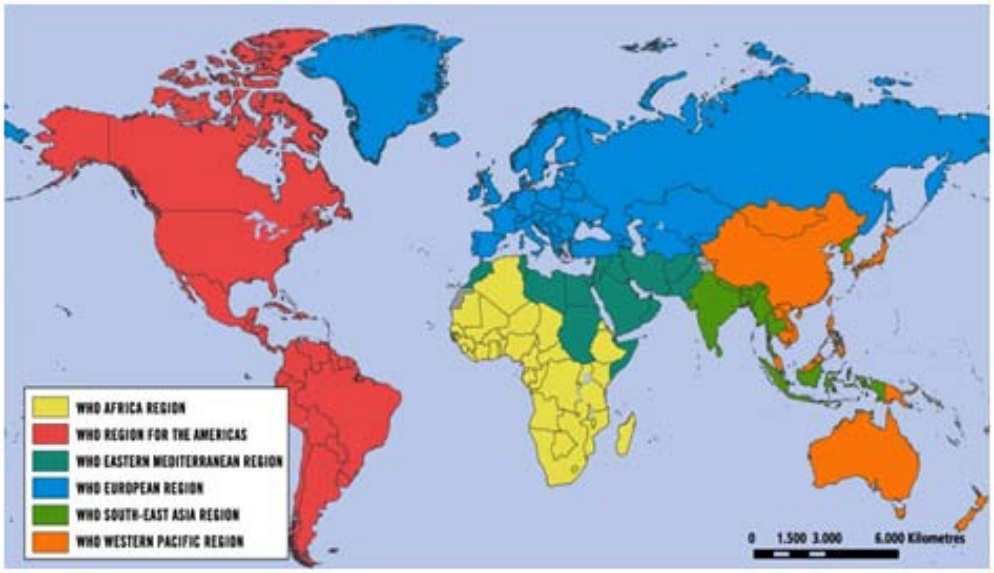

Figure 11.2: WHO Regions

Source: WHO,2009

11.2.6 Phase 6: Global Pandemic Declared with Inter-Regional Outbreaks

Besides the requirements specified in Phase 5, the pandemic **phase 6** is characterised by community-level outbreaks in at least one additional nation in a different WHO region. The designation of this stage will signal the onset of a pandemic on a worldwide scale.

11.2.7 Post Peak Period: Monitoring Pandemic Decline and Preparing for Potential Waves

In most nations with sufficient monitoring, pandemic disease levels will have fallen below peak recorded levels during the **post-peak period**. The post-peak period indicates that the pandemic activity seems to be waning, but it is unknown if there will be more waves, in which case nations will need to be ready for a second wave.

There have been surges of activity during previous pandemics that lasted for months. A crucial communication effort will be to balance this knowledge with the risk of another wave as soon as the disease activity level declines. Months can elapse between pandemic waves, making an initial "at-ease" signal premature.

11.2.8 Post-Pandemic Period: Transition To Seasonal Influenza and Preparedness Measures

The level of influenza disease activity will have reverted to that seen during the **post-pandemic period**. The pandemic virus is anticipated to act like the seasonal influenza A virus.Maintaining surveillance and updating pandemic preparedness and response plans as necessary are crucial at this point. There could be a need for an intensive phase of recuperation and assessment.

This phased strategy aims to assist nations and other stakeholders in anticipating when certain situations will necessitate choices and choosing the appropriate time to conduct major measures (Table 11.1). Each step applies

globally after it has been notified, just like in the 2005 guidance. Individual nations will experience the effects at various periods, though. Depending on their unique circumstances, nations may opt to create further national distinctions in addition to the pandemic phase that has been publicly stated. For instance, nations may desire to consider if a potential pandemic virus is spreading illness within their borders, in neighbouring nations, or nations close by (WHO, 2009).

Table 11.1: WHO:Pandemic Phases, Description, and Major Actions

<table>
<tr><th>Phase</th><th>Estimated Probability of Pandemic</th><th>Description</th><th>Main Actions in Affected Countries</th><th>Main Actions in Not-yet-Affected Countries</th></tr>
<tr><td>Phase 1</td><td rowspan="3">Uncertain</td><td>There is no evidence that any animal influenza virus in circulation may infect humans</td><td colspan="2" rowspan="3">Creating, putting into action, practising, and coordinating national emergency preparedness and response plans with national pandemic influenza readiness and response plans</td></tr>
<tr><td>Phase 2</td><td>Since the animal influenza virus is known to have infected humans, it is regarded as a particular potential pandemic hazard whether it is present in domesticated or wild animals</td></tr>
<tr><td>Phase 3</td><td>Human-to-human transmission of the animal or human-animal influenza reassortant virus has only seldom resulted in isolated instances or small clusters of illness in people</td></tr>
<tr><td>Phase 4</td><td>Medium to High</td><td>It has been proven that influenza reassortant viruses capable of causing community-wide epidemics may be transmitted from person to person</td><td>Rapid containment</td><td>Readiness for pandemic response</td></tr>
<tr><td>Phase 5</td><td>High to Certain</td><td>At least two countries in one WHOregion have seen ongoing community-level outbreaks caused by the same virus.</td><td rowspan="2">Each nation must take the steps outlined in its national strategy in the event of a pandemic</td><td rowspan="2">Readiness for imminent response</td></tr>
<tr><td>Phase 6</td><td>Pandemic in Progress</td><td>The same virus has maintained community-level outbreaks in at least one additional country in another WHOregion, in addition to the requirements listed in Phase 5 of the evaluation process.</td></tr>
<tr><td colspan="2">Post-Peak Period</td><td>In the majority of nations</td><td>Evaluation of the</td><td>-</td></tr>
</table>

	with sufficient surveillance, pandemic influenza levels have decreased from their peaks	reaction, healing, and potential second-wave preparation	
Possible New Wave	In most nations with sufficient surveillance, the level of pandemic influenza activity is once more on the rise	Response	
Post-Pandemic Period	In most nations that have effective surveillance, influenza levels have recovered to those observed during the seasonal influenza season	Analysis of the response, plan change, and recovery	

Source: WHO, 2009

PHASE CHANGES

It is crucial to emphasise that phases were created to help governments undertake initiatives, not as an epidemiological forecast. While growing levels of pandemic risk may be roughly correlated with subsequent phases, this risk is simply unknown in the first three phases (i.e., Phase 1 - Phase 3). Therefore, there may be circumstances that enhance the risk of a pandemic without actually causing one.

Alternatively, despite vast improvements in worldwide influenza surveillance and monitoring systems, it is still feasible that the initial pandemic outbreaks may go undetected or unnoticed. For instance, if symptoms are vague and mild, a pandemic-potential influenza virus may circulate widely before being discovered; as a result, the global phase may change from Phase 3 to Phase 5 or 6.Phase 4 could go back to Phase 3 if fast containment efforts are effective.WHO will carefully assess whether the requirements for the new phase are satisfactory before making changes to the current global phase.

Check Your Progress 1

Note: a) Use the space given below for your answers.
b) Check your answer with those given at the end of the Unit

1) List the phases of a pandemic.

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2) Write a note on the Transition to Seasonal Influenza and Preparedness Measures

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11.3 RECOMMENDED ACTIONS: BEFORE, DURING AND AFTER A PANDEMIC

Recommendations are grouped according to pandemic phases and the five components of preparedness and response are the following:

i) ***Planning and Coordination***

Providing leadership and coordination across sectors is the aim of planning and coordinating activities. Integrating pandemic preparation into national emergency preparedness frameworks is a crucial component.

ii) ***Situation Monitoring and Assessment***

Before a pandemic occurs, information on its risk should be gathered, interpreted, and shared. Once a pandemic has started, it should be monitored for activity and other characteristics.It will be crucial to keep a check on the infectious agent, how contagious it is to people, and how diseases spread in communities to determine whether the danger of a pandemic is rising. Data collection on influenza viruses, the genetic alterations occurring and resulting changes in biological properties, as well as quick investigation and evaluation of outbreaks are crucial. Analysing the success of the countermeasures will be crucial if a pandemic influenza virus starts to spread.

iii) ***Reducing the Spread of Disease***

Increasing "social distance" between individuals will be essential to reducing the transmission of disease. It will be crucial to take precautions at the individual/household, social, and worldwide levels as well as to employ antivirals, other medications, and vaccinations.

a) *Balancing Individual and Societal responses to pandemic challenges:*Risk communication, personal cleanliness, personal protection, sick person care at home, and contact quarantine are only a few examples of actions used at the individual or household level. In contrast to people or families, societies or communities are the subjects of socioeconomic measurements. These actions need a shift in public behaviour, the engagement of several sectors, the mobilisation of resources, effective communication, and media support.

b) *Navigating global health and trade amid travel restrictions:*International travel restrictions will affect trade and transportation while also delaying the spread of the pandemic sickness into unaffected nations. Countries should strike a balance between lowering public health risks and avoiding unneeded interference with global trade and transportation.

c) *Pharmacological approaches in influenza prevention and treatment:*There are several methods for using pharmacological treatments to treat or prevent influenza. In many situations,

successful secondary or pre-existing disease prevention and treatment will also play a crucial role in lowering the total burden of sickness and mortality.

iv) ***Continuity of Health Care Provision***

Health systems will need to offer medical services while handling the inflow of people suffering from influenza during a pandemic. The extent to which the current healthcare system can be expanded to handle the increased patient load will be determined by planning for surge capacity in healthcare facilities. To safeguard healthcare professionals, patients, and visitors, healthcare institutions must maintain proper triage and infection control procedures.

v) ***Communications***

For the public, partners, and stakeholders to make informed decisions and take the proper steps to protect health and safety and respond, relevant information must be shared with them before and during a pandemic. This is a key component of efficient risk management.The WHO's strategy for preparing for epidemic communications outlines five guiding principles: preparation, trust, openness, early announcement, and listening (WHO, 2008). Communication techniques that only convey outbreak information and advice will not be sufficient due to the complicated dangers and perceptions connected with an influenza pandemic. The task's magnitude and complexity call for regular, open, and proactive information sharing with the public, partners, and other stakeholders regarding decisions, health recommendations, and related topics.In addition to the proposed activities listed below, nations are urged to build fundamental risk communication capabilities like those outlined in the WHO handbook for preparing outbreak communications. Member States' communication response capabilities for any potential public health disaster would be strengthened by creating a strong foundation for pandemic-influenza communications.

A pandemic influenza communication's fundamental components are:

- To uphold and increase public faith in public health agencies, before, during, and after the influenza pandemic
- To assist local, national, regional, and international public health partners in coordinating and making optimum use of their limited resources
- To educate the public about pertinent public health issues
- To ensure that disadvantaged groups have the knowledge they need to make informed decisions
- To take necessary steps to safeguard their health and well-being
- To limit disturbance to society and the economy.

Following Table (11.2) displays the new WHO Pandemic phases, and a list of suggested measures for each phase.

Table 11.2: New WHO Pandemic Phases and Suggested Measures for Each Phase

Preparedness Components	Phases				
	1-3	**4**	**5-6**	**Post Peak**	**Post Pandemic**
Planning and Coordination	Create, test, and regularly update national preparedness and response strategies for influenza pandemics	In coordination with WHO, direct and coordinate immediate pandemic containment efforts to stop or slow the spread of illness	To lessen the social and economic effects, provide multisectoral resources with leadership and coordination	Plan and organise extra capabilities and resources for potential future waves	Review the lessons learnt and communicate your experiences to the world Restock your supplies
Situation Monitoring and Assessment	Create effective national monitoring systems in cooperation with the national animal health agencies and other pertinent industries	Boost the surveillance. Observe the containment procedures. Report findings to WHO and the world community	Actively track and evaluate the pandemic's development, as well as its effects and available mitigations	Maintain observation to find new waves	Consider the future pandemic and other public health emergencies while evaluating the pandemic features and situation monitoring and evaluation instruments
Reducing the Spread of Disease	Encourage people to engage in healthy practices so they can protect themselves. Prepare for the usage of medications and immunisations	Implement quick pandemic containment operations and other initiatives; work together as needed with WHO and the international community	Implement pharmacological, social, and individual measures	Analyse the success of the steps taken to update the rules, procedures, and algorithms	Conduct a comprehensive analysis of all the interventions used

Continuity of Health Care Provision	Prepare the health system for expansion	Activate backup plans	Put emergency preparations in place for the whole health system	Rest, replenish supplies, update strategies, and restore vital services	Analyse the health system's response to the pandemic and explain the insights you discovered
Communications	Finalise your communication strategy and start your outreach efforts to inform people about current and future threats	Promote and spread the word about the suggested measures for lowering and preventing population and individual risk	Continue updating the general public and other stakeholders on the pandemic's status and risk-reduction efforts	Provide regular updates on any alterations to the pandemic's status to the general public and other stakeholders	Recognise the contributions of all groups and sectors in public and share the lessons learned; integrate the lessons learned into communications efforts and the preparation for the following significant public health disaster

Source: WHO (2009) **HISTORY OF PANDEMICS**

From the earliest days, diseases have been a persistent challenge for humanity. However, it wasn't until the transition to agrarian communities that diseases became more widespread. Increased trade brought new opportunities for interactions, leading to the emergence of diseases like malaria, tuberculosis, leprosy, influenza and smallpox. As human civilisation advanced – with larger cities, expanded trade routes and greater contact with diverse populations, animals and ecosystems – the risk of pandemics grew (LePan, 2020).

Here are a few of the most significant pandemics in history (Table 11.3):

Table 11.3: Pandemics over Time

Name	Period	Type / Pre-human host
Antonine Plague	165-180	Believed to be either smallpox or measles
Japanese smallpox epidemic	735-737	Variola major virus
Plague of Justinian	541-542	*Yersinia pestis* bacteria / Rats, fleas

Black Death	1347-1351	*Yersinia pestis* bacteria / Rats, fleas
New World Smallpox Outbreak	1520 – onwards	Variola major virus
Great Plague of London	1665	*Yersinia pestis* bacteria / Rats, fleas
Italian plague	1629-1631	*Yersinia pestis* bacteria / Rats, fleas
Cholera Pandemics 1-6	1817-1923	*V. cholerae* bacteria
Third Plague	1885	*Yersinia pestis* bacteria / Rats, fleas
Yellow Fever	The late 1800s	Virus / Mosquitoes
Russian Flu	1889-1890	Believed to be H2N2 (avian origin)
Spanish Flu	1918-1919	H1N1 virus / Pigs
Asian Flu	1957-1958	H2N2 virus
Hong Kong Flu	1968-1970	H3N2 virus
HIV/AIDS	1981-present	Virus / Chimpanzees
Swine Flu	2009-2010	H1N1 virus / Pigs
SARS	2002-2003	Coronavirus / Bats, Civets
Ebola	2014-2016	Ebolavirus / Wild animals
MERS	2015-Present	Coronavirus / Bats, camels
COVID-19	2019-Present	Coronavirus – Unknown (possibly pangolins)

Source: **LePan, 2020**

11.4 CASE STUDIES

Unexpected and potent impacts of COVID-19 were experienced globally. This case study for India examines the immediate consequences of closing and reopening schools, highlighting the initial repercussions on students, their families, and the educational system. It sought to gain an understanding of the various approaches to the pandemic to evaluate their effectiveness. The objective was to comprehend the contextual elements that could have facilitated or hindered learning, with a specific focus on the most marginalised individuals disproportionately affected by the pandemic. The analysis aimed to achieve several goals. Firstly, it sought to evaluate and

quantify the diverse effects of the COVID-19 pandemic on Asian stakeholders and the education system. Additionally, the analysis aimed to investigate the financial and policy implications of progress made towards achieving Sustainable Development Goal 4 (SDG4: Education) by the year 2030. Lastly, the goal was to identify instances of effective solutions and tactics within the realms of education and related social sectors that could be shared and implemented in other nations.*COVID-19's effects on the educational sector*

Access to and participation in learning

In March 2020, during the final stages of the 2019–20 academic year, all educational institutions in India were temporarily closed. The closures had a profound impact on millions of students in pre-primary through secondary grades. The transition from face-to-face to distance learning revealed significant disparities within and across states' educational systems. Discrepancies were observed in the capabilities of instructors, learning outcomes, government-provided digital infrastructure, and access to technology. Despite the production and distribution of a substantial amount of digital content to support remote learning, there is a lack of data on how much the outreach to the students, their engagement with it, and its overall effects. The Alternative Academic Calendar (AAC) (National Council of Educational Research and Training [NCERT], n.d.) operated on the assumption that all Indian states had established digital ecosystems with seamless internet and mobile device access for instructors and students. However, a 2019 study indicated that only 32 per cent of people in rural areas over the age of 12 and 54 per cent in urban areas had internet access. Furthermore, only 11 per cent of Indian families owned computers such as desktops, laptops, and tablets (excluding smartphones) (Internet and Mobile Association of India [IAMAI], 2019).

According to a status report on schools during COVID-19 (OXFAM India, 2020), children attending government schools were particularly hardhit. In Odisha, Bihar, Jharkhand, Chhattisgarh, and Uttar Pradesh, over 80 per cent of government school children did not receive any instructional materials during the lockdown (Malik, 2020). The lack of access to digital devices and e-learning resources within families played a significant role in this shortfall. WhatsApp emerged as the primary method of delivering instruction in both public and private schools to households with internet connectivity (75%), followed by phone conversations between educators and learners (38%). However, due to limited access, financial constraints, or a slow and unreliable internet connection, more than 75 per cent of parents reported encountering difficulties in ensuring access to WhatsApp lessons.

11.4.1 Responses to COVID-19

To mitigate the adverse impacts of COVID-19 on the education sector, the government implemented several measures. These included various remote-learning tools, encompassing traditional methods like textbooks and home visits, tech-enabled approaches such as WhatsApp, YouTube, TV, and radio, as well as blended methods combining face-to-face and e-learning. Additionally, learning-enabling technologies like midday meals, sanitation

kits, and financial support were introduced.To enhance access to digital learning, the Ministry of Education endeavoured to create a library of educational materials and conducted EdTech interventions in collaboration with NGOs.Noteworthy government e-learning systems included Digital Infrastructure for Knowledge Sharing (DIKSHA), e-Pathshala, Swayam, and the National Repository of Open Educational Resources (NROER).

The state governments were accountable for enforcing the regulations made by the federal government. Consequently, responses to COVID-19 varied by state, with local needs-specific learning continuity solutions: Assam supplied worksheets along with midday meals, Gujarat focused on providing textbooks with QR codes, Bihar and Uttar Pradesh focused on learning programs on TV, Kerala focused on textbook distribution and WhatsApp groups (United Nations Children's Fund [UNICEF], 2021a). Since online lectures couldn't reach all learners due to inadequate cellphone coverage, Odisha turned to radio (Barik, 2020). Except in confinement zones, states were allowed to initiate gradual school reopenings on October 15, as per the Ministry of Home Affairs Order of September 2020 (Ministry of Home Affairs [MHA], 2020).

11.4.2 Challenges faced due tothe Digital Divide among Teachers

Future economic, educational, and digitalisation policies are needed to confront the challenges presented by the digital gap among instructors due to the swift transition to e-learning triggered by the pandemic. These issues of inequality and the digital divide have been persistent for some time. Despite the desire to enhance e-learning, the majority of instructors and students in government schools were lacking in the resources, equipment, and skills essential for participating in this digitalisation process. Figure 11.3 illustrates some of the primary challenges that teachers identified with remote instruction.

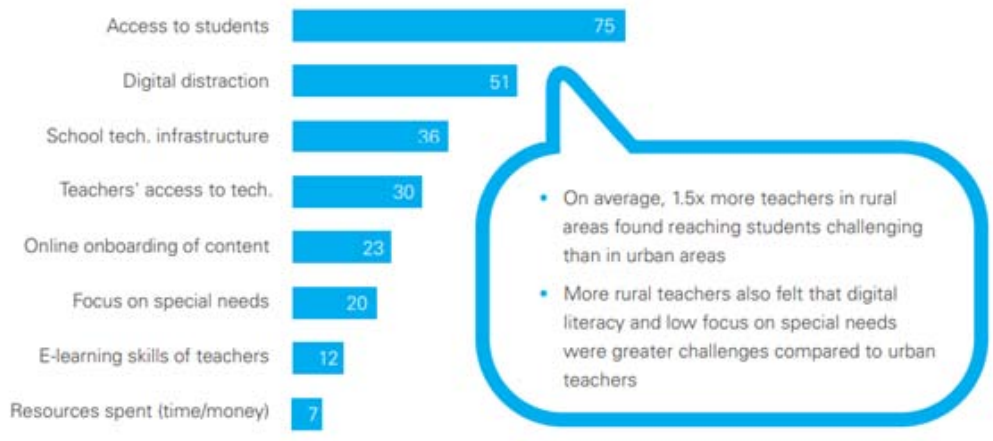

Figure 11.3: Challenges of Remote Teaching as seen by Teachers

Source: UNICEF (2021b)

11.4.3 Lessons Learned

The lessons underlying the proposals, which focused on the challenges Indian teachers faced, were as follows:

Strategic planning - Schools and instructors were not prepared at all to shift from classroom-based to distant learning overnight for an arbitrary amount of time. It could have been easier for the education system to adapt to school closures if there had been planning and time for preparation, including teacher training, school cleanliness, and increasing student familiarity with Information and Communications Technology (ICT).

Recognising and closing the digital gap - According to parents and instructors, the most significant obstacles to ongoing learning have been the cost of devices and data, as well as network access infrastructure. The development of a robust and ubiquitous power infrastructure that offered consistent, affordable, and uninterrupted electricity to facilitate technology use was a crucial precondition.

Teacher support - The foundation of the educational system was its teachers. They were essential to the entire development of children and needed to have all the resources required to perform their jobs well. Given the need to transition to a blended learning educational system, it was important to consider how teachers' roles had developed and what kind of support and professional development they required.

11.4.4 Suggestions for a Better Recovery

These suggestions consider how to build on the achievements and knowledge gained from the COVID-19 experience:

- Closing the digital gap
- Prepare instructors for online learning
- Create a distance learning plan for the most disadvantaged
- Enhance data gathering to direct investments in the right places

Conclusion

The 2020 National Education Policy (NEP), released despite the pandemic, reflectsthe Government's commitment to education and the significant efforts it has undertaken in response to the impact of COVID-19.In such a large and diverse nation, its decentralised approach to addressing the consequences of COVID-19 made sense, and several states devised strategies that could be successfully replicated elsewhere. Although both the NEP and the response to COVID-19 underscored the importance of utilising digital technology in the future, there were several reasons why digitalisation would only constitute a portion of the educational infrastructure. Recovery hinged on addressing the learning loss experienced by children during school closures, particularly those from low-income and displaced families (UNICEF, 2021).

Check Your Progress 2

Note: a) Use the space given below for your answers.

b) Check your answer with those given at the end of the Unit

1) What are the recommendations for a specific period, that is after a pandemic?

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2) Discuss the lessons based on responses toCOVID–19 and suggest necessary measures for better recovery.

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11.5 CONCLUSION

In this unit, we have discussed the pandemic phases and transitions. In this context, the World Health Organization prepares for and responds to pandemics in six steps. The first three phases focus on capacity building and planning for readiness. Besides, phases four through six necessitate response and mitigation. However, pandemic danger may rise in later stages, but it's unclear in the first three. We have highlighted the recommendations for pre-pandemic, during-pandemic, and post-pandemic phases. The suggestions provided in this Unitwill include five preparedness and reaction parts. In this regard, especially during the pandemic phase, the recommendations are based on preparation, coordination, situation monitoring, minimising sickness transmission, health care continuity, and communication. The reference to past pandemics in this Unit has explained the black death, yellow fever, and swine flu. Lastly, we have explained and examined various case studies.

11.6 GLOSSARY

Mitigation : Mitigation is the process of reducing something dangerous or its negative repercussions. It might be used to describe steps made to lessen the negative impacts of risks that are still present or to control negative events that have already happened. It is a step or part of risk management and emergency preparedness.

Preparedness : The ability of governments, professional response organisations, communities, and people to foresee and successfully react to the effects of expected, impending, or actual threats, events, or situations is referred to as preparedness. It entails setting up systems that will enable national authorities and aid

agencies to be aware of threats and promptly deploy personnel and resources when a crisis arises.

Viruses : A virus is a tiny, simple infectious agent that reproduces solely in the living cells of microorganisms, plants, and mammals.

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11.8 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:
   - For details, refer to Sections 11.1 and 11.2
2) Your answer should include the following points:
   - For details, refer to Section 11.2.8

Check Your Progress 2

1) Your answer should include the following points:
   - For details, refer to Section 11.3
2) Your answer should include the following points:
   - For details, refer to Section 11.6