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Seasonal Diseases Occurring in Brazil

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Abstract: The term seasonal refers to the periodicity of certain events. Anything that occurs within a time interval with a beginning, middle, and end and a certain frequency is considered seasonal. In other words, the word refers to that which is temporary and relative to each year's season. In this sense, seasonal diseases are those typically triggered or worsened at a specific time of the year. Differences in temperature and fluctuations in relative humidity favor the development of certain dysfunctions and complicate their healing process, also due to the habits that people maintain due to climate change or the chronological distributions of certain diseases in terms of maximum and minimum records always occur in the same period, whether year, month, week, or day. In these distributions, the variation is characterized by a certain seasonality related to the property according to which the phenomenon always repeats itself in the same season. The objective of this manuscript is to report seasonal diseases occurring in Brazil. To produce this article, a bibliographic survey was carried out in original articles, reviews, and meta-analyses obtained from the PubMed database between the years 1985 to 2024. As a search strategy, the terms used were "seasonal", "diseases", "autumn", "spring", "summer", and "winter" terms "or" and "and". The exclusion criteria adopted were the time limit from 1980 to 2024, no relation to the search strategies, abstracts without a pharmacological aspect of the system of endocannabinoids, and duplicate articles. Finally, they were accessed in full for the construction of this work, totaling 39 scientific works for its development.

Keywords: Autumn, Diseases, spring, summer, winter.

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Research Paper

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1.0 INTRODUCTION

The angle of inclination and the movement of the Earth's translation the movement it makes around the sun are the factors that define the seasons of the year. The closer the Earth is to the sun, the warmer and brighter the days are the further away, the colder and shorter they are. It is easy to observe the changes that these cycles cause in nature, and you have certainly noticed that these changes cause seasonal diseases. This happens because a series of climatic events influence the relative humidity of the air, the life cycle of various pathogens, and also the chances of these agents proliferating. Together, these particularities characterize the seasons, which bring with them some discomforts, especially for those who already suffer from a certain health disorder or have low immunity (Rouquayro *et al.*, 2003; Dantas *et al.*, 2015; Oliveira *et al.*, 2020; OMRON, 2024).

The solstice occurs at two times of the year, in June and December. When the incidence of sunlight is greater in one of the hemispheres, the summer solstice occurs. When the incidence of sunlight is less in one of the hemispheres, the winter solstice occurs. The summer solstice is characterized by having days longer than nights. At the winter solstice, the nights are longer than the days. The equinox occurs at two times of the year, in March and September. The occurrence of the equinox marks the beginning of spring and autumn. Due to the same intensity of the sun's rays in both hemispheres, the days and nights have the same duration (Figure 1) (Sousa, 2024).

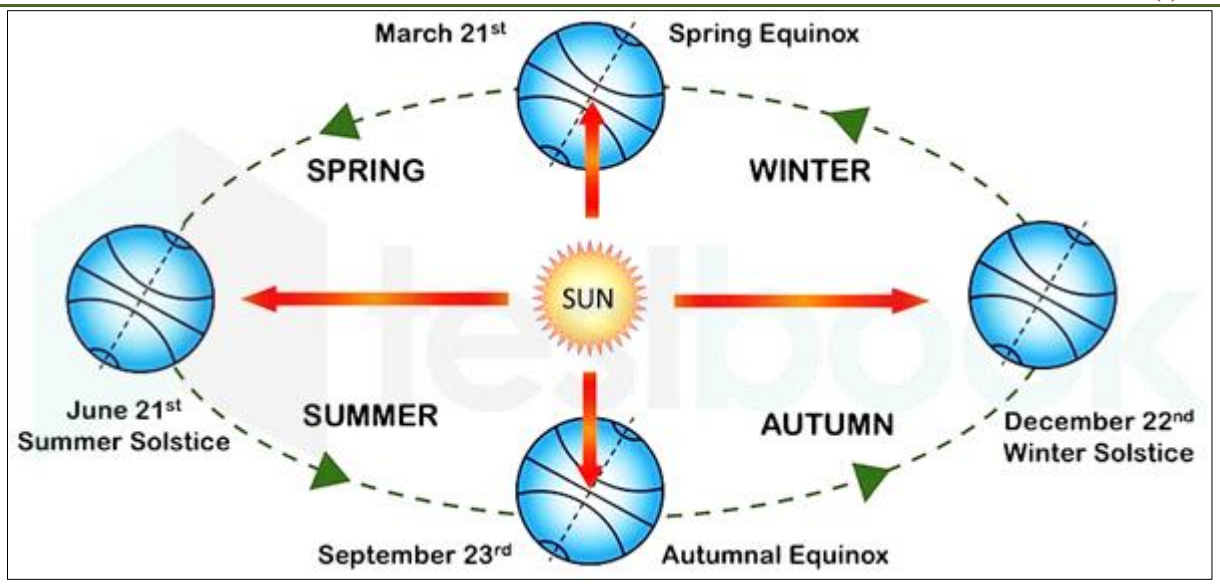

Figure 1: The angle of inclination and the movement of the Earth's translation of the movement
Source: https://testbook.com/question-answer/the-movement-of-the-earth-around-the-sun-is-known--60cadad6da92e204f43a5cd9

The term seasonal refers to the periodicity of certain events. Anything that occurs within a time interval with a beginning, middle, and end and a certain frequency is considered seasonal. In other words, the word refers to something temporary and relative to each year's season. In this sense, seasonal diseases are those typically triggered or worsened at a specific time of the year (Tian *et al.*, 2017; Dias *et al.*, 2020; ABCMED, 2021).

Differences in temperature and fluctuations in relative humidity favor the development of certain dysfunctions and complicate their healing process, also due to the habits that people maintain due to climate change or the chronological distributions of certain diseases in terms of maximum and minimum records always occur in the same period, whether year, month, week, or day. In these distributions, the variation is characterized by a certain seasonality, which is related to the property according to which the phenomenon always repeats itself in the same season (Espinosa *et al.*, 2010; Lucio *et al.*, 2010; ABCMED, 2021; Xavier *et al.*, 2022).

For example, low winter temperatures cause people to crowd together in closed or poorly ventilated spaces, and this facilitates the spread of the flu virus. In addition, life cycles in nature also affect our daily lives. It is during spring that most plants are at their reproductive peak, and the amount of pollen released into the air triggers rhinitis attacks in many people. Summer presents particularly favorable conditions for mosquitoes to reproduce, which increases the risk of dengue fever. It is worth noting that the fact that a disease is more likely to occur during a certain time of year does not mean that it ceases to exist and that we are free from it during other seasons. Furthermore, there are regions in the country where the seasons are not well defined or where summer and winter are marked by heavy rainfall, and care should be taken (Rouquayro *et al.*, 2003; Oliveira *et al.*, 2020; OMRON, 2024).

The seasons are directly related to the development of human activities, such as agriculture and livestock farming. In addition, they determine the types of vegetation and climate in all regions of the Earth. And they are opposite concerning the two hemispheres of the planet, North and South. When it is winter in the Northern Hemisphere, it is summer in the Southern Hemisphere. Likewise, when it is spring in one of the hemispheres, it will be autumn in the other. This occurs precisely due to the position that each hemisphere occupies with the Sun at that time, which determines the amount of solar radiation it is receiving. In autumn and spring, the days and nights are the same length (Miranda, 2014).

Children are a group that is susceptible to climate variations. This fact can be explained by the immaturity of the immune system and the reduced caliber of the airways, which can be even more repressed in the winter. Low temperatures promote spasms of the respiratory tract and ischemia due to capillary contraction in children, resulting in weakened ciliary movement and, consequently, difficulty in removing viruses and bacteria from the respiratory epithelium (Espinosa *et al.*, 2010; Lucio *et al.*, 2010; Tian *et al.*, 2017; Dias *et al.*, 2020; ABCMED, 2021; Xavier *et al.*, 2022).

Human physiology and pathophysiology are interconnected with these and other environmental occurrences through the intermediary action of several factors of different natures, ranging from mood swings caused by gray, rainy days or bright, sunny days to the increased production of allergenic pollen in spring. Even diseases that cannot be classified as seasonal can have their course influenced by environmental climatic factors. The best way to restrict them is through the climatic seasons of the year: summer, autumn, winter, and spring. Each of these seasons implies significant changes in the environmental factors that act on people, largely determining their way of becoming ill (Figure 2) (Rouquayro *et al.,* 2003; Dantas *et al.,* 2015; Oliveira *et al.,* 2020; OMRON, 2024).

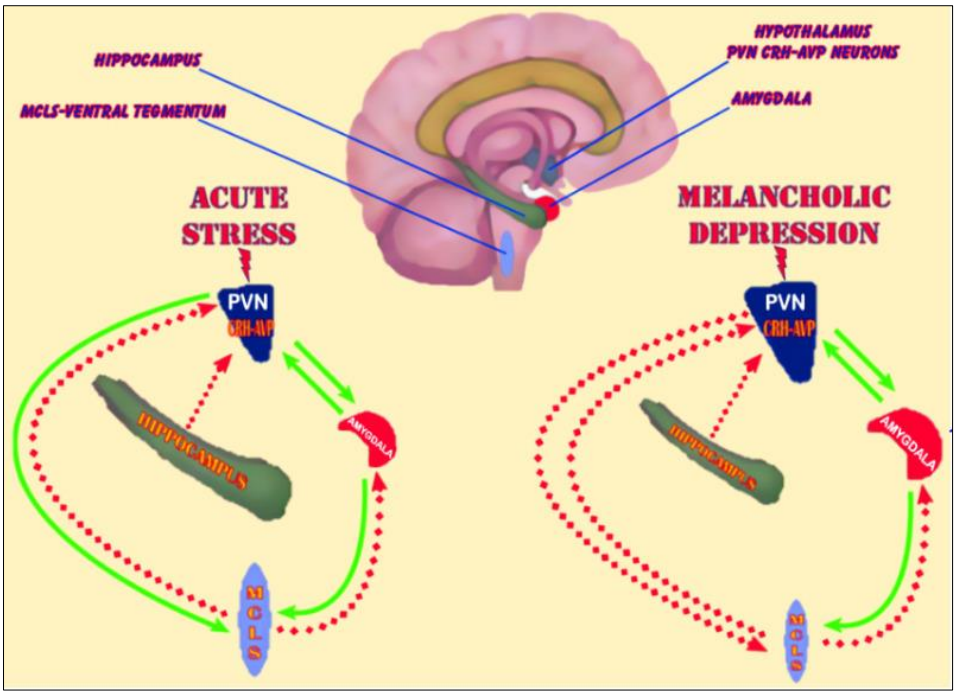

Figure 2: Schematic representation of the central neurocircuitry and its altered activity implicated in acute stress and melancholic depression (chronic stress system hyperactivation). Hyperfunctioning amygdala, hypo-functioning hippocampus, and hypo-functioning Mes corticolimbic system (MCLS) could be associated with chronic hyperactivation of the PVN CRH-AVP system and predispose to melancholic depression. PVN: paraventricular nucleus; CRH: corticotropin-releasing hormone; AVP: arginine vasopressin. Solid green lines and inhibition by dashed red lines represent activation
Source: https://www.ncbi.nlm.nih.gov/books/NBK278995/

There are environmental changes that can be perceived, such as temperature, air humidity, pollution, and sunlight, and other more subtle ones that go unnoticed, such as the phases of the moon or the migration of birds, for example. In addition, the different seasons of the year generate their habits in people, with different repercussions on their health. Low winter temperatures cause people to crowd together more in closed spaces, which in turn facilitates the spread of infectious agents, such as the flu virus (Tromp, 1980; ABCMED, 2021; Xavier *et al.,* 2022).

High summer temperatures expose people to dehydration, sunburn, and drowning in swimming pools, ponds, or beaches. In addition, life cycles in nature also affect daily habits, with their specific repercussions: in winter people are more withdrawn and bundled up, while in summer they let loose more, travel more, play more sports, and dress more lightly (Espinosa *et al.,* 2010; Lucio *et al.,* 2010; Tian *et al.,* 2017; Dias *et al.,* 2020).

"These respiratory diseases can have similar symptoms such as cough, fever, runny nose, and nasal obstruction. In older children and adults, these infections are usually mild and self-limited, but in some groups with young children or with complex conditions such as those resulting from prematurity, those with heart disease, with previous lung diseases and immunosuppressed, can evolve into a more serious form, requiring care in the emergency room or hospitalization", explains the infectious disease specialist at Sabará Hospital Infantil". [Dr. Francisco Ivanildo de Oliveria Junior] (Souza *et al.,* 2012; ABCMED, 2021; OMRON, 2024; SHI, 2024).

The specialist explains that there is not always a need to rush to the emergency room. Most cases experience improvement in symptoms after three days. But, if it does not stabilize during this period or the child presents shortness of breath and tiredness; difficulty breathing: greater effort in the neck and belly; prostration inactivity, or increased respiratory rate in the absence of fever (rapid breathing), parents should seek a specialist (ABCMED, 2021; OMRON, 2024; SHI, 2024).

At the Children's Hospital, cases treated in the emergency room due to flu syndromes increased by 66.7% when comparing the periods from March to June between 2021 and 2022. "Due to all the post-pandemic routine changes, the Seasonal virus infections also changed throughout the year, changing the period and often the distribution of viruses in recent years. Therefore, we still cannot predict the pattern for this year" [Dr. Francisco] (ABCMED, 2021; OMRON, 2024; SHI, 2024).

1.1. What Types of Diseases Have Emerged with Climate Change?

Climate change affects health and can influence the spread of vectors, water quality, and food production, in addition to contributing to air pollution. The diseases most sensitive to these changes are infectious diseases, such as leishmaniasis, malaria, dengue, and other arboviruses. Climate change also increases the risk of new pandemics and contagious diseases emerging. Climate change is responsible for significant impacts on health (Figure 3) (Kroll *et al.*, 2023; Bergallo, 2024; PUC Goias, 2024).

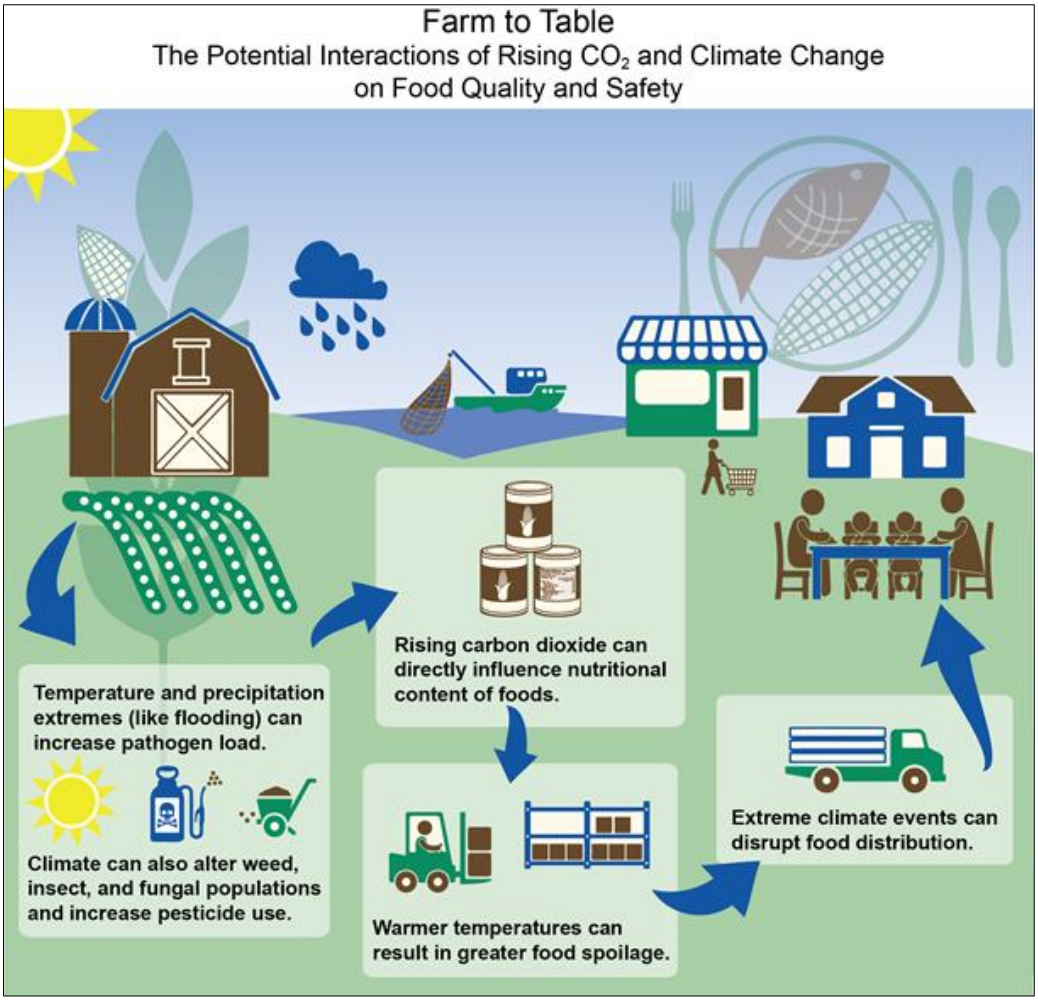

Figure 3: The food system involves a network of interactions with our physical and biological environments as food moves from production to consumption, or from "farm to table." Rising CO2 and climate change will affect the quality and distribution of food, with subsequent effects on food safety and nutrition
Source: USGCRP (2016)

Rising temperatures, air pollution, the greater occurrence of extreme weather events such as storms and droughts, and increased humidity contribute to the worsening of respiratory diseases. Droughts play an

important role in the worsening of respiratory diseases and can cause more serious illnesses, including lung cancer, due to chronic exposure. Floods and increased humidity are also factors that can affect respiratory health, as they facilitate the proliferation of fungi and mold, which release spores that, when inhaled, cause inflammation of the airways (Kroll *et al.*, 2023; Bergallo, 2024; PUC Goias, 2024).

The World Health Organization (WHO) estimates that climate change is currently causing at least 150,000 deaths per year, a number that is expected to double by 2030. Rising temperatures, melting glaciers, and environmental degradation are some of the problems quickly associated with the climate crisis, but they are not the only ones. These changes directly threaten the health of the population. The report by the Intergovernmental Panel on Climate Change (IPCC), of the WHO, released in August 2022, indicates that climate change is worse and faster than previously feared. Around 2030, a decade earlier than estimated, the Earth could reach the limit of a temperature increase of another 1.5°C. According to the IPCC, if the planet reaches an additional 2°C, the impacts could be intense and widespread (Figure 4) (Epstein, 2005; Anderko *et al.*, 2020; Kroll *et al.*, 2023; PUC Goias, 2024).

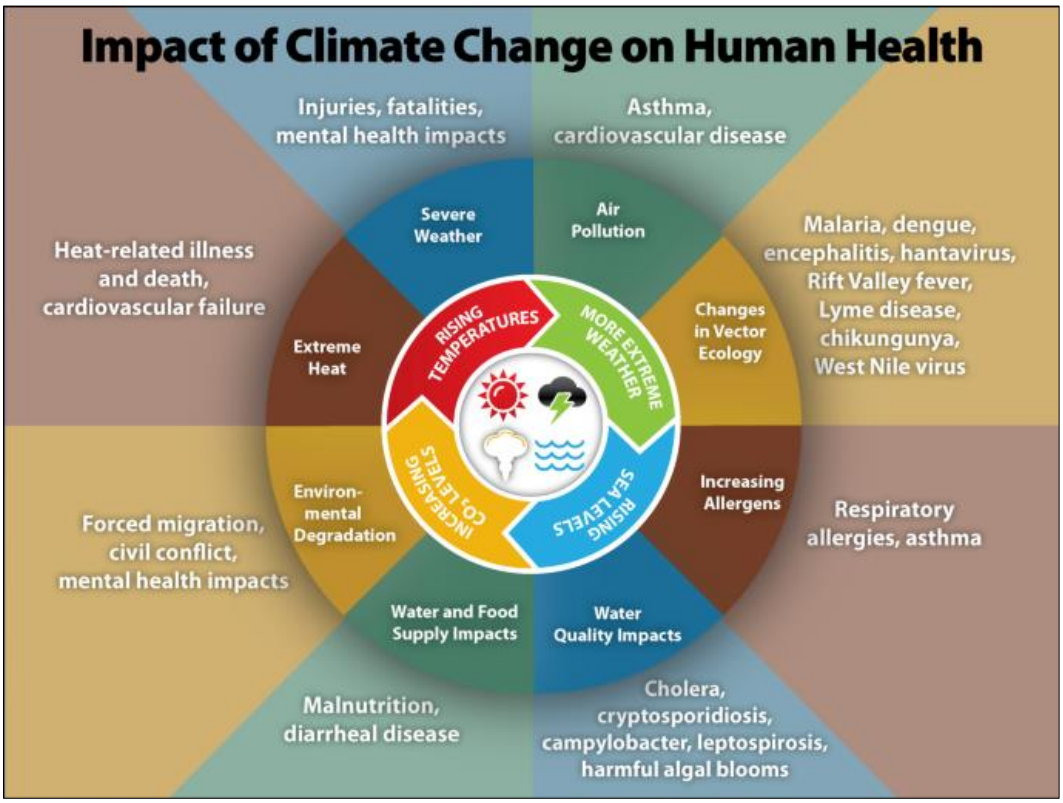

Figure 4: Impact of climate change on human health From Centers for Disease Control and Prevention
Source: https://www.cdc.gov/climateandhealth/effects/

If this were to occur, one-third of the world's population would be regularly exposed to severe heat, warm-water coral reefs would be destroyed, and Arctic sea ice would melt entirely at least one summer per decade. A 2021 WHO report states that changes in weather and climate are causing one of the most urgent health emergencies currently faced. In October 2021, at least 300 organizations representing 45 million health professionals published an open letter calling for the international community to commit to climate action (Kroll *et al.*, 2023; PUC Goias, 2024).

In Brazil, Law 7.518/2024 was published this Wednesday (03) in the Official Gazette of the Federal District, establishing the crisis management protocol for dealing with seasonal diseases in the Federal District. The rule, created and processed in the Legislative Assembly, determines that the public health network applies preventive and preparatory measures in cases such as dengue and respiratory diseases. Authored by deputy Joaquim Roriz Neto, “the law aims to facilitate health management in the DF, at any time of the year, with serious or milder diseases, such as dengue, rhinitis, asthma, or flu, but which have as a common characteristic the peak of cases in already known periods” (Vicente, 2024).

The most common seasonal illnesses are respiratory infections, such as flu and colds (more common in the transition to the colder seasons), and

respiratory allergies, which tend to appear especially in spring. These changes in weather conditions can trigger or worsen respiratory symptoms such as coughing, shortness of breath, and allergies, as well as increasing mucus production, causing wheezing, fatigue, rapid pulse and cyanosis, a bluish tinge to the lips, nails, and skin, due to lack of oxygen (WHO, 2014; INMET, 2015; ABCMED, 2021; Pinto *et al.*, 2023; SeegeneBrazil, 2023; OMRON, 2024; Targino, 2024).

1.3. OBJECTIVE

The objective of this manuscript is to report seasonal diseases occurring in Brazil.

2.0 METHODS

To produce this article, a bibliographic survey was carried out in original articles, reviews, and meta-analyses obtained from the PubMed database between the years 1985 to 2024. As a search strategy, the terms used were “seasonal”, “diseases”, “autumn”, “spring”, “summer”, and “winter”, as well as their synonyms linked by the Boolean terms “or” and “and”. The exclusion criteria adopted were the time limit from 1980 to 2024, no relation to the search strategies, abstracts without a pharmacological aspect of the system of endocannabinoids, and duplicate articles. Finally, they were fully accessed for the construction of this work, totaling 39 scientific works for its development.

3.0. SELECTED STUDIES

3.1. Diseases Caused in spring

The transition season from winter to summer. Temperatures are still mild, but their gradual rise and the longer period of sunlight activate several microorganisms that were inactive or had their functions limited by the cold. In addition, spring is marked by the flowering of plants, and the pollen released in large quantities into the air favors the emergence of allergies and irritations. Another characteristic of the season is the volume of rainfall, which is usually more intense in the first weeks. It is important to be aware of this, as floods can also spread diseases, such as leptospirosis (Oliveira *et al.*, 2020; ABCMED, 2021; Xavier *et al.*, 2022; OMRON, 2024).

Rhinitis is an inflammatory process that affects the nasal mucosa. When we come into contact with certain substances, the body interprets them as threats and triggers hypersensitivity in this region. A flower garden can be a real nightmare for those who suffer from rhinitis, but it is worth remembering that contact with mold and dirt in winter is also an enemy for those who suffer from allergies. To reduce discomfort, runny nose, and sneezing attacks, it is important to keep the airways clean and lubricated (Figure 5) (Oliveira *et al.*, 2020; ABCMED, 2021; Xavier *et al.*, 2022; OMRON, 2024).

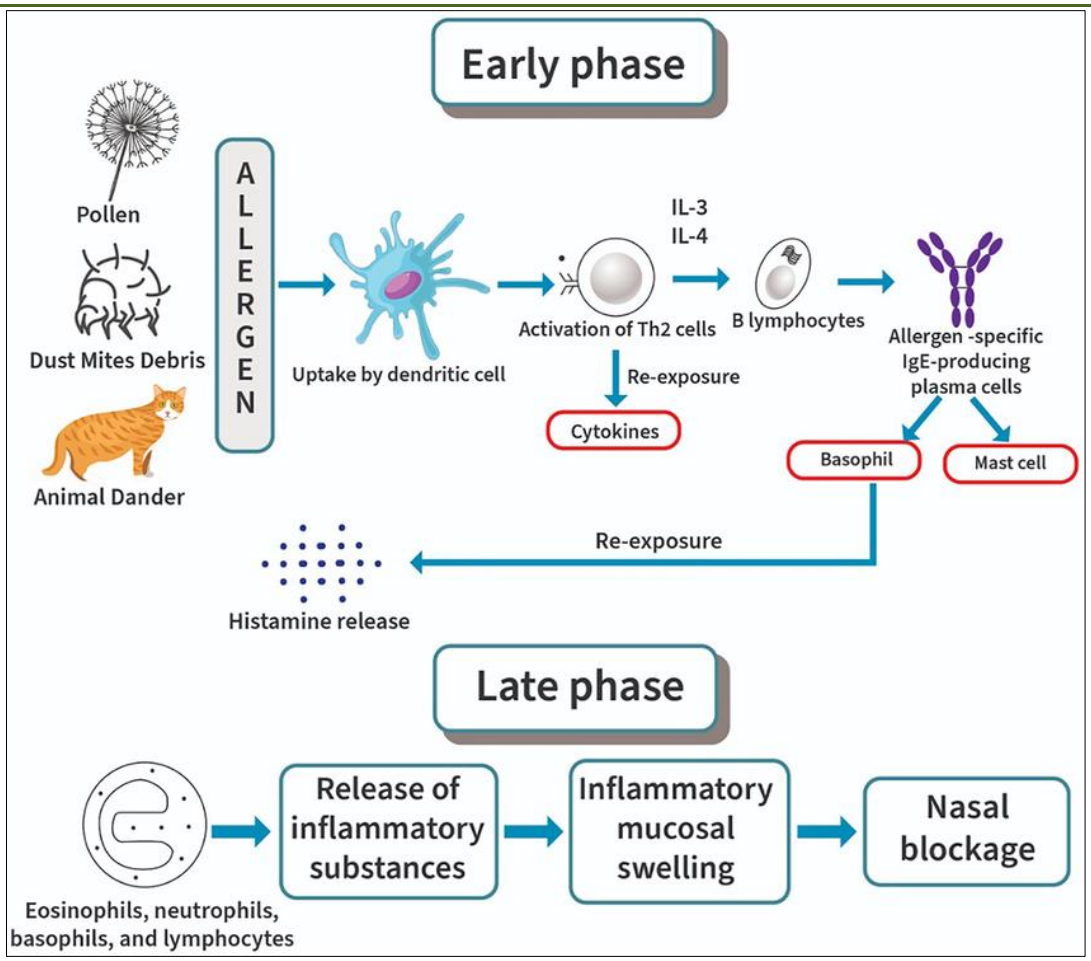

Figure 5: Pathophysiology of allergic rhinitis: early phase and late phase
Source: https://www.researchgate.net/figure/Pathophysiology-of-allergic-rhinitis-early-phase-and-late-phase_fig1_350840200

Scarlet fever is a disease caused by bacteria after an episode of tonsillitis or streptococcal pharyngitis. Due to sudden temperature changes, it is common in spring. Since transmission occurs through contact with saliva or nasal secretions of infected individuals including coughing or sneezing, it is advisable to avoid crowds and sharing utensils such as glasses and cutlery. Treatment is simple and involves antibiotics (ABCMED, 2021; Xavier *et al.*, 2022; OMRON, 2024).

Chickenpox or varicella is caused by a virus that becomes more active at high temperatures. The transmission also occurs through contact with secretions from infected people and is therefore highly contagious. It is not very serious in children, but infected adults may have compromised airways, so care is needed. The most effective way to protect yourself. Like chickenpox, measles is caused by a virus that is more active when temperatures rise and is transmitted through secretions. It is a potentially dangerous disease that can leave sequelae and even lead to death. These extreme cases are usually the result of secondary infections that occur due to weakness (Lucio *et al.*, 2010; Tian *et al.*, 2017; Dias *et al.*, 2020; ABCMED, 2021; OMRON, 2024).

Hand, Foot, and Mouth Disease:

Entering the universe of diseases that mainly affect children, there is Hand, Foot, and Mouth Disease, caused by different types of enteroviruses, such as the coxsackie virus. The infection usually causes fever and small, painful ulcer lesions on the feet, hands, and mouth (ABCMED, 2021; OMRON, 2024).

Rubella:

In some cases, rubella can be confused with measles or even chickenpox, since one of the main symptoms is red spots on the body in children among the differences is that the rashes start on the face and are caused by the rubella virus (OMRON, 2024).

Mumps:

Caused by the paramyxovirus that arrives through saliva droplets, mumps have the following initial symptoms: fever, muscle pain, and difficulty chewing and/or swallowing. Then, the salivary glands near the

ears swell, leaving the face temporarily deformed. Depending on the severity, it can cause deafness or even meningitis (WHO, 2014; INMET, 2015; ABCMED, 2021).

Roseola:

Unlike the other diseases already mentioned that are common during the spring season and cause spots on the skin, roseola is not preventable through vaccines. In most cases, the disease that causes skin rashes, swollen neck glands, and high fever is triggered by infections with human herpesvirus 6 or human herpesvirus 7. Transmission occurs through droplets (SeegeneBrazil, 2023; OMRON 2024; Targino, 2024).

3.2. Diseases Caused by summer

These diseases are not exclusive to this season, but they are popularly known as summer diseases, precisely because of the increase in the incidence of cases during this hottest time of the year. Let's learn a little more about the main diseases of this season, the main regions of prevalence, and the rapid tests that can be performed as clinical screening.

Food poisoning can be caused by viruses or bacteria. Food deteriorates more quickly in hot weather, due to the action of toxins and bacteria. As a result, these microorganisms proliferate more quickly, which is why it is recommended that food be handled with the utmost care and hygiene (ABCMED, 2021; OMRON, 2024).

Conjunctivitis is an inflammation of the conjunctiva the transparent membrane that covers the eye that can be caused by viruses or bacteria. In the second case, mucus is formed and treatment is via antibiotics. However, conjunctivitis can also be triggered by an allergic reaction to polluting or irritating substances, such as chlorine in swimming pools and pollen from flowers. To prevent it, avoid sharing objects with infected people and frequently crowded places, in addition to not rubbing your eyes and washing your hands frequently (ABCMED, 2021; SeegeneBrazil, 2023; OMRON 2024).

Mycosis is an infection caused by fungi that affect the skin, nails, and scalp. These are not serious conditions, but they cause discomfort, irritation, itching, and flaking of the affected area. This can serve as a gateway for other infections, so it is good to be careful. Summer is also the most favorable period for the emergence of various mycoses, as heat and humidity are the ideal combination of factors for fungi to spread. Treatments are usually long, lasting months, and it is necessary to be persistent, as symptoms usually disappear long before the causative agents (ABCMED, 2021; SeegeneBrazil, 2023; OMRON 2024; Targino, 2024).

Dengue:

A disease that was eradicated in 1955, but due to a lack of preventive measures, it returned and became endemic in Brazil. Its etiological agent is a virus that causes red spots on the body from the 5th day onwards, high fever (over 38 degrees), muscle and joint pain, and can also trigger serious hemorrhages (Figure 6) (ABCMED, 2021; SeegeneBrazil, 2023; OMRON 2024).

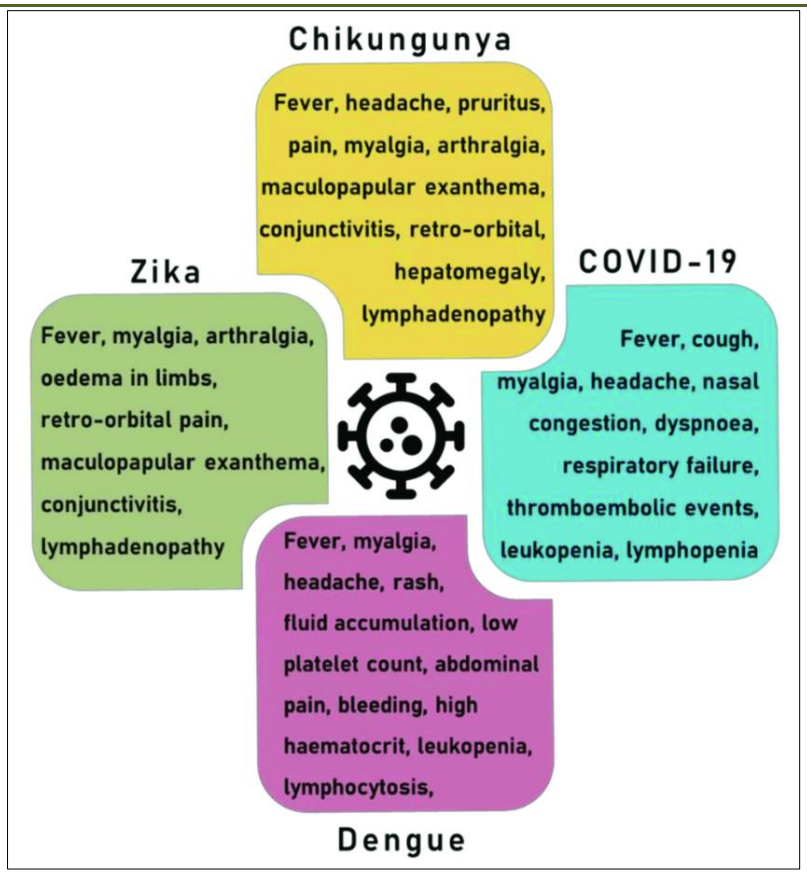

Figure 6: The main symptoms related to COVID-19, dengue, Zika, and chikungunya
Source: https://www.researchgate.net/figure/The-main-symptoms-related-to-COVID-19-dengue-Zika-and-chikungunya_fig1_350497824

Zika:

Only about 20% of people infected with the Zika virus develop clinical manifestations. Its main symptoms are headache, low fever, mild joint pain, red spots on the skin, and red eyes. Others may include swelling, coughing, and vomiting. In pregnant women, the infection can harm the brain development of the fetus (INMET, 2015; ABCMED, 2021; Pinto *et al.*, 2023; OMRON, 2024).

Chikungunya:

Another arbovirus that triggers intense body pain, headache, high fever, and red spots on the skin is Chikungunya. However, one major difference sets it apart from the previous two: it is not possible to contract the disease twice. Approximately 30% of those infected do not present symptoms, making it more common for the virus to be detected and, therefore, the number of registered cases higher (INMET, 2015; ABCMED, 2021; OMRON, 2024).

Geographical Bug:

This is the popular name for the skin disease caused by larva migrans, which live in the intestines of dogs and cats. Its main symptoms are itching and the appearance of crooked lines on the surface of the skin, which resemble the representations of river basins on maps, hence its name (INMET, 2015; ABCMED, 2021; SeegeneBrazil; 2023; OMRON, 2024).

Leptospirosis:

This is the disease caused by the *Leptospira* bacteria, which is present in the urine of infected rats. Its symptoms are very generic, such as fever and muscle pain, which makes diagnosis difficult. There are also many variations between patients, who may present mild or severe and fulminant clinical symptoms, which can be fatal (INMET, 2015; ABCMED, 2021; SeegeneBrazil, 2023; OMRON, 2024).

Dehydration:

Sweat and exposure to the sun (even if there is no apparent sweating) cause the body to lose a lot of fluid in the summer. In the rush of everyday life or in the excitement of having fun at the beach or pool, many people don't realize this and end up becoming dehydrated to the point of needing to seek emergency medical care to recover (INMET, 2015; ABCMED, 2021; OMRON, 2024).

Sunstroke:

Excessive and unprotected exposure to the sun, especially during the hours when its ultraviolet rays are strongest (from 10 am to 4 pm), can lead to heatstroke. Its symptoms are an increase in body temperature which can reach 40°C -, fever, nausea, diarrhea, and vomiting (ABCMED, 2021; SeegeneBrazil, 2023; OMRON, 2024).

Burns:

Once again, unprotected exposure to the sun is the body's greatest villain in the summer. Burns occur due to not using sunscreen and staying in the sun between 10 am and 4 pm, the times when UVA and UVB rays are most prevalent. Depending on the degree of exposure, burns can be first-degree, characterized by redness of the skin, and second-degree, when blisters appear. There are also phytophoto dermatoses, which are dark spots caused by the combination of lemon juice or another citrus fruit or perfume on the skin and exposure to the sun (Targino, 2024).

Mononucleosis is a viral disease caused by the EBV Epstein Bark virus from the herpes virus family. It is commonly known as the kissing disease because it is highly transmissible among young people, especially during Carnival in the summer, but it can occur at any time of the year (Gov.br., 2024a).

3.3. Diseases Caused by autumn

Sinusitis is an inflammation of the sinuses, which are air-filled spaces located within the facial bones, skull cheekbones, forehead, and around the nose and eyes. The inflammation is a consequence of an obstruction of the secretions that pass through these channels. It is triggered by both viruses or bacteria and by allergic reactions. These allergic reactions can be a response to dust, chemical agents, strong smells, and thermal shock. For this reason, sinusitis attacks usually appear in the fall, which puts pressure on the sinuses, causing intense and constant pain (ABCMED, 2021; SeegeneBrazil, 2023; OMRON, 2024).

A common name for acute rhinopharyngitis is a cold. It is often confused with the flu, as the symptoms are quite similar: sneezing, coughing, runny nose, sore throat, and stuffy nose. However, more than 200 types of viruses cause colds, while the flu comes only from Influenza. The clinical signs of a cold are much milder than those of the flu and, as it is a self-limiting disease that has a specific course and eventually ends), it usually does not require more than rest, fluid intake, and the use of analgesics and antipyretics (Figure 7) (ABCMED, 2021; SeegeneBrazil, 2023; OMRON, 2024).

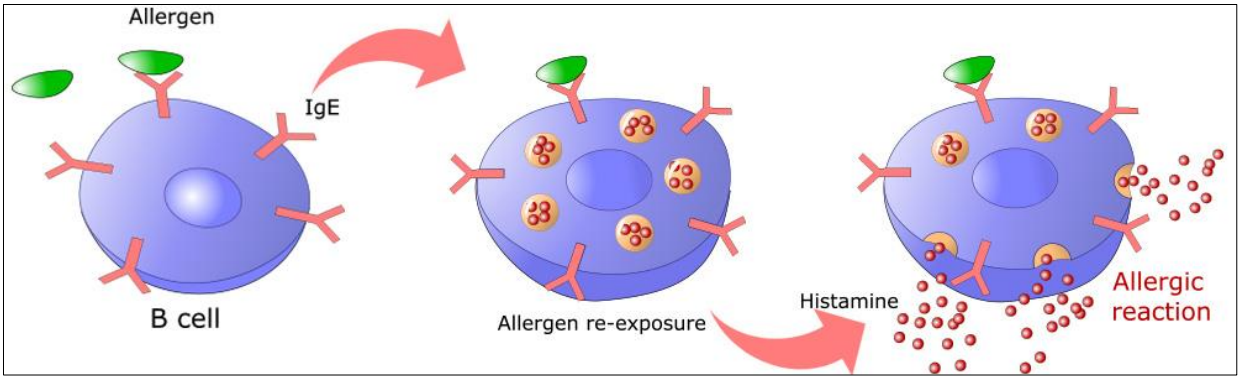

Figure 7: To fight the threat, your body overreacts and creates immunoglobulin (IgE), an antibody. The IgE binds to your "defender" mast cells, which are the troublemaker cells that cause allergic reaction symptoms. When allergens come into contact with the IgE that is coating the mast cells, it "tickles" the cell, and histamine stored inside is released. That release of histamines triggers bothersome and potentially life-threatening allergic reaction symptoms

Source: https://www.allergychoices.com/blog/what-happens-during-an-allergic-reaction/

The clinical signs of a cold are much milder than those of the flu and, as it is a self-limiting disease (which has a specific course and eventually ends), it usually does not require more than rest, fluid intake, and the use of analgesics and antipyretics. However, it is advisable not to take it easy and take the same precautions already mentioned for pathogens that are transmitted by secretions, such as avoiding crowds sharing personal objects and washing your hands frequently (ABCMED, 2021; SeegeneBrazil, 2023; OMRON, 2024).

Tonsillitis is the inflammation that affects the tonsils, which are located in the upper part of the neck, more specifically in the path between the mouth and the pharynx. The inflammatory process is caused by contact with viruses or bacteria, whether orally or nasally. Symptoms include local pain, spots in the throat, swelling, fever, bad breath, headache, and hoarseness. In most cases, anti-inflammatories solve the problem, but prevention is always better than cure. Since heatstroke is

a trigger for the development of the disease, prevent tonsillitis by dressing warmly, in addition to taking the same precautions as for other diseases that spread through contact with secretions (Figure 8) (BRAZIL, 2009; WHO, 2014; INMET, 2015; Yucong *et al.*, 2023).

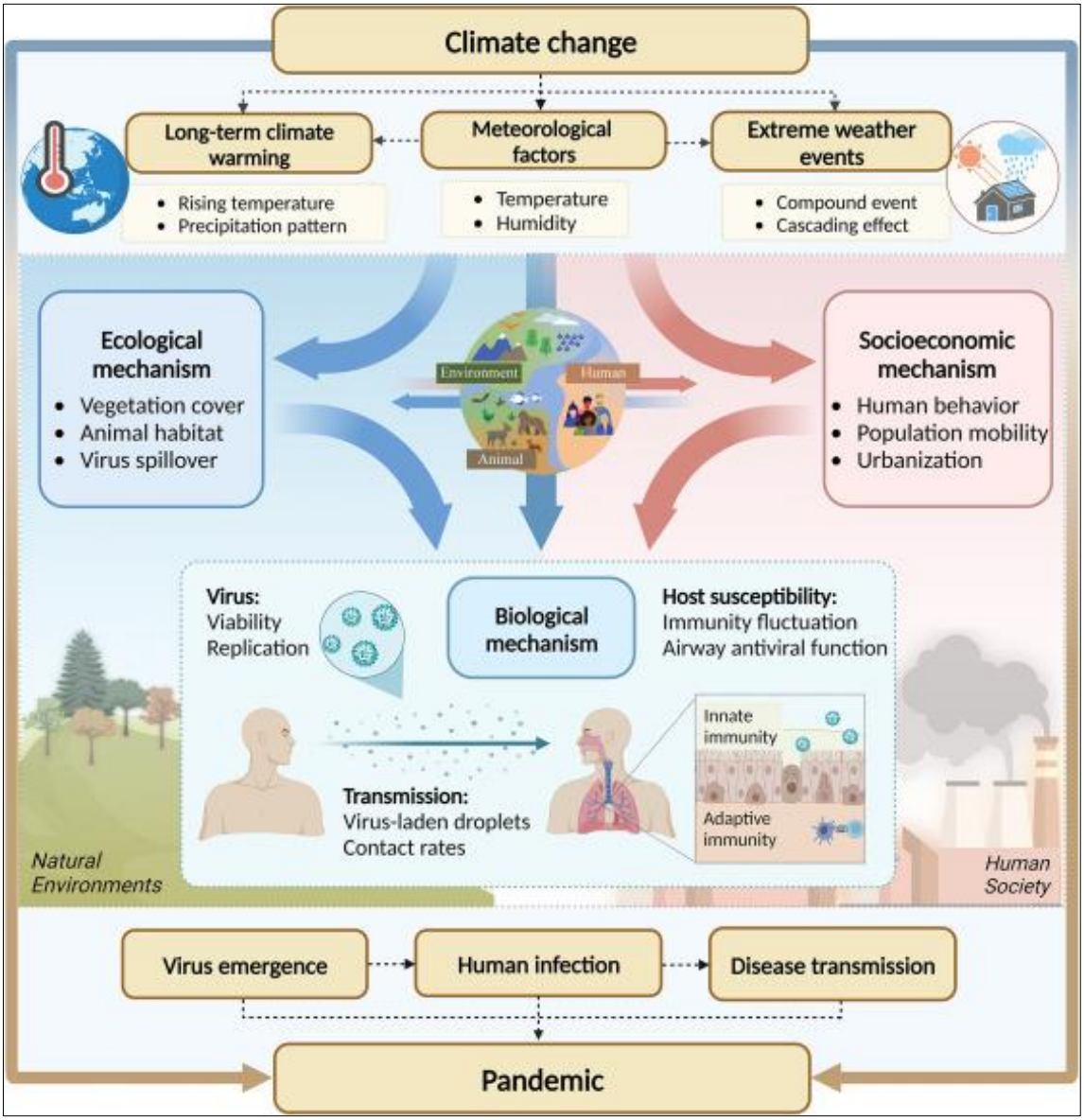

Figure 8: Mechanistic pathways through which climate change influences Viral Respiratory Infections (VRIs)
Source: Created with BioRender.com

Chronic Obstructive Pulmonary Disease (COPD) is related to smoking. With dry air and inflammation of mucous membranes between March and June, there is a higher incidence of chronic bronchitis (narrowing of the airways) and emphysema (irreversible damage to the alveoli). COVID-19: There is the appearance of an inflammatory condition of the throat, progressing to a dry cough, followed by sneezing, runny nose, malaise, fever, as well as weakness (BRAZIL, 2009; WHO, 2014).

Bronchiolitis, caused by RSV (Respiratory Syncytial Virus), is common in babies and children under two years of age, with wheezing, fever, and fatigue (BRAZIL, 2009; WHO, 2014).

Children with chronic respiratory disease, asthma, or who have an autoimmune problem require more care. "This group also includes people with comorbidities, immunosuppression, cancer, and tuberculosis (Sounis, 1985; Baxter *et al.*, 1997; Haines and Patz, 2004; Ianni and Quitério, 2006).

3.4. Diseases caused in winter

Periodically between March and June, there is an increase in pediatric emergency room visits. This is due to the arrival of autumn, which, with drier and colder air, leads to greater circulation of the Respiratory Syncytial Virus (RSV) (metapneumovirus, mouth virus, influenza, adenovirus, rhinovirus), causing respiratory tract infections such as flu and colds, pneumonia and bronchiolitis. And, since 2020, with the onset of the COVID-19 pandemic, a respiratory infection caused by SARS-Cov-2 has occurred, although the seasonality of this virus is not yet well established (ABCMED, 2021; Xavier *et al.*, 2022; SHI, 2024).

Influenza is the most common winter disease and, even with extensive vaccination campaigns around the world, thousands of people die every year due to secondary complications or due to the severity of the type of virus that infected them. The flu is transmitted by Influenza, which is subdivided into categories and subtypes. The H1N1 virus, for example, is part of class A. All subtypes of Influenza viruses are transmitted very easily through contact with the secretions of infected people. The crowding of people in closed spaces, with little air circulation, increases the spread of contagion (Figure 9) (Souza *et al.*, 2005; ABCMED, 2021; Xavier *et al.*, 2022; SHI, 2024).

Figure 9: Be prepared for the common diseases that often come with the cold season. Your well-being matters
Source: https://www.facebook.com/ElcareIndia/posts/be-prepared-for-the-common-diseases-that-often-come-with-the-cold-season-your-we/334597818948384/

Asthma is a chronic disease triggered by a combination of environmental factors dust, pollution, pollen, fungi, mites, smoke, aerosols, and genetic predisposition family history of asthmatics when its origin is allergic. Even so, it is considered seasonal, since our winter habits aggravate the situation, as well as sudden temperature changes. Non-allergic asthma, on the other hand, is caused by emotional reasons and even by the practice of physical exercise. Regardless of the type, the dysfunction is an inflammation of the respiratory tract that causes bronchoconstriction, resulting in wheezing, coughing, and episodes of extreme shortness of breath (Souza *et al.*, 2005; ABCMED, 2021; Xavier *et al.*, 2022; SHI, 2024).

Mumps, also known as epidermal parotitis, is an infectious disease transmitted through the respiratory tract, by saliva droplets, nasal secretions, and close contact with infected people. It usually affects the salivary glands, also known as parotid glands, causing inflammation, swelling, and pain (Caproni, 2018).

Pneumonia is most often caused by bacteria that settle in the lung alveoli, causing the production of fluid in the region and great difficulty breathing. Other symptoms include high fever and dry cough or cough

with greenish or yellowish phlegm indicating a bacterial infection. Other pathogens can trigger pneumonia, such as fungi, viruses, and allergens, but these are rarer cases, as vaccination is very effective (Souza *et al.*, 2005; ABCMED, 2021; Xavier *et al.*, 2022; SHI, 2024).

Sinusitis is a condition that involves inflammation of the sinuses, which are air-filled cavities located around the nose and eyes. The cause is related to viral, bacterial, or fungal infections, allergies, and irritations in the respiratory tract. Common symptoms of sinusitis include nasal congestion, facial pain, headache, thick and colored nasal discharge, sinus pain, and decreased sense of smell. Count on GnTech: For 11 years, GnTech has been contributing to medicine in Brazil, to offer health and well-being, working to discover new opportunities to offer a quality of life and make health increasingly precise and personalized for people (Souza *et al.*, 2005; ABCMED, 2021; SHI, 2024).

Oropouche is a disease caused by an arbovirus virus transmitted by arthropods of the genus *Orthobunyavirus*, of the Peribunyaviridae family. *Orthobunyavirus oropoucheense* (OROV) since then, isolated cases and outbreaks have been reported in Brazil. Oropouche is transmitted mainly by the insect known as maruim. After biting an infected person or animal, the virus remains in the insect for a few days. When the insect bites a healthy person, it can transmit the virus (Figure 10) (Elliott and Blakqori, 2011; Sakkas, 2018; Gov.br, 2024).

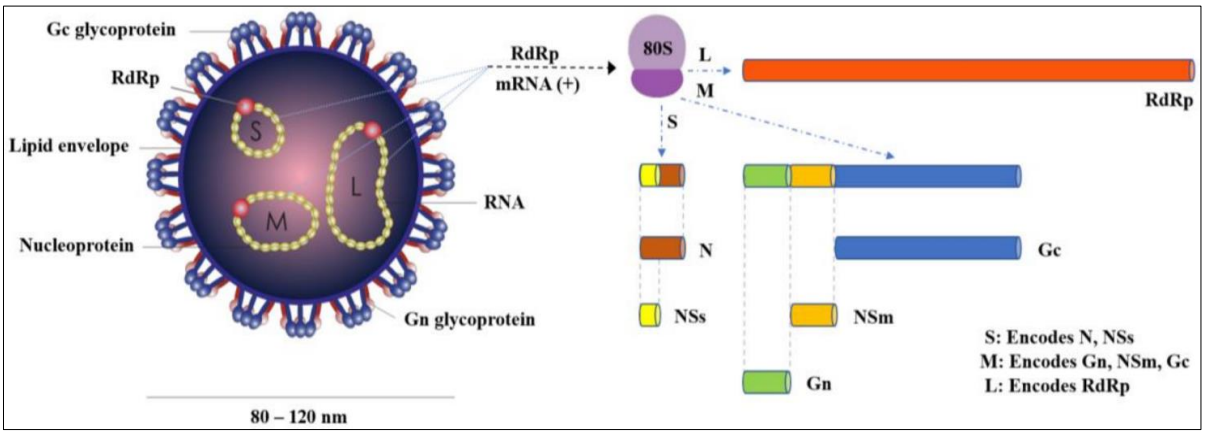

Figure 10: OROV is a negative-sense, single-stranded RNA virus with a spherical lipid-enveloped genome, sized from 80 to 120 nm in diameter, consisting of three single-stranded RNA segments called large (L), medium (M) and small (S), surrounded by helicoidal nucleocapsid and encoding the viral RNA-dependent RNA polymerase (RdRp), the viral surface glycoproteins (Gn and Gc) and the nucleocapsid protein (N), respectively. Two more proteins, the nonstructural NSm, and NSs, are also encoded by the OROV genome, the first by the M segment and the latter by the S segment

Source: Doi.org/10.3390/v10040175

3.5. Diseases Caused in spring and summer Mayaro fever

Mayaro fever is a disease transmitted by mosquitoes, especially through the bites of *Haemagogus janthinomys* Dyar, 1925 (Diptera: Culicidae), which also transmits yellow fever. Other mosquitoes, such as the common mosquito *Culex* Linnaeus, 1758 and *Culex aegypti* Linnaeus, 1762 (Diptera: Culicidae), can also transmit the virus. With diurnal habits (the period of greatest activity is between 9 am and 4 pm), *H. janthinomys*, the main transmitter, inhabits the treetops and vegetation of humid areas near rivers (Figure 11) (ABCMED, 2021; Xavier *et al.*, 2022; SHI, 2024).

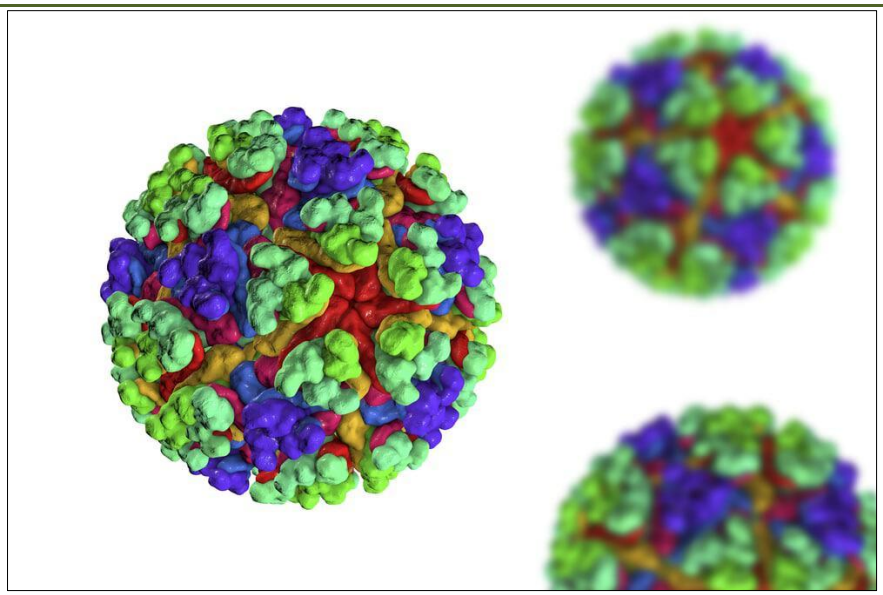

Figure 11: 3D illustration of the Mayaro virus, which causes Mayaro Fever, an endemic disease vectored by a mosquito
Source: Image Kateryna Kon – Shutterstock

The Biological Cycle:

A mosquito with the Mayaro virus infects a human being or a monkey. These hosts then contribute to the spread of the disease, since another insect can bite them, receive the virus, and pass it on. After being bitten by an infected mosquito, symptoms usually begin 1 to 3 days after infection. This time may vary from person to person, depending on individual immunity, the number of viral particles inoculated, and the viral strain, among other factors. The main symptoms are sudden onset of fever but of short duration two or three days (Figure 12) (MSM, 2019; Xavier *et al.*, 2022; SHI, 2024).

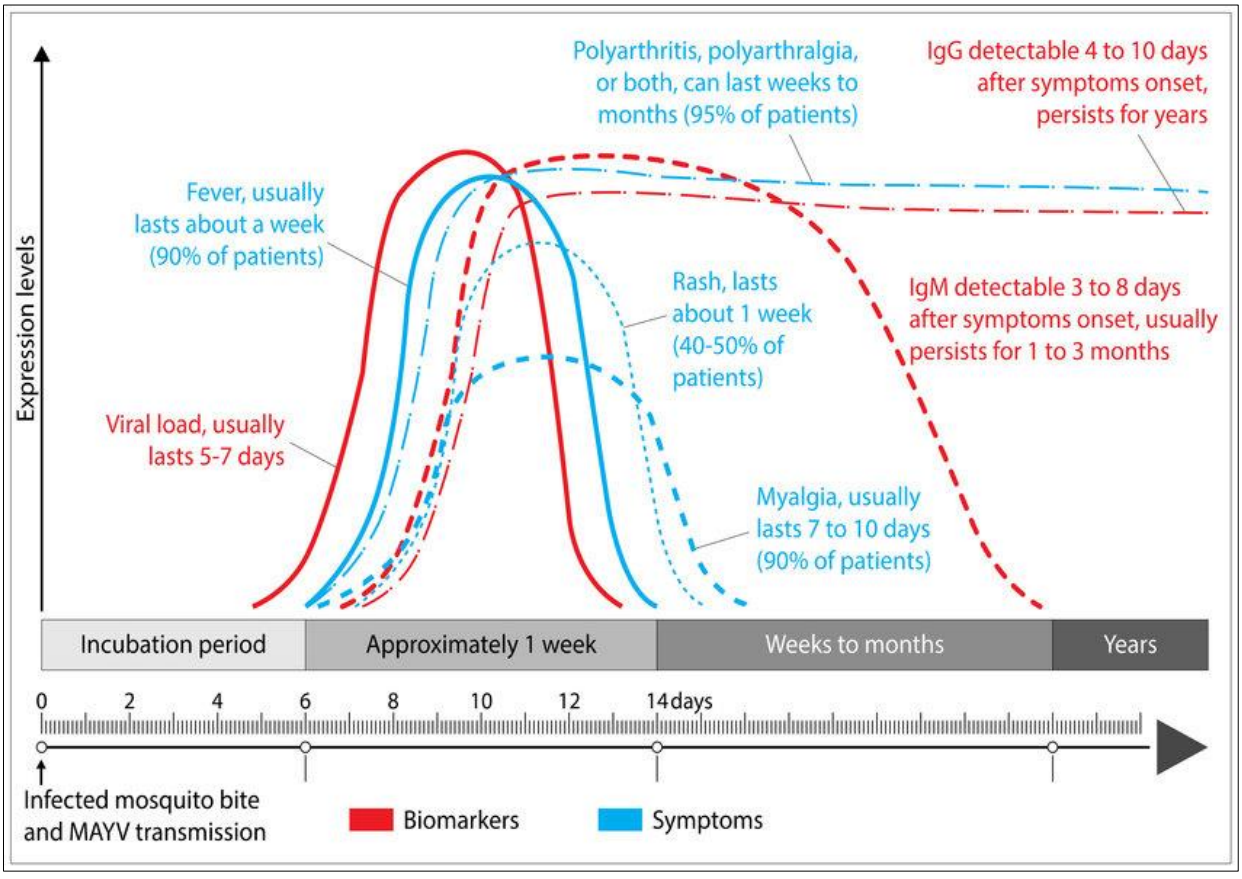

Figure 12: Pathogenesis of Mayaro fever. Time course of MAYV viremia and detection of immunoglobulin M/G (IgM/IgG) after the inoculation of MAYV into a susceptible host by an infected mosquito. Duration of clinical manifestations that may appear in an infected individual. The figure was designed using Adobe Creative Cloud apps
Source: https://www.adobe.com/creativecloud.html

Chills; Headache; Red spots on the skin; Muscle pain; Inguinal lymph nodes; Photophobia; Nausea; Dizziness. Joint pain. Since its symptoms are similar to those of yellow fever, dengue fever, and, especially, chikungunya, it is common to confuse them. Only laboratory tests can truly distinguish between the infections. Considering that there are currently no vaccines available on the market, the only way to minimize the risk of Mayaro fever is to avoid exposure to unprotected bodies in forested areas and riverbanks, especially during the times of greatest vector activity between 9 am and 4 pm (MSM, 2019; ABCMED, 2021; SHI, 2024).

3.5.1. The Diagnosis of Mayaro Fever is Clinical, Epidemiological, and Laboratory

Suspicion is based on the clinical evaluation of the patient, based on the symptoms described, and the history of exposure to risk situations in the 15 days before the onset of symptoms. Due to the similarities with other arboviruses, especially Chikungunya, laboratory diagnosis is essential to determine the etiological cause, together with clinical and epidemiological findings. Laboratory diagnosis can be made using direct tests viral isolation, molecular biology) or indirect tests serology (WHO, 2014; INMET, 2015; ABCMED, 2021; SeegeneBrazil; 2023).

3.5.2. Treatment

There is no specific therapy or vaccine. Patients should remain at rest, accompanied by symptomatic treatment, with analgesics and/or anti-inflammatory drugs, which can provide relief from pain and fever (ABCMED, 2021; SeegeneBrazil; 2023).

3.5.3. Prevention

Considering that there is currently no vaccine available and that it is not possible to eliminate the wild cycle of virus transmission, preventive measures consist of avoiding contact with areas where it occurs and/or minimizing exposure to the bite of the vector, either through individual protection resources (use of repellents, long clothing) or collective protection (use of curtains; mosquito nets, especially in rural and wild areas, in addition to avoiding exposure in affected areas), aiming to minimize contact between humans and the wild vector (especially between 9 am and 4 pm). Additional care should be taken in areas where transmission of the Mayaro virus has recently occurred (Sounis, 1985; Rouquayrol *et al*., 2003; WHO, 2014).

3.5.4. Therefore, it is recommended

1. Avoid exposure to forest areas, especially unprotected areas, during the period of greatest activity of the mosquito that transmits the disease.
2. Use of long clothing and repellents can help to avoid contact with the wild vector and reduce the risk of infection.
3. Use of mosquito nets, especially in rural and wild areas.
4. Avoid exposure in affected areas (with active transmission (Gov.br, 2024b; OMRON, 2024; Targino, 2024).

4.0. CONCLUSION

Seasonal diseases are illnesses that tend to occur predominantly during specific times of the year. Various factors contribute to their seasonality, including changes in weather, temperature, humidity, and the activity levels of disease-causing agents like viruses and allergens.

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