WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 14, Issue 4, 354-381. Review Article ISSN 2277–7105

EPIDEMIOLOGY AND GLOBAL DISTRIBUTION OF CHIKUNGUNYA VIRUS

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Article Received on
25 Dec. 2024,

Revised on 15 Jan. 2025,
Accepted on 04 Feb. 2025

DOI: 10.20959/wjpr20254-35577

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ABSTRACT

Chikungunya infection (CHIKV) is an infection that is making worldwide worries due it causing numerous flare-ups. This review focuses on examining the epidemiology as well as the global distribution of CHIKV. Most CHIKV infections are transmitted by Aedes aegypti and Aedes albopictus mosquitoes, who cause fever, swollen joints and pain to the patient. CHIKV first revealed in Tanzania in 1952. Since then, more than 60 countries have been affected by this virus including the Indian subcontinent, Italian peninsulas, Caribbean isles, parts of the Americas as well as South East Asian regions. The distribution of CHIKV globally depends on the climate, the level of urbanization as well as travel. While climate and distribution of mosquitoes have effect on the risk for chikungunya, due to urbanization, these viruses have spread because of increased vector density and increased transmission. The epidemiological attributes of CHIKV are an incubation period of 2-12 Days, Aedes mosquitoes as the vector, Attack rate in the range of 30-70 percent and 0.1 to 1.5 percent of case fatality rate. Other factors related to risk involved in the transmission of CHIKV also include climate, urbanization, travel, vector control as well as behaviors of people. Control and prevention strategies include these: vector control, vaccination, personal protection, surveillance, and public education. Vaccine Candidates are being tested, but none has been approved. This review has focused on the importance of further development of vaccines, enhancement of

vector control measures as well as research on CHIKV as there is an upsurge in its distribution. Public awareness and Biological modification programs are significant to mitigate the outbreaks and explain the spread of such diseases. It is important to understand the epidemiology and geographical spread of CHIKV in order to formulate appropriate measures for its prevention and spread control. This audit gives important experiences into the worldwide dispersion, transmission elements, and counteraction and control measures for CHIKV.

KEYWORDS: Chikungunya virus, epidemiology, geographic spread, mechanisms of transmission, measures to reduce infection and management.

INTRODUCTION

Chikungunya Virus (CHIKV) is a public health issue, which has become a global concern in recent years.[1] This alphavirus, which is most commonly spread by Aedes mosquitoes, causes debilitating joint pain, fever and swelling for variable periods from weeks to years. The chikungunya virus was first discovered in Tanzania in 1952. Since then, it has been gaining attention, with outbreaks in more than 60 countries, such as India, Italy, Caribbean, America, and Southeast Asia. Many reasons can be cited for the rapid spread of the disease outbreaks like that of chikungunya in the recent years where some include climate change, urbanization and movement of people. The virus has reached alarming levels in terms of public health and even earning the worry of health experts for its potentiality of causing large-scale outbreaks and much more morbidity and economic burden. Treatment and CHIKV prevalence studies enabling the understanding of the country's epidemiology as well its global distribution are important for control measures to be successfully established.

CHIKV Transmission mainly takes place via the bite of infected Aedes mosquitoes whose other infections are courses of dengue fever and Zika virus. The infection can also be passed from the mother to the unborn child via vertical transmission or via childbirth. Three to seven days is the regular incubation period for CHIKV Infection that follows an infected mosquito bite and continues for weeks. Different factors like climate, urbanization and tourism influence the global spread of chikungunya virus. So far, the virus has been described in temperate, hot and humid and wet regions with outbreaks taking place mostly in elevated temperature and humidity season. Although mosquitoes spread CHIKV in the wild, the spread of urban areas have increased rates of urban Chikungunya virus transmission because of higher vector density and enhanced transmission.

Taking into consideration the epidemiological features of the chikungunya virus (CHIKV), most notably its incubation period of 2-12 days, the transmission via Aedes mosquitoes, the attack rate of 30-70%, and the case fatality rate of 0.1-1.5%. Though the virus can affect all age groups, severe cases mostly occur in the elderly population. The virus has also been implicated in various neurological and rheumatological disorders.Each such CHIKV outbreak carries a great economic burden, the costs of which are estimated in the millions or even billions of dollars. The virus has also brought about deep social and psychological impacts expressed in terms of lost productivity, stigma and fear.

In terms of prevention and control practices, vector control, vaccination, personal protective measures, surveillance and education on the prevention are among the approaches that are instituted. And while there are experimental vaccines in the works, none have yet been approved for general patient use. Additionally, insect repellents, appropriate clothing and window meshes are just a few of the personal protective measures that are effective in minimizing the chances of transmission.

The purpose of this review is to assess the epidemiology and the worldwide distribution of CHIKV while elaborating on aspects that aid its circulation, its geolocation, and public health effects. Along these lines, the current prevention and control strategies will also be analyzed and the importance of research on vaccine development, vector control, and surveillance to mitigate the global threat of CHIKV emphasized. This is essential in the sense that the evaluation of the epidemiology and spatial distribution of CHIKV will enable policymakers, public health officials and researchers to effectively anticipate and manage outbreaks, lessening the health and socio-economic impact of the disease and enhancing the quality of life of the affected populations. This review provides useful information concerning the geography, life cycle and management of CHIK virus.[2]

History and origin[3]

HISTORICAL BACKGROUND (1952-1960)

The first report of the Chicungunya virus (CHIKV) was in Tanzania in the year 1952. It was during this year that this virus was obtained from the blood of a febrile patient, who presented with severe arthralgia. This virus was found to be most prevalent in areas within the eastern African region such as Kenya, Uganda, Mozambique.

1952: Discovery in Tanzania

The first record of isolation this virus is achieved in 1952 on the Makonde Plateau of Tanzania. The blood was collected from the patient and agglutinated with a febrile condition with painful inflamed joints.

Initial Outbreaks (1952-1955)

The early cases of the emerging disease in Africa which is caused by the CHIKV virus took place during the 1950s and was reported from Tanzania, Kenya and Mozambique. Such outbreaks were generally quite small and restricted to the remote regions.

Identification of the Virus (1955)

In 1955, estimations, identification and characteristics of the causative organism were done at the Virus Research Laboratory of the Rockefeller Foundation located in Entebbe, Uganda.

More Recent Studies (1955-1960)

The earliest research conducted on Chikungunya virus looked into its transmission, the vectors which help in its spread and manifestations of the virus in clinical terms. It was evident that Aedes mosquitoes were responsible for the transmission of the CHIKV virus and that it caused serious inflammatory pain in the articulations of the body.

Volunteer: Help Tanya Concentrate in Class for Me – 3 People π 0.7 Translation as one example of the intermediate term sylvatic cycle of a disease.

Scientists hypothesize that chukugunya virus went through sylvatic cycle due to its infection in non-human animals like monkeys and rodents and their mosquitoes. Such a cycle is believed to have occurred for many years with the presence of the virus in a particular geographical region through the interaction of mosquitoes and other virus carriers.

Urban Transmission (1960's)

In the years of 1960, virus, the cause of the Chikungunya fever infection, started to fit into rural and urban adaptation. It extended to the man after an Aedes mosquito with this particular CHIKV strain had bitten him. This distinct ecology of the virus brought about more infections and outbreaks in urban settings.

Important Discoveries (1952-1960s)

In the fond memories of the early days of CHIKV research, the following highlights can be mentioned:

1. Virus isolation: blood from human patients and mosquito samples yielded the isolation of the virus.
2. Transmission dynamics: Aedes mosquitoes were found to be the main disease vector.
3. Clinical manifestations: Distinctive signs of the illness such as severe pain and swelling of joints were acknowledged.
4. Sylvatic cycle: Forest mosquitoes and non-human primates were suggested to be responsible for the virus Let us examine how the virus spread.
5. Urban transmission. CHIKV expanded its tropics and adapted to cities causing more transmission and attack rates.

The SYLVATIC CYCLES (1960s-1980s)

Studies also indicated that the virus causes diseases in human beings that are associated with nonhuman primates such as monkeys, and therefore had always been circulating with monkeys in the forests along with some mosquitoes.

Epidemiology (1980's-today)[4]

In 1980's, it has been noticed that the virus started adapting to human infection through the urban cycle, as the infected mosquitoes Aedes began to bite humans. In the ecology of the virus, this was a notable presence, as transmission increased and outbreaks of the disease after infection became more common in cities.

Geographic Diffusion (2000s-now)

The decades of 2000s experienced accelerated global dissemination ofCHIKV, with notable incidences reported in:

- India (2005-2006): 1.3 million infections rose
- Italy (2007): reported infections rose to 200
- Caribbean region (2013-2014): estimated infections rose to 1 million
- America region (2014-2015): approximately 1.7 million estimated infections

Indian Ocean Outbreak (2005-2006)

CHIKV carried its first major outbreak in the 2000s in the Indian Ocean rim rocking mainly the islands of Réunion, Mauritius and Seychelles. The outbreak record kept over 1.3 million cases.

India Outbreak (2006-2010)

In 2006 CHIPK mave its way tIndia with reports gven of infections in various ststes including Maharashtra Gujarat and Karnataka. Over 1.4 million cases were recorded.

Southeast Asia Outbreak (2007-2010)

CHIKV made its way and rampant reigned to Southeast Asia with reported cases in Malaysia Thailand and Indonesia. The outbreak resulting in over 100000 cases.

Caribbean Outbreak (2013-2014)

In 2013 the Caribbean was invaded by CHIKV, by then the authorities were informed about ChiK found in Saint Martin. The outbreak covered the region and within a short time caused over one million people within the region.

Americas Outbreak (2014-2015)

The movement of CHIKV to the northern continent began in 2014 as it was noticed in countries such as the United States and Mexico and also Central and South Ameria. The outbreak number surpassed 1.7 million cases.

Africa Outbreak (2015-2017)

CHIKV was distributed to many countries in Africa such as Angola Democratic Republic of Congo and Ethiopia. The outbreak number exceeded 300,000.

Asia Outbreak (2016-2017)

The spread of CHIKV afflicted some Asian countries such as China Japan and the Philippies. The outbreak number exceeded 100,000.

Current Situation (2018-present)

CHIKV is still aggressively expanding on a global scale with reports of outbreaks in several areas such as Africa, Asia and the Americas.

Challenges and prospects of controlling Disease vectors in intervention

Quito and south America have acquired the chikungunya disease in a sporadic manner since the last few years adding environmental and climatic factors to the global spread risk. Among the many factors are explained.

Global Distribution of Chikungunya Virus (CHIKV)[5]

India

Background

After several decades when many countries, including India, have been free from outbreaks of Chikungunya, the country reports an outbreak of the chikungunya virus (CHIKV) between 2005 to 2006 that swept over 1.3 million people in 13 states.

Outbreak Characteristics

1. Temporal Patterns: The outbreak spanned between June 2005 to February 2006.
2. Extent of Geography: Outbreaks were reported in about 13 states but mainly in middle and southern regions of India where such states include:

- Andhra Pradesh
- Karnataka
- Maharashtra
- Tamil Nadu
- Kerala

3. Incidence: There were over 1.3 million incidences.
4. Mortality: Mortality figures indicate that 67 deaths took place.
5. Defense Rate: In some regions, the defense rate was approximated to be about 20-30%.

Epidemiological Features

1. Index Case: As per the story, the first case was detected in Krishnagiri district, Tamil Nadu, in the month of June 2005.
2. Transmission: The bite of the male and female Aedes aegypti and Aedes albopictus mosquitoes was the major mode of virus transmission.
3. Incubation Period: The average incubation period was between 2-12 days.
4. Symptoms: Symptoms that were frequently observed were:

- Onset of fever
- Arthralgia
- Edema
- Cephalalgia

- Exanthema

Response and Control Measures(6)

1. Surveillance: Enhanced surveillance was built to keep track of the outbreak.
2. Vector Control: Brilliance against the larval stage by removal of breeding sites and use of insecticides techniques has been put into place.
3. Public Awareness: The people were sensitized through campaigns aimed at CHIKV prevention and control.
4. Medical Management: Medical teams were sent into the field to treat the patients in the war-ainfested regions.

Difficulties Encountered and Conclusions Drawn

1. Lag Time: There was a lag time in the initial response, which permitted the outbreak to extend its limits.
2. Poor Systems: Poor resources and systems greatly compromised control measures.
3. CHIKV: Since the populations were not educated on CHIKV, the epidemic outbreak was readily embraced.
4. Mosquito Control: There were ineffective breeding control activities which led to the breeding of mosquitoes.

Influence and Effects

1. Financial Repercussions: The epidemic outbreak was a great financial concern especially to the states affected by it.
2. Medicine: The outbreak underlined the need to fortify the health system in the country of India.
3. CHIKV Studies: The CHIKV outbreak and its effects resulted in an increase in the studies carried out on CHIKV.

Africa

1. East Africa: The countries of Tanzania, Kenya, Uganda, Mozambique, and Ethiopia have all experienced outbreaks of CHIKV.
2. Central Africa: Within this region, the Democratic Republic of Congo, Republic of Congo and Angola maintained transmission of the CHIKV.
3. West Africa: The regions of Nigeria, Ghana and Senegal all documented cases of the CHIKV.

4. Southern Africa: In the southern part of Africa, the countries of South Africa, Namibia and Zambia have all reported outbreaks of the CHIKV.

Asia

1. In the year's 2005 and 2006 outbreaks were prevalent and in 2010 too.
2. Chaikungunya virus epidemic outbreaks reportage are also noted in countries such as, but not limited to, Indonesia, Malaysia, Thailand, and the Philippines.
3. within the continent: Countries like Sri Lanka, Bangladesh, and Nepal have been under the assault of CHIKV.

Americas

1. Caribbean: Epidemics happened in 2013-2014 in places including Saint Martin, Saint Barthelemy and Martinique.
2. Central America: CARIBBEAN COAST: Costa Rica, Panama, Belize CHIKV reported positive cases.
3. South America: CHIKV circulation occurred in Brazil, Colombia and Peru.

Europe

1. Italy: In 2007 a localized outbreak affected the Ravenna area.
2. France: Outbreaks occured in 2010 and 2014, with reported cases.
3. Spain: Reported cases were noted in 2010 and 2015.

Pacific Islands

1. Administrative Region of French Polynesia: An outbreak took place in 2011.
2. New Caledonia: Existence of cases in the year 2011 and also in 2013.

Reasons Affecting Global Distribution

1. International mobility-enhanced trade: The concept of international trade and commerce leads to the movement infested with mosquitoes and people.
2. Migration and mobility of human beings: Migration and travel of human beings take the virus into different geographical regions.
3. Modification of the weather: Climatic changes interfere with ecosystems which helps in breeding of mosquitoes and in the spread of viruses.
4. Population growth: Urbanization tends to increase the virus’s transmission through increased concentration of human beings.

5. Ecology and distribution of vectors: The distribution and ecology of Aedes mosquitoes, play a role in the transmission of CHIKV.

Patterns of Distribution in Regions

1. Regions with Warm Climate: CHIKV is predominantly found in the tropics and countries with a warm climate.
2. Urbanized Cropping Districts: Urban areas are often sites of CHIKV epidemics due to the high density of population coverage.
3. Environmental context: Areas where sanitation and waste management are lacking are favorable for the transmission of the disease.

Different Kinds of Global Distribution[7]

1. Endemic Distribution: The transmission of chikungunya virus (CHIKV) is invariably present and active in some localised regions such as the tropics and subtropics.
2. Epidemic Distribution: Protection from epidemics is not guaranteed in areas of recurrence and particularly in those of low CHIKV transmission where the vector mosquitoes or infected people may be reintroduced.
3. Pandemic Distribution: Distribution of CHIKV is endorsement and attributed to the dynamics of world travel and trade of the virus.
4. Irregular Distribution: Few cases of the CHIKV disease present themselves from time to time and in different places mostly as a result of travel, tourism or importation of goods.
5. Cluster Distribution: CHIKV incidences are reported from a few geographical peripheral sections e.g. urban and semi urban centers.

Hypotheses on Global Dispersal

1. Theory of Diffusion: In this way, it is believed that the movement of CHIKV is presented due to individuals' movement and activity, which includes migration, traveling and trade.
2. Gravity Model: When causing the spread of chikingunya virus (chikv), population distanced and economic factors come into play.
3. Hierarchical Diffusion: Regions outside of cities are affected by the CHIKV propagation after the cities have been infected first.
4. Contagion Theory: The virus CHIKV is spread through contact between persons or other hosts, which is different from the vectors.
5. Network Theory: The packets show that the social, economic, or even transport and communication networks work effectively in transmitting CHIKV.

Reasons Contributing to the Global Spread(8)

1. Climate: The degree of temperature and humidity and the pattern of precipitation influence the breeding of mosquitoes and the spread of the virus CHIKV.
2. Vector ecology: The distribution, behavior and ecology of the Aedes mosquito affect how the virus CHIKV is spread.
3. Human Migration: Only one aspect of the problem is movement of human beings that aids the spread of the virus CHIKV.
4. Global Trade: Movement of trade and people across borders further facilitates the introduction of already infected mosquito and human populations.
5. Urbanization: Increased population growth rates and inadequate waste management promote the spread of Chikungunya virus infections.
6. Economic Factors: The social features of a given population during insufficiency of education or health and health care services increases the risk of normal economic activities leading to excess CHIKV transmissions.

Epidemiological Characteristics

Index Case

1. Site: The initial affected person was discovered within Krishnagiri district, situated within Tamil Nadu, a state found in Southern India.
2. Period: The period under consideration is June 2005.
3. Gender: The gender of the index case is Male aged 45 years
4. Clinical picture: High grade fever, extreme arthralgia and edema were the symptoms with which the patient came to the hospital.

Mode of Transmission

1. Agents: The most common agents were Aedes aegypti and Aedes albopictus mosquitoes.
2. Way of transmission: The illness was transmitted by an infected mosquito through biting.
3. Attack rates and secondary transmission: No incidents of virus transmission through direct contact with contaminated fluids to another person were documented.

Onset of The Illness And Its Symptoms

1. Range: Two to twelve days.
2. Average: Between three to seven days.
3. Variation:Systematic differences, for instance age, health status, and viral load also existed in the incubation period.

Signs and Symptoms[9,10]

1. Fever: The most common symptom experienced was fever as high as 39-40 degrees Celsius.
2. Joint rub and increase due to pain metabolism was achy and tender especially to the hands and the feet.
3. Headache: Severe headaches were common amongst patients.
4. Rash: In some patients maculopapular rashes were seen.
5. Others: Muscle aches, weakness and vomiting were mentioned as well.

Case Fatality Ratio (CFR)

1. General CFR: 0,005% (67 deaths/1.3 million cases).
2. Age-Based CFR: Higher in older people (>60).
3. Comorbidities: Patients who had preexisting conditions tended to have worse symptoms and were more likely to die.

Attack Rate

1. Distribution: In certain regions between 20-30% is reported.
2. Urban vs rural: Urban areas reported higher attack rates.
3. Diversity: The attack rates differed depending on variation in population density, mosquito activities, interventions made by the health systems.

Sex Disparity

1. Gender composition: Males 1:1.2 - Majority of patients were female.
2. Explanation: This could have resulted from the females' biological vulnerability focusing on their hormones and innate immunity.

Age Diversity

1. All age groups dealt with the issue.
2. Most susceptible age range: three decades to four decades.
3. Changes: Age diversity differed in relation to the occupation and way of life and the risk of mosquito bites.

WORKING POPULATION

1. Work-related risks: The work of outdoor laborers, farmers, and construction workers tend to have more exposed individuals who can get infected.

2. Explanation: More mosquitoes and little protection.

Periodic

1. Most intense infectivity: At the period of the rains (June-September).
2. Least infectivity: At the period of the dry chilly season (December-February).
3. Explanations: Biting and breeding of mosquitoes increased during the season of rains.

Risk Factors and Transmission Dynamics

The Effect of Temperature

1. Mosquito survival and activity is greatest when the temperature is maintained at the optimal range of 20-30°C (68-86°F).
2. temperature above 25-30°C (77-86°F) is most conducive for the process of development of viruses in mosquitoes.
3. Mosquito activity increases above 30°C (86°F), and decreases when the temperature is below 20°C (68°F).
4. Mosquito eggs are best laid at 20-25°C (68-77°F).

Humidity Effect Politeness Strategy

1. Mosquito lived for longer period at high humidity level (>60%).
2. Humidity also is a determine in the physical characteristics of the virus-enhanced transmissibility of the virus.
3. Mosquito breeding is also possible in areas with high moisture content.

Temperature and Humidity - Their Interrelationship[11,12]

1. Synergetic outcome: Good temperature and humidity level for mosquitoes and also for the spread of the virus.
2. Enhancing transmissibility: A temperature of 25 to 30 degrees Celsius (77 to 86 degrees Fahrenheit) and relative humidity greater than 60% facilitates a rise in transmission levels.

Regional Differences

1. Tropical areas: Transmission of Chikungunya is often observed in tropical areas where warm temperatures and humidity are present.
2. Seasonal conditions: There are seasonal variations in the transmission rates, with sustained high peaks during the monsoon seasons in India.

Influence on Transmission Dynamics

1. Amplified vector biology: Temperatures and humidity that are more comfortable and effective, enhance the focal vector biology of mosquitoes.
2. Improved ability for viral replication: Temperature and moisture levels conducive also aid in bringing out the replication of virus.
3. Raise the human-host contact with vectors mosquitoes' activity: Higher mosquito interaction activities and populations call for trillions of contacts between humans and mosquitoes.

Urbanization Factors Contributing to Increased Vector Density

1. Higher numbers of people are crowd in them: Cities are more populated which allows more breeding spots for mosquitoes.
2. Waste disposal problems: Improper waste disposal and stagnant water provide favorable conditions for mosquito breeding.
3. Lack of greeneries: More better amenities have mirrored higher mosquito population due to less greeneries.
4. Poor drainage system: Mosquitoes thrive in areas with stangnant water which is a common situaton in areas with poor drainage system.

Effects on the Density of Vectors

1. More mosquitoes: this is increased by urban centers which also increase the amount of diseases that can be spread.
2. Increased mosquito vector capacity: mosquitoes in cities are more efficient as vectors because the resources for breeding and attaching are more.
3. Increased chances of human infection: Higher the densities of mosquitoes, higher the inter action the humans have with mosquitoes, hence the risk of diseases is elevated.

Dynamics of Transmission

1. Elevated rates of transmission: The interaction of higher vector density and human mosquito contact leads to raised transmission rates.
2. Urban centers of transmission: Areas characterized by inadequate sanitation and consisting of a large population becomes the center of transmission.
3. Outbreaks of infectious illness: Over the years, urbanization has contributed to the emergence of outbreaks of vector-borne diseases such as Chikungunya.

Issues Related to Public Health

1. Higher burden of diseases: Healthcare apparatus is further strained by urbanization leading to an increase in cases and even deaths.

2. Problems with the management of diseases: Residing in urban settings brings about issues for management control of diseases due to imbalance in proportions of the population and the existing infrastructure.

3. Integrated Vector Borne Disease Management is required by urbaniza: The last point explains why urbanization demands integrated vector borne disease management.

Factors Associated with Travel[13]

1. Long-haul Flights: Increased air travel enables infected persons to reach new destinations and hence increases the possibility of virus dissemination.

2. Accessibility: The comprehensive transport network together with globalization encourages the interrelation of people, services and especially trade which increases the chances of the spread of viruses.

3. Infection: Travelling individuals might tour areas which are highly infested with the virus, raising their chances of infection.

Transmission Modes While Traveling[14]

1. Through risks related to infected travelers: there are ways individuals who are infected are able to spread the disease to other persons without contacting them in any way, for example, via bites from mosquitoes or the use of tainted syringes.

2. through contaminated supplies: infected species of mosquitoes or any other tissues or materials known to be virus-positive can be transported in cargo which creates room for the spread of the disease.

3 Handling of travel-related areas such as Airports and transport: This implies that places where there are large numbers of people, such as airports, and bus stations, are likely to be hot zones for the transmission of the virus.

Travel Tour Groups Exposed to High Risk

1. Tourists: Travellers visiting places with high transmissibility of the virus are at greater risks.

2. Work travelers: Constant passengers are more prone to infected mosquitoes.

3. Immigrants: Moving from endemic regions to fresh territories.

Consequences of Expansion of the Epidemic Worldwide[15,16]

1. Reignitions: Importation of cases associated with travel can result in reignitions in areas that were previously free of the illness.
2. Virus amortization: In the case of repeated reintroductions, there is a likelihood that the virus will be established in new regions, thus complicating control measures.
3. Enhanced transmission: Travel promotes the circulation of the virus, presenting the risk of enhancing its transmission.

Approaches for Reducing and Preventing Sti-Related Vulnerabilit

1. In-flight health checks: Find and isolate infected persons with these measures of in-flight health checks.
2. Travel health promotion: The risks of Chikungunya to the travelers and its preventive measures shall be taught to the travelers in order to lower the possibility of spread.
3. Environmental management: The use of these measures in sites associated with movement of people and in recreation areas is likely to cut down the transmission windows.

Underdeveloped Vector Control Measures

1. Failure to remove mosquito breeding sites: There is a lack of concern for obvious obstacles to mosquito proliferation such as stagnant water and refuse and the result is an upsurge in mosquitoes.
2. Improper use of insecticides: The application of insecticides focusing on larvae and adult mosquitoes has been weak and as a result mosquitoes have not been controlled.
3. Absence of integrated control: Control of mosquitoes is exercised solely by means of chemical agents and not strategies that incorporate physical forms or living entities.
4. Insufficient awareness of the public: There is little knowledge in the general public about the locations mosquitoes breed and measures to be taken to avoid that.
5. Poor management of waste: Sites for breeding mosquitoes are encouraged by negative waste management habits such as throwing away items like used tires and containers in the wrong places.

Effects on Epidemics Management[17]

1. Overbearing mosquito populations: Inadequate vector control measures always result in increased mosquito populations hence the risk of transmission increases.
2. Elevated transmission rates: Transmission rates are higher due to higher mosquito densities and increased human-mosquito interactions.

3. Extensive epidemics: Poor measures of vector control can result in extensive epidemics with a great portion of the population being affected.
4. High toll on simulated representative communities: Economic outbreaks can be very taxing to reimburse especially in the case of communities living in the tropics.

Successful Vector Control Methods[18]

1. Integrated pest management (IPM): Use IPM actions which can be physical, chemical and biological at the same time.
2. Mosquito breeding site elimination: Identify and remove any sites where mosquitoes can breed.
3. Insecticide use: Employ the use of larvicides or adulticides as appropriate insecticides.
4. Public Advocacy Programs: Inform the public with respect to the presence of mosquito breeding sites and how to prevent them.
5. Waste Management: Ensure proper waste disposal systems are in place.

Threat to Health and Environment

1. Lack of appropriate disposal waste: Inadequate disposal of waste like used tires, baskets, and other containers creates locations where mosquitoes breed.
2. Lack of proper hygiene: Lack of hygiene practices and facilities such as latrines lead to the breeding and increase of mosquitoes.
3. Poor management of water: Keeping water in open containers, barrels or tanks encourages the existence of mosquitoes.
4. Low family cleanliness: Not using mosquito spray or net, or wearing insect proof clothes increases the risk.

Inadequate Knowledge and Information

1. Irregularities in understanding the symptoms of Chikungunya. Failure to know the disease and how it can be transmitted and prevented.
2. Lack of awareness on where mosquitoes bred: There are areas where standing water and wastes exist but persons are not aware that these breed mosquitoes.
3. Protection possibilities not declared: For example, mosquito nets, repellents, or protective clothing were not used.
4. Failure of clients to attend to services on time: Clients do not attend for treatment and this facilitates the spread of the disease.

Influence on Exchange

1. Increased mosquito breeding: Bacteria constrained environments where breeding sites for mosquitoes is conducive contribute to increased transmission.
2. Transmission rates upsurges: Having no information and maintaining poor hygienic conditions causes the transmission rates to increase.
3. Universal epidemics: Ingrained uncouth practices in provision of services along with ignorance may lead to universal epidemics.
4. Catastrophic financial strain: Exceedingly large outbreaks have a financial strain on the concerned parties involved in the outbreak control.

Successful Approaches

1. Use of the media: Engage the public on issues regarding Chikungunya by talking about the disease, how it is spread and how it can be prevented.
2. Encourage hygiene: Practice proper disposal of refuse, waste management and safe storage of water.
3. Make available mitigative measures: Mosquito nets, mosquito repellents, and protective clothing shall be provided.
4. Strengthen the service delivery system: Medical personnel and equipment shall be available to ensure that health services are offered without delays.

Prevention and Control[19]

Insecticide Treated Nets (ITNs)

1. Efficacy: Malaria and Chikungunya transmission is decreased by 50 to 60% with the use of ITNs.
2. Variety: The nets can be treated with either pyrethroids or permethrin or deltamethrin.
3. Supply: Provided for free or for subsidized payment to the at risk populations.
4. Adherance: Frequent re washing and changing after the duration of 2 to 3 years.

Larval Management Techniques

1. Techniques: Outlets for larviciding measure extremely use of temephos.
2. Breeding sites: Comprise still waters, garbage and other refuse.
3. Biological control: Using bio control agents including their predators and pathogens.
4. Environmental modification: Removal of breeding sites or better drainage.

Controlling Adult Mosquitoes[20]

1. Strategies: Use insecticides (e.g. pyrethroids) for killing adult mosquitoes.
2. IRS: Reside Insecticides are applied on surfaces like walls and ceiling.
3. Room Treatment: Aerosols or fog appliances are employed to kill mosquitoes.
4. Outdoor Space Busting: Vehicles or handheld pumps are used.

Integrated Vector Management (IVM)

1. Mix: Use ITNs, larval, and adult mosquito control in combination.
2. Monitoring: Manage mosquito populations and their associated disease transmission.
3. Practices: Promote and educate communities.
4. Edward and Sadibe: If all the above do not work, modify the approaches to the local setting and resistance.

Advantages[21]

1. Decrease the risk of spread: Mitigate the spread of Chikungunya.
2. Cost-effective: Savings over the long-term.
3. Better health: Less illness and death.
4. Higher living standards: Less economic impact.

Difficulties encountered

1. Resistance: Mosquitos' resistance to insecticides.
2. Logistic: Problems in distribution, maintenance, and supply chain.
3. Community acceptance: Cultural and social barriers.
4. Fundings: Scarcity of resources.

Vaccination: Experimental vaccines under development[22]

There are several types of vaccines

1. Inactivated vaccines These vaccines employ killed viruses for immune activation
2. Live attenuated vaccines These vaccins use weakened viruses to elicit immune response
3. Subunit vaccines These vaccines employ a few specific components or parts of the virus
4. Virus-like particle VLP vaccines These types of vaccines utilize virus-like particles in their composition
5. mRNA vaccines These types of vaccines are based on the use of messenger ribonucleic acid.

Vaccines Under Research

1. Chikungunya virus-like particle (CHIKV VLP) vaccine: Created at the National Institute of Allergy and Infectious Diseases (NIAID).
2. Chikungunya vaccine: Live attenuated CHIKV developed at the University of Texas Medical Branch.
3. An inactivated Chikungunya virus (CHIKV) vaccine: Created at the Indian Institute of Technology (IIT) Biotech.
4. mRNA-1893 vaccine: Created at Moderna Therapeutics in cooperation with the National Institutes of Health and Takeda Pharmaceuticals in Japan.
5. Chikungunya virus like particle – vaccine: University of North Carolina developed this vaccine.

Clinical Research Development Phases[23]

1. Phase I: Determination of safety and tolerability.
2. Phase II: Assessment of efficacy and immune response.
3. Phase III: Efficacy and safety confirmation.

Difficulties encountered

1. Viral variability: A number of forms of CHIKV.
2. Immune response: Immune response is different between individuals.
3. Safety concerns: Risks of adverse effects.
4. Manufacturing: Issues of producing large amounts.
5. Regulatory approval: Obeying the law.

Ways forward

1. Lipopeptide vaccines: against several conditions at the same time
2. Vaccine delivery systems: Linguistic modification of procedures that dispense vaccines.
3. Vaccine development for underrepresented groups within specific age categories: encapsulating mostly children and elderly persons.

Personal protection: Insect repellents, clothing, and screening

Insect Repellents

1. Forms: DEET, picaridin, oil of lemon eucalyptus, and IR3535.
2. Safety: DEET (20-30% concentration) and picaridin (20% concentration) provide long-lasting effects.

3. Usage: Apply on exposed skin and clothes.
4. Warnings: Do not apply on broken skin, mucous membranes, and mouth.

Attire

1. Essential protective wear: long sleeve t-shirts, long trousers and socks must be worn.
2. Treated clothing: clothes to be worn have permethrin and deltamethrin treated wear.
3. Clothing Color: Mosquitoes are less attracted to the white color clothing.
4. Loose clothing: do not wear well-fitted pants or attire which mosquitoes can bite through.

Insect Screen

1. Window screening - put screens in windows and doors.
2. Door screen - put screens in doors to stop mosquitoes from crawling in.
3. Mosquito netting – sleep under mosquito nets to avoid skin contact with mosquitoes while asleep.
4. Screen maintenance – inspect the screens at reasonable intervals and make repairs where necessary.

Additional Strategies

1. Time restriction – avoid the outdoors between dawn and dusk to prevent mosquito bites.
2. Air conditioning – Sit in air-conditioned rooms to minimize access of mosquitoes.
3. Mosquito coils – or vaporizers, Susztronstein provides additional resources for such traditional appliances.
4. Weekly surveillance – spraying of residual insecticide should be done routinely to prevent any accumulation of mosquito breeding surfaces.

Advantages

1. Decreased probability: Utilization of personal protection strategies helps in reducing the chances of Chikungunya infection.
2. Economical: Personal protection measures are more economical.
3. Simple Application: Simple Application of personal measures is possible.
4. Permanent safeguard: Personal measures ensure long-term safeguard.

Disadvantages

1. Adherence: There is a need to ensure that personal protection measures are adhered to at all times.

2. Availability: Unavailability of essential repellents and processed clothing.
3. Expenses: Certain repellents and processed garments come with an exorbitant price tag and can therefore be considered expensive.
4. Social customs and beliefs:, Social and Gneodemocratic customs and attitudes, may discourage their usage.

Surveillance: Enhanced monitoring and reporting[24]

Additional Surveillance

1. Case detection: Define and notify suspected cases in a timely manner.
2. Laboratory confirmation: Laboratory confirm (PCR, serology) cases.
3. Vector surveillance: Monitory mosquitoes and their breeding sites.[25]
4. Environmental monitoring: Monitor climatic conditions including rainfall, temperature and humidity.

Reporting

1. Timeliness of reporting: Notify health authorities of all cases and outbreaks in a timely manner.
2. Consistent reporting: Adhere to uniformed reporting procedures and forms.
3. Digital reporting: Make use of electronic surveillance systems to increase reporting efficiency.
4. Community participation: Encourage the civil population to contribute in the reporting and surveillance activities.

Monitoring Solutions

1. System for Integrated Disease Surveillance and Response(IDs). Improve the quality of the heretofore existing IDs.[26]
2. Electronic Surveillance Systems: A real-time report employing the use of digital means.
3. Sentinel Surveillance: Set sentinel sites for better observation.
4. Participatory Surveillance: Focus on communities as key surveillance members.

Advantages

1. Improved early outbreak management: Improved surveillance makes it possible to find outbreaks much earlier.
2. Rapid intervention: Early information allows for interventions and other control activities to take place rapidly.

3. Evidence based management: Decisions on policies and programs are based on surveillance data.
4. Better outbreak management: Good surveillance minimises the degree of outbreaks.

Obstacles

1. Lack of resources: shortage of assets available (financial, human, physical).
2. Data quality: Making sure that surveillance information is precise and dependable.
3. Community engagement: Motivating society to take part in surveillance.
4. Sustainability: Keeping surveillance activities in the long run.

Public awareness: Education campaigns and community engagement

This section describes the strategies that will be employed for education and awareness of the masses in the campaign.

1. Mass media: Information can be broadcast or Tele but uses electronics such as the internet, telephones, radios and other gadgets.
2. Posters and flyers: Pictures and writings can be posted on but not limited to the streets.
3. Public events: This actually involves activities such as organizing health fairs and community gatherings.
4. School programs: In this case Chikungunya education will be added to the syllabus implemented by schools.

Community Engagement[27]

1. Community outreach: In this process leaders and institutions are reached for mutual cooperation.
2. Volunteer programes: Efforts directed towards education and outreach are supplemented with enlisting volunteers.
3. Partnerships: Local businesses, health care facilities and government agencies are engaged.
4. Focus groups: These assist to understand the issues that the community perceives and the attituds held about them.

Essential Commitments

1. Symptoms of Chikungunya: Sensitize on its signs and symptoms such as high fever, joint aches, and biting rashes.
2. Transmission: Describe how it transmitted by mosquitoes.[28]

3. Prevention: Stress self – protective approaches like the use of repellents and clothes.
4. Treatment: Educate about treatment programs.

Audience Segmentation

1. The population: Pay attention to children, pregnant women, and elder adults that are more vulnerable.
2. Health workers: Inform health workers on the aspects of disease management such as diagnosis, rehabilitation and disease control.
3. Traditional / religious leaders: Involve traditional leaders for reinforcement of the messages.

Surveillance and Research

1. Questionnaire Evaluation: Administer questionnaires to evaluate the changes in knowledge and behavior.
2. Group Discussions: Conduct group interviews which aim to assess the impact of the campaign.
3. Go Across the Company: Measure the levels of media, including any public interactions.

Benefits[29]

1. General awareness: Alleviate the general ignorance about Chikungunya.
2. Behavioral modification: Motivate people to take preventive actions.
3. Engaged Community: Have the community actively participate in the prevention.
4. Reduced transmission: Help in the lowering of the Chikungunya transmission rates.

Challenges

1. Resource constraints: Lack of necessary funding and workforce.
2. Socio-cultural challenges: Focus on varied sociocultural environments.
3. Continued attention spanning an extended period: Ensuring sustained focus.
4. Message exhaustion: Preventing overexposure of the audiences to messages

Future Directions[30]

1. Vaccine formulation: Design and create effective vaccines against Chikungunya.
2. Combined vector management: Put eco-friendly and flexible measures for vector control in practice.

3. Surveillance and monitoring: Upgrade surveillance and monitoring systems for effective early warning and response.
4. Community engagement: Build and educate communities towards the prevention and control of diseases in the long term.
5. Intersectoral collaboration: Create interactions between health, education, and environmental management sectors.
6. Research and Development: Seek out new techniques and technologies in the control of vectors and diseases.
7. Global coordination: Improve external relations and sharing of information.

CONCLUSION

Chikungunya is one of the global disease threats affecting millions of people in humid regions of the world, especially the tropics. The epidemiology, dynamics of transmission of the disease and measures for its prevention and control warrant a detailed insight.

Individually used, tend to work well, insecticide treated nets, repellents, and protection clothing are some of the personal protection measures included in the prevention and control strategies. Also, elimination of mosquito vectors by controlling their larval stages and adult populations is also important. Some of these activities include destruction of breeding sites and improvement of community hygiene.

Nevertheless, there are still obstacles. Mosquitoes' resistance to insecticides, inadequate finances, and social and cultural barriers interfere with ones capacity to control the vector. As a result of this, there is a need for fresh perspectives and integrated methods.

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