

IMMENSELY IMPACTED EPIDEMIC AND PANDEMIC VIRAL OUTBREAKS IN INDIA: A REVIEW ARTICLE

M.Durga¹, K.Janani¹, A.Narmadha¹, Dr.S.Gowri², Dr.V. Dhana Rangesh Kumar^{*3}

¹Student, Department of Biochemistry

²Head, Department of Biochemistry

^{*3}Assistant Professor, Department of Biochemistry

^{1,2,*3}Dr.N.G.P. Arts and Science College, Coimbatore, Tamilnadu - 641048, India

Abstract: The new discoveries and technologies are day by day progressing, on the same time new different diseases also increasing in the world. The microbes are one of the disease causing factors for human being. The viruses are the most dangerous microbes in the world, now a day there is no specific medicine and treatment for more number of viruses. In current outbreak SARS CoV-2 virus is fully changed the world environment. In this present study focused to the most important past, present viral outbreaks in India in 19th-21st century. This review has compiled with clear information's about viruses which are highly affected in India.

Keywords: Microbes, Virus, SARS CoV-2, Outbreaks

INTRODUCTION

India has improved its ranking on global healthcare even it faced some pandemics and epidemics throughout history in current we facing corona virus SARS Cov-2. It is not uncommon for sudden and rapid outbreaks to occur in India and many articles direct the cause for this in such developing countries being malnutrition, lack of sanitation and proper public health system [1]. The 20th century has seen significant reductions in ecosystems and biodiversity and equally dramatic increases in the numbers of people and domestic animals inhabiting the Earth. In fact, continued inadvertent human activities leads to degradation of health care resources has increased the opportunity for various pathogenic agents including some deadly viruses to pass from the animals to humans causing emergence of new diseases [2]. Microbes can make humans, animals and plants sick by causing infection and disease. A virus is a simple organism which is made up of a protein coating and some genetic material. Viruses are well reproduce and grow in living organisms. Viruses are transmitted as organisms much smaller than bacteria and incapable of multiplying outside the host, but often associated with larger particles in the water environment [3]. Since the dawn of man, he has been vulnerable to microbial attack, from a mild fever to a fatal disease. Scientists have been working diligently to prepare vaccines or to discover cures for various infections [4]. During the period of 19th – 21st century India faced several epidemics and pandemics, among those some highly impacted viruses are discussed in this article.

IMMENSELY IMPACTED EPIDEMICS AND PANDEMICS

Here we discussed about Cholera, Dengue, Chikungunya, Swine Flu, Zika, Nipah and SARS-CoV-2 which are more affected outbreaks in India.

CHOLERA

Cholera is an acute, diarrheal illness caused by infection of the intestine with O1 or O139 sero groups of *Vibrio cholerae*. Profuse watery diarrhea and vomiting can lead to dehydration and shock. Without treatment, death can occur within hours. Oral and intravenous rehydration therapy has decreased fatality rates but cholera remains a dreaded illness because of its rapid onset, severity, and potential to cause outbreaks that easily overwhelm public health systems in impoverished settings [5]. Cholera infection is through ingestion of food containing *Vibrio cholerae* in company of fecal material via oral route. The bacteria dislike acid and they tend to die due to presence of gastric juice [6]. Beside this there are several other factors like contaminated foods, especially raw shellfish, may also transmit the cholera-causing bacteria [7]. India reported cholera cases and deaths from 1997 to 2006. Over the 10-year period, the average number of cases reported annually was 3,631 and fatality rate showed a decreasing trend (range: 0.57–0.07). The numbers of cholera cases and deaths in National health profile 2006 were found to be similar to the numbers reported to the WHO [8]. This outbreak was mainly caused by drinking contaminated water and the primary case person's faeces contaminated the water inside [9].

DENGUE

Dengue viruses (DV) belong to family *Flaviviridae* and there are four serotypes of the virus referred to as DV-1, DV-2, DV-3 and DV-4. It is transmitted mainly by *Aedes aegypti* and *Ae. Albopictus* mosquitos. Dengue virus was isolated in Japan in 1943 by inoculation of serum of patients in suckling mice and at Kolkata in 1944 from serum samples of US soldiers [10]. The dengue virus symptoms are high fever, severe headache, muscle and joint pain, nausea, abdominal pain, respiratory distress, skin rashes and bleeding manifestations [11]. The different findings methods are used to detect dengue virus such as, demonstration of DV IgM antibodies or by NS-1 antigen in patients' serum depending upon day of illness using ELISA kit, RT-PCR, DV isolation in tissue culture cells and its sequencing is also being done to identify this virus [12]. The outbreak of dengue (1, 88,401) cases and

325 deaths are reported at India [13]. There is no accurate vaccine treatment is available in dengue virus, the preventing and control measurement are used to protect human against dengue fever. Such prevention and control ideas are using mosquito coils and electric vapors mats during the day to prevent from dengue. Discard all wasted items getting gathered around the living area to avoid the breeding of mosquitoes. Patients suffering from dengue-fever must be isolated for at least 5 days. Keep the water stores clean and closed and take prompt medical advice once a fever starts [14].

CHIKUNGUNYA

Chikungunya virus (CHIKV), an alpha virus of the family *Togaviridae*. The virus is transmitted between humans through the bite of an infected *Aedes* mosquito, primarily *A. aegypti* or *A.albopictus* [15]. It is considered as a tropical disease because it had only been documented in Africa, Asia and India. In India the first outbreak occurred in 1964 in South India, followed by another in 1973 in central India. *A.albopictus* was the principal vector in the outbreaks in the Indian Ocean islands and *A.aegypti* in the 2006 Indian epidemic [16].Symptoms start with fever and the majority of infected persons develop severe, often debilitating polyarthralgias. The joint pains are usually symmetric and occur most commonly in wrists, elbows, fingers, knees, and ankles but can also affect more-proximal joints [17]. The virus re-emerged in 2006 and wreaked havoc in India by causing an epidemic that involved more than a million people [18]. Methods for Diagnosing are screened for CHIKV specific IgM antibodies in serum specimens by ELISA using a commercial kit and CHIKV RNA by RT-PCR [19]. There are no specific treatments for CHIKV. Treatment with medications according to the symptoms usually to relieve from fever and aching.

SWINE FLU

Virus belongs to the family *Orthomyxoviridae*. Influenza A (H1N1) virus has caused serious respiratory illness (swine flu) and death over the years. The first confirmed case of swine flu H1N1 in India was documented in May 2009, but huge numbers of cases were reported thereafter. In 2015, swine flu outbreak in India had led to significant morbidity and mortality [20]. The clinical signs may include fever, lethargy, anorexia, weight loss, coughing, sneezing, nasal and ocular discharge, conjunctivitis, listless behaviour and laboured breathing (expiratory dyspnea or “thumping”).The United States Centres for Disease Control and Prevention includes symptoms of swine flu infection are fever, cough, sore throat, diarrhea, vomiting, myalgia and joint pains [21].The diagnosis of 2009 H1N1 influenza was confirmed by testing of combined nasal and throat swabs with the use of a real-time reverse transcriptase polymerase chain reaction (RT-PCR)assay [22].The direct transfer of the virus probably occurs either by pigs touching noses, or through dried mucus and airborne transmission through the aerosols produced by pigs coughing or sneezing is also an important means of infection [23].An outbreak of swine influenza A due to an H1N1 virus reached around 34,636 with death claimed cases 2123 [24].

ZIKA VIRUS

Zika virus is a type of *Flavivirus* which were first recognized in 1947 from monkey species rhesus macaque located from the Zika Forest. This virus was latterly isolated from the mosquito *Aedes africanus* in the Zika forest itself [25]. Zika virus commonly causes extremely low or no symptoms of illness during its earlier stages in children and adults. The symptoms like headache, pain in the body, fever or rashes can develop if any occurs [26]. The Zika virus was diagnosed two different methods, one is Nucleic Acid testing (NAT) is utilized to identify hereditary proof of the Zika infection. Blood and pee are used in this analysis and another one methods are Immunoglobulin M (IgM) testing is utilized to identify proteins, known as antibodies, which are created by the body in light of the Zika disease. The test is blood based analysis [27]. In 2017 the first four cases of ZIKV infection reported in India (three cases in Gujarat state and one in Tamil Nadu). The India National Centre for Disease Control, Ministry of Health and Family Welfare reported 159 confirmed cases of ZIKV infection from Rajasthan state (including 63 pregnant women), 130 cases from Madhya Pradesh and one case from Gujarat state in December 2018 [28]. There is no specific treatment for zika virus, only fever, headache, anti-inflammatory drugs are used. To controlling mosquito population, reducing mosquito-human interactions, sleeping under mosquito nets, wearing clothes that cover maximum parts of the body. Buckets, flowerpots or tyres that can hold water need cleaning or covering with suitable materials these are most significant prevention control measurement of zika virus [29].

NIPAH VIRUS

Nipah virus (NiV) is a member of the genus *Henipavirus* in the family *Paramyxoviridae*. Fruit bats of the genus *Pteropus* (flying foxes) are the main reservoir hosts for Nipahvirus [30]. Nipah virus experimentally isolated from urine, kidney and uterus of infected bats and also may be found in fruit or juice (e.g. unpasteurised date palm sap) contaminated with bat saliva or urine. Other sources for infection are contaminated drinking water and aborted bat foetuses or other fluids/tissues of parturition [31]. The symptoms were fever, headache, myalgia, vomiting, altered sensorium, respiratory symptoms (tachycardia to acute respiratory distress) and involuntary movements or convulsions. Latent infection with subsequent reactivation of Nipah virus and death has also been reported months to years after exposure [32]. Diagnosing methods are Detection of IgM antibody in serum or CSF is used. ELISA also used for the antibody detection. The best test for direct detection is polymerase chain reaction (PCR) due to its high sensitivity, specificity and the rapidity with which results can be reported [33]. There is no treatment against Nipah Virus infections. Number of vaccines has been made but none of them proved to be effective against humans or animals [34].

SARS-CoV-2

An outbreak of Coronavirus disease 2019 (COVID-19) caused by a novel severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2) arises in early December 2019. On January 30, 2020 the World Health Organization declared the outbreak as a

Public Health Emergency of International Concern. SARS-CoV-2 is a member of the family *Coronaviridae* and order *Nidovirales*. The family *Coronaviridae* consists of two subfamilies, *Coronavirinae* and *Torovirinae* and members of the subfamily *Coronavirinae* are subdivided into four genera: (a) *Alphacoronavirus* contains the human Coronavirus (HCoV)-229E and HCoV-NL63; (b) *Betacoronavirus* includes HCoV-OC43, Severe Acute Respiratory Syndrome human Coronavirus (SARS-HCoV), HCoV-HKU1, and Middle Eastern respiratory syndrome Coronavirus (MERS-CoV); (c) *Gamma corona virus* includes viruses of whales and birds and; (d) *Deltacoronavirus* includes viruses isolated from pigs and birds [35]. Members of the Coronavirus family have four structural proteins: the spike (S), membrane (M), envelope (E), and nucleocapsid (N) proteins [36]. The most common symptoms at illness onset are fever (99%), fatigue (70%), dry cough (60%), myalgia (44%) and dyspnea. Less common symptoms are headache, dizziness, diarrhea, nausea and vomiting. Symptoms such as pharyngeal pain, dyspnea, dizziness, abdominal pain and anorexia are more likely to be present in patients with severe illnesses [37]. The level and duration of infectious virus replication are important factors in assessing the risk of transmission and guiding decisions regarding isolation of patients. Because Coronavirus detection is more sensitive than virus isolation, most studies have used qualitative or quantitative viral RNA tests as a potential marker for infectious Coronavirus. For SARS-CoV, viral RNA was detected in respiratory specimens from patients as long as 4 weeks after disease onset. Similarly, the duration of MERS-CoV RNA detection in lower respiratory specimens persisted for at least 3 weeks, whereas the duration of SARS-CoV-2 RNA detection has not been well characterized [38]. Collecting specimens of nasopharyngeal and oropharyngeal swab for RT-PCR. Clinicians may also collect LRT (Lower Respiratory Tract) samples when these are readily available (for example, in mechanically ventilated patients). The first case of SARS-CoV-2 in India was reported on 30 January 2020. As of 26th March, the Indian Council of Medical Research and Ministry of Family Welfare has confirmed a total of 649 cases (subjected to change in due course), 42 recoveries, 1 migration and 13 deaths in the country. The Government has also issued lockdown across the country where confirmed cases have been reported [39].

CONCLUSION

India fought against several epidemics and pandemics with high responsibilities. Ayurveda and Siddha are traditional medicines also provide enormous growth in the standard of medical facilities that seems improvement in overall global healthcare ranking. Now we are facing a SARS CoV-2 pandemic globally, India fighting well against that hopefully we will reach the state to eradicate SARS CoV-2. This Article is comprised with clear references and information's to know the previous virus outbreaks in India.

ACKNOWLEDGEMENT

The authors express their sincere thanks to the host Institution Dr.N.G.P. Arts Science college, Management, Principal, Deans, Head of the Department, Guide and all other staffs of Department of Biochemistry for rendering all the facilities and support with DBT-Star Scheme. Communication number: DrNGPASC 2020-21 BS036

CONFLICT OF INTEREST

No conflict of interest

REFERENCES

- [1] Swetha G, AnanthaEashwar V M, and Gopalakrishnan S, Epidemics and Pandemics in India throughout History: A Review Article. Indian Journal of Public Health Research & Development, August 2019, Vol. 10, No. 8, 1570-1576.
- [2] Ahmed JU, Rahim MA, Uddin KN, Emerging Viral Diseases. Birdem Medical Journal Vol. 7, No. 3, September 2017, 224-232.
- [3] Smruti Ranjan Singh, Krishnamurthy N.B., Blessy Baby Mathew, A Review on Recent Diseases Caused by Microbes. Journal of Applied & Environmental Microbiology, 2014, Vol. 2, No. 4, 106-115.
- [4] Bushra Uzair, Zahra Mahmood and Sobia Tabassum, Antiviral Activity of Natural Products Extracted from Marine Organisms. Bio Impacts, 2011, 1(4), 203-211.
- [5] Deen JL, von Seidlein L, Sur D, Agtini M, Lucas MES, et al. (2008) The High Burden of Cholera in Children: Comparison of Incidence from Endemic Areas in Asia and Africa. PLoSNegl Trop Dis 2(2): e173. doi:10.1371/journal.pntd.0000173.
- [6] Abdulhadi SK, Tukur AD, Ahmed BOK, et al. Contemporary understanding of Vibrio cholerae and cholera outbreaks. J Infectious Disease Med Microbiol. 2018;2(3):1-6
- [7] Jitendra Sharma and Sashi Gupta, Reemergence of Cholera in Lakhimpur District of Assam, India AJDDT(2) (1) (2005) 009-015. America Journal of Drug Delivery and Therapeutics.
- [8] S Kanungo, BK Sah, AL Lopez, JS Sung, AMPaisley, DSUR, a JD Clemens & G BalakrishNair, Cholera in India: an analysis of reports, 1997–2006. Bull World Health Organ 2010;88:185–191 | doi:10.2471/BLT.09.073460.
- [9] Pande G, Kwesiga B, Bwire G, Kalyebi P, Rioux A, Matovu JKB, et al. (2018) Cholera outbreak caused by drinking contaminated water from a lakeshore water-collection site, Kasese District, south-western Uganda, June-July 2015. PLoS ONE 13(6): e0198431.
- [10] Nivedita Gupta, Sakshi Srivastava, Amita Jain and Umesh C. Chaturvedi, Dengue in India. Indian J Med Res 136, September 2012, pp 373-390.
- [11] Goswami L, Chowdhury R, Rasul ES, Seroprevalence of dengue infection in a tertiary care hospital in Assam. IJMDS, January 2018; 7(1):1582-1585

- [12] Nivedita Gupta, Sakshi Srivastava, Amita Jainand Umesh C. Chaturvedi, Dengue in India. *Indian J Med Res* 136, September 2012, pp 373-390.
- [13] N. Komal Kumar, R. Lakshmi Tulasi, D. Vigneswari, Investigating dengue outbreak in Tamil Nadu, India. *Indonesian Journal of Electrical Engineering and Computer Science* Vol. 18, No. 1, April 2020, pp. 502~507.
- [14] Gunjan Mahendru, P. K. Sharma, V. K. Garg, A. K. Singh, S. C. Mondal, Role of Goat Milk and Milk Products in Dengue Fever. *Journal of Pharmaceutical and Biomedical Sciences*, 2011, 8 (06).
- [15] B. M. C. Randika Wimalasiri-Yapa, Liesel Stassen, Xiaodong Huang, Louise M. Hafner, Wenbiao Hu, Gregor J. Devine, Laith Yakob, Cassie C. Jansen, Helen M. Faddy, Elvina Viennet & Francesca D. Frentiu (2019) Chikungunya virus in Asia – Pacific: a systematic review, *Emerging Microbes & Infections*, 8:1, 70-79.
- [16] S.P.Kalantri, Rajnish Josh, Lee W.Riley, Chikungunya epidemic: An Indian perspective. *The National Medical Journal of India* vol.19, No.6, 2006, 315-22.
- [17] J. Erin Staples, Robert F. Breiman, and Ann M. Powers. Chikungunya Fever: An Epidemiological Review of a Re-Emerging Infectious Disease, *Emerging Infections- Invited article*. An official publication of the Infection Diseases Society of America, 31 Aug 2009, 49(6):942-948.
- [18] Binoy J. Paul .Shajit Sadanand, Chikungunya Infection: A Re-emerging Epidemic. *Rheumatol Ther* 5,317-326 (2018).
- [19] Chikungunya Infection in India: Results of a Prospective Hospital Based Multi-Centric Study. Pratima Ray, Vinod H. Ratagiri, Sushil K. Kabra, Rakesh Lodha, Sumit Sharmal, B. S. Sharma, Mani Kalaivani, Naveet Wig. *PLoS One*.2012;7(2):e30025. Published online 2012 Feb 17.
- [20] Shatriya RM, Khara NV, Ganjiwale J, Lote SD, Patel SN, Paliwal RP. Lessons learnt from the Indian H1N1 (swine flu) epidemic: Predictors of outcome based on epidemiological and clinical profile. *J Family Med Prim Care* 2018;7:1506-9.
- [21] Ragasa S, Hirpa E (2017) Review on Swine Flu and Status of Swine Flu in Ethiopia. *Int J Vaccines Vaccin* 4(2): 00077. DOI: 10.15406/ijvv.2017.04.00077.
- [22] Rashmi Ranjan Das, Abdus sami, Rakesh Lodha, Richa Jain, S. Broor, S. Kaushik, B.B. Singh, M.Ahmed, Rachna Seth and Sushil K. Kabra. Clinical Profile and Outcome of Swine Flu in Indian Children, *Indian Pediatrics* volume 48,17 May 2011:373-378.
- [23] Gangurde HH, Gulecha VS, Borkar VS, Mahajan MS, Khandare RA, Mundada AS. Swine Influenza A (H1N1 Virus): A pandemic disease. *Syst Rev Pharm Jul-Dec 2011, Volume 2,issue 2: 110-124*.
- [24] Kendall P. Myers, Christopher W. Olsen, Gregory C. Gray. *Clinical Infectious Diseases*, Volume 44, Issue 8, 15 April 2007:1084-1088.
- [25] Shruti Chauhan and Amit Alexander Charan, *Zika Virus: A Review Article*. *The Pharma Innovation Journal* 2018; 7(4): 679-681.
- [26] Mohd Abdullah, Sher Ali, Ayesha Tazeen, Irshad H. Naqvi, Hirday N. Verma, Anwar Ahmed, Syed N. Kazim, and Shama Parveen, *Zika Viral Infection and its Future Prospects*. *Indian Journal of Health Sciences and Care* Vol. 3, No. 2, August, 2016, pp-78-84.
- [27] Ayushi Arora, Anush Dogra, Ayush Dogra, Bhawna Goyal and Apoorav Sharma, *Zika Virus: A Surprising Savage Infection Worldwide*. *Biomedical & Pharmacology Journal*, March 2019. Vol. 12(1), p. 79-84.
- [28] *Zika epidemiology update*, World Health Organization, 2019.
- [29] Devendra T. Mourya, Pratip Shil, Gajanan N. Sapkal and Pragya D. Yadav, *Zika virus: Indian perspectives*. *Indian J Med Res* 143, May 2016, pp 553-564.
- [30] Spickler, Anna Rovid. 2016. *Nipah Virus Infection*. Retrieved from <http://www.cfsph.iastate.edu/DiseaseInfo/factsheets.php>.
- [31] Aditi, Shariff M (2019). *Nipah virus infection: A review*. *Epidemiology and Infection* 147, e95, 1–6
- [32] Giangaspero M (2013) *Nipah Virus*. *Trop Med Surg* 1: 129. doi:10.4172/ 2329-9088.1000129
- [33] Prarthana MS. *Nipah virus in India: past, present and future*. *Int J Community Med Public Health* 2018;5:3653-8.
- [34] *Nipah Virus: An Outbreak of Deadly Paramyx virus*. Ayushi Arora, Anush Dogra, Ayush Dogra, Bhawna Goyal and Apoorav Maulik Sharma. *Biomedical & Pharmacology Journal*, September 2018. Vol. 11(3), p. 1177-1185
- [35] Harapan Harapana and Mudatsir Mudatsir. *Journal of Infection and Public Health* Volume 13, Issue 5, May 2020, Pages 667 673.
- [36] Yi-Wei Tang, Jonathan E. Schmitz, David H. Persing, Charles W. Stratton Alexander J. McAdam, Editor. *Laboratory Diagnosis of COVID-19: Current Issues and Challenges*. *Journal of Clinical microbiology*. DOI:10.1128/JCM.00512-20.
- [37] Chatterjee P, Nagi N, Agarwal A, Das B, Banerjee S, Sarkar S, Gupta N, Gangakhedkar RR. *The 2019 novel coronavirus disease (COVID-19) pandemic: A review of the current evidence*. *Indian J Med Res [serial online]* 2020 [cited 2020 Jun 3];151:147-59.
- [38] Fei Zhou, Ting Yu, Ronghui Du, Guohui Fan, Ying Liu, Zhibo Liu, Jie Xiang, Yeming Wang, Bin Song, Xiaoying Gu, Lulu Guan, Yuan Wei, Hui Li, Xudong Wu, Jiuyang Xu, Shengjin Tu, Yi Zhang, Hua Chen, Bin Cao. *Clinical course and risk factors for mortality of adult in patients with COVID-19 in Wuhan, China: a retrospective cohort study*. www.thelancet.com Vol 395 March 28, 2020: 1054-1062.
- [39] Kachroo V. *Novel coronavirus (COVID-19) in India: current scenario*. *International Journal of Research and Review*. 2020; 7(3): 435-447.