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The Serious Danger of Viral Infections to Health and the Health Care System and the Urgency of Combating Them

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Annotation: An integrated global health system was created at MIP to protect against known and unknown infectious diseases. The system consists of many formal and informal networks of organizations that serve various stakeholders. These organizations have different goals, working methods, resources, and accountability, and they work at different regional levels such as regional, national, regional, or global. The system also covers public, private and non-governmental sectors. People of all ages often get viral infections. In general, the spectrum of diseases is wide, but young children and people with weakened or insufficient immune systems are more susceptible to severe outcomes. This chapter discusses the viral causes of diseases that are common in intensive care units, such as myocarditis, hepatitis, pneumonitis and meningitis/encephalitis, etc. The article is devoted to the causes, diagnosis and treatment to help readers in the initial examination of patients with severe viral diseases in terms of diagnosis and specific antiviral therapy. Currently, there is no unified system in the world that could help in creating and coordinating these responses. The creation of a multidisciplinary Global Technical

Council on Threats Related to Infectious Diseases will significantly reduce unnecessary costs in the global health system, allow resources to be redirected to where they are needed, and reduce the risk of the spread of infectious diseases.

Keywords: Viruses, PCR, enzyme immunoassay, immunofluorescence analysis, retroviruses, economic impact.

Introduction. Viruses, derived from the Latin word "virus" and "poison", are the most common and numerous evolutionary creatures. However, we may never know how many unique viruses exist on Earth, but it is estimated that approximately 320,000 species of viruses infect mammals alone, which is approximately 5,500 species, and more than 1,000 species of viruses are known to infect humans. Although the origin of viruses is controversial, it is interesting to note that they could have existed before the last universal cellular ancestor four billion years ago and played an important role in the evolution of life on Earth, including ours. At least 8% of the human genome consists of sequences associated with infectious retroviruses [1,2,3,4].

Viral infections affect many tissues and organs, such as the intestine, liver, spinal cord (e.g. poliovirus), leukocytes, vascular endothelial cells (e.g. Ebola virus) and the upper respiratory tract and lungs. In the history of mankind, viral infections have caused a huge number of deaths. It is believed that in the 20th century alone, smallpox (caused by the variola virus), which was successfully eradicated in 1980, led to 300-500 million deaths. According to WHO (https://www.who.int/gho/hiv/en /), to date, HIV has infected 75 million people and killed 32 million of them. As of December 1, 2020, more than 63 million people have contracted the coronavirus that causes severe acute respiratory syndrome 2 (SARS CoV-2), and more than 1.4 million people have died. In addition, the number of cases continues to grow rapidly. This disease also hits the global economy hard [5,6,7,8,9]. Despite its track record, the global health system in its current state cannot provide effective protection against an expanding and evolving range of infectious diseases. Recent outbreaks of Ebola, Zika virus, dengue fever, Middle East respiratory syndrome, severe acute respiratory syndrome and influenza have called into question this ability, as well as the impending [1,6,7,9].

These diseases, along with many other known and unknown pathogens, pose a danger not only to human health, but also to social and economic well-being. Of particular concern is the lack of a unified system that could adequately and fully represent the full range of possible threats, including natural, accidental or intentional biological attacks, as well as a network of organizations responsible for their identification, prevention and mitigation [1,4,7,8]. We propose the creation of a multidisciplinary Global Technical Council on Threats Related to Infectious Diseases to address emerging global problems related to infectious diseases and associated social and economic risks. In order to strengthen the global health system, the council, which can be established either autonomously or as part of an existing organization, will do the following: (1) improve interaction and coordination between relevant organizations; (2) fill knowledge gaps on issues such as epidemiological surveillance of infectious diseases, research and development (R&D) needs, financing models, supply chain logistics, as well as social and economic [10,11,12,13,14].

The main purpose of the presented manuscript is to conduct a brief analysis of the global burden and danger to human health and the health system of viral infections causing pandemics today, and measures to combat them.

Infectious diseases pose economic and social threats. Infectious diseases, as well as the fear and

panic that accompany them, pose many economic and social risks. Outbreaks and epidemics, both natural and caused by human activities, pose significant challenges to the health system with regard to the provision of medical services and outbreak control. A major outbreak could add to the burden on the health system by limiting its ability to address other everyday health problems. In addition to health shocks, epidemics cause those who get sick and those who care for them to skip work or work less efficiently, which reduces productivity. Extremely important human resources, such as engineers, scientists and doctors, are subject to loss of productivity [11,15,16,17].

Epidemics pose a significant economic risk. According to a recent study, the fight against pandemic influenza will cost approximately $500 billion per year (0.6% of global income), including lost profits and internal costs associated with increased mortality. The World Bank also predicts that the flu pandemic could lead to a loss of up to 5% of global GDP as a result of 28 million additional deaths. The expected high mortality and morbidity rates are the main reasons for the significant projected economic impact of the influenza pandemic. Nevertheless, the economic consequences of an outbreak can quickly worsen, even if its impact on health is negligible [4,7,18,19,20].

Since the magnitude of the potential health burden of SCP is difficult to predict for many reasons, forecasts of the potential economic impact of SCP vary significantly. The high limits of the existing estimates are worrisome. The World Bank predicts that, in the worst case scenario, SCP could reduce global GDP by 3.8% by 2050, with developing countries bearing a disproportionate burden. The 2014 Antimicrobial Resistance Review report, prepared by David Cameron and chaired by Jim O'Neill, predicts that by the middle of the century there will be a cumulative cost of $100 trillion if resistance to a number of pathogens such as HIV, tuberculosis and malaria develops unchecked. Although the likelihood of such emergencies is debatable, SCP clearly poses a significant economic risk [1,5,11,21,22].

Diagnostic measures for viral infections. In people with weakened immune systems, the role of respiratory viruses in the development of diseases of the lower respiratory tract is becoming more and more obvious. As a result of the increased availability of molecular diagnostic tests, there will be a significant increase in the number of viral diagnoses. High-quality samples taken in the early stages of the disease are crucial for the diagnosis of viral pathogens. The five main methods of diagnosing viral infection: detection of the virus in cell culture by observing characteristic cytopathic effects; virus detection using methods related to specific antibodies with viral antigens (complement fixation, neutralization, immunofluorescence analysis, enzyme immunoassay); identification of characteristic viral inclusions at the microscopic level; use of serology procedures that detect either early or late forms of viral infection [7,12,17,21].

Immediately after the assumption of a viral cause, several diagnostic studies can be performed. For subsequent interpretation, the acute phase serum should be retained. Before the administration of intravenous blood products or immunoglobulin, it is very important to take this sample. Using tampons made of viscose or dacron with plastic rods, samples of viral culture and PCR should be taken from the appropriate places. Cotton and wood inhibit the growth of viruses, and may also contain substances that inhibit enzymes that are used for PCR. Since the cell lines selected for infection vary depending on the suspected virus, the virology laboratory should be informed of the diagnosis or suspected pathogens. Since fluorescent antibodies stain cells, nasal smears and smears from the base of a vesicle or ulcer (for HSV and HPV) must contain enough cells for the analysis to be sensitive [14,15,18,19,21].

The importance of immunization to prevent the spread of viruses. There are effective vaccines to prevent diseases caused by certain viral pathogens such as influenza, measles, mumps, rubella and varicella zoster virus, as well as antiviral drugs for certain pathogens such as influenza, herpes virus, cytomegalovirus and varicella zoster virus. Currently, neither vaccines nor antiviral drugs are available for most respiratory viral pathogens.The latest respiratory viruses always get between humans and animals. Avian and swine flu viruses, severe acute respiratory syndrome, Middle East

respiratory syndrome and hantavirus pulmonary syndrome are some of the recent examples. To stop the pandemic, it is necessary to constantly monitor new pathogens [24,27,28,29,30]. Vaccination is the last resort to prevent mass outbreaks when highly effective antiviral drugs for the treatment of severe viral diseases do not exist, especially in elderly patients or with concomitant diseases, and infection control measures are difficult to implement or comply with. The most common annual flu vaccine is to vaccinate people at risk or others to protect them from flu complications and prevent outbreaks in health facilities. In Hong Kong, a subtropical city, the number of hospitalizations and deaths associated with seasonal influenza is 10,000 and 1,100 cases, respectively [1,3,4,5,6].

Inactivated influenza vaccine can reduce the risk of hospitalization due to pneumonia by 21-38%, the risk of cardiovascular disease by 18-30% and the risk of death from any cause by 39-56% in a meta-analysis evaluating the effectiveness of the flu vaccine in elderly patients. Vaccination is especially effective for people who have been in contact with the virus if the incubation period of the virus is long enough for people who have been in contact with the virus to have enough time to develop protective immune reactions before the onset of symptoms of the disease [27,28,29]. Examples include measles (days 7 to 18), mumps (days 12 to 25), rubella (days 14 to 23) and chickenpox (days 10 to 21). Reactive vaccination has been shown to be effective during a measles outbreak. In 1996, 138 cases of paralysis were reported among adults aged 19-25 years, which is 10 cases per 100,000 people. With the help of two rounds of mass vaccination with a three-component oral poliovirus vaccine intended for people aged 0 to 50 years, the epidemic was controlled [23, 24, 25,27].

Discussion. Viral infections are the main cause of morbidity and mortality worldwide. Complex and multifactorial external causes such as climate change, increased mobility of people and goods, and rapid demographic changes may be part of the reasons for the recent increase in the number of such infections. Together with these external factors, we begin to understand the internal factors of viral immunity. Recently, it has become increasingly clear that the microbiomes of the gastrointestinal tract (GI tract) play an important role in the host's immune system. The immune system of the gastrointestinal tract regulates the immune system and the protective functions of the body. Recent studies show that a violation of homeostasis between the host immune system and the microbiome of the gastrointestinal tract can negatively affect antiviral immunity [1,2,14,24]. This review examines the factors of early development, antibiotic exposure, immune aging, diet and inflammatory diseases, as well as the effects of host-microbiota interaction on the immune system. In addition, we discuss evidence that microbiome therapy and host commensal microorganisms can prevent and treat some viral infections. For example, viral gastroenteritis, viral hepatitis, human immunodeficiency virus (HIV), human papillomavirus (HPV), viral infections of the upper respiratory tract (IVDP), influenza and SARS CoV-2 [14,17,21,27].

Despite the fact that the interaction between invasive viruses, the microbiome of the gastrointestinal tract and intestinal physiology is complex and not fully understood, more and more information shows that the microbiome can influence the course of viral diseases. Although the existing evidence base is useful, additional carefully planned human clinical trials will be required to fully understand the immunological mechanisms underlying these complex relationships [11,12,19,23]. While bacterial, fungal and parasitic infections are usually treated with standard laboratory diagnostic tests and specific antimicrobials, we are just entering an era when rapid nucleic acid tests and a wider range of antiviral drugs to combat viral infections are available. Starting from respiratory viruses, arthropod-borne viruses, and ending with the deadliest blood-borne viruses, there is a wide range of viruses that cause morbidity and mortality worldwide [25,26,27,29]. In some places where people are often near wild animals, such as wildlife markets and slaughterhouses, new or re-emerging viruses sometimes cause large-scale epidemics. In countries with poor governance and weak health infrastructure, epidemics such as Ebola and SARS CoV-2 can be deadly. Currently, there are no antiviral drugs. To stop the spread of these viruses, it is important to carry out prevention and vaccination. [24,25,28,29].

Conclusions. There is a lot of disagreement about the risks associated with infectious diseases and their consequences. However, outbreaks and epidemics are almost inevitable, antimicrobial resistance will be at risk as long as we use standard antimicrobial treatments, and conflicts between humans and pathogen research will be the inevitable consequences of biosafety research. Fortunately, there are responses to each of these types of hazards caused by infectious diseases.

Currently, there is no unified system in the world that could help in the development and coordination of these responses. The creation of a multidisciplinary Global Technical Council on Threats Related to Infectious Diseases will significantly reduce unnecessary costs in the global health system, allow resources to be redirected to where they are needed, and reduce the risk of the spread of infectious diseases.

Currently, there are no effective antiviral drugs. Thus, in order to prevent the spread of these viruses, it is extremely important to carry out prevention through effective infection control and vaccination methods.

References.

1. Tobin NH, Campbell AJP, Zerr DM, Melvin AJ. Life-Threatening Viral Diseases and Their Treatment. Pediatric Critical Care. 2011:1324–35. doi: 10.1016/B978-0-323-07307-3.10095-3.
2. Bloom David E., Cadarette Daniel. Infectious Disease Threats in the Twenty-First Century: Strengthening the Global Response, Frontiers in Immunology, Volume=10,2019,https://www.frontiersin.org/journals/immunology/articles/10.3389/fimmu.2019.00549, DOI=10.3389/fimmu.2019.00549
3. Harper Ashton , Vijayakumar Vineetha , Ouwehand Arthur C. , ter Haar Jessica , Obis David , Espadaler Jordi , Binda Sylvie , Desiraju Shrilakshmi , Day Richard
4. Viral Infections, the Microbiome, and Probiotics. Frontiers in Cellular and InfectionMicrobiology,Volume=10,2021, DOI=10.3389/fcimb.2020.596166
5. World Health Organization. Global Health Observatory (GHO) Data: HIV/AIDS. (2019). Available online at: https://www.who.int/gho/hiv/en/ (accessed February 12, 2019).
6. Saunders-Hastings PR, Krewski D. Reviewing the history of pandemic influenza: understanding patterns of emergence and transmission. Pathogens. (2016) 5:66. doi: 10.3390/pathogens5040066
7. United Nations, Department of Economic and Social Affairs PD. World Population Prospects: The 2017 Revision, DVD Edition. (2017).
8. Foreman KJ, Marquez N, Dolgert A, Fukutaki K, Fullman N, McGaughey M, et al. Forecasting life expectancy, years of life lost, and all-cause and cause-specific mortality for 250 causes of death: reference and alternative scenarios for 2016-40 for 195 countries and territories. Lancet. (2018) 392:2052–90. doi: 10.1016/S0140-6736(18)31694-5
9. Camacho A, Bouhenia M, Alyusfi R, Alkohlani A, Naji MAM, de Radiguès X, et al. Cholera epidemic in Yemen, 2016-18: an analysis of surveillance data. Lancet Glob Health. (2018) 6:e680–90. doi: 10.1016/S2214-109X(18)30230-4
10. Dawood FS, Iuliano AD, Reed C, Meltzer MI, Shay DK, Cheng P-Y, et al. Estimated global mortality associated with the first 12 months of 2009 pandemic influenza A H1N1 virus circulation: a modelling study. Lancet Infect Dis. (2012) 12:687–95. doi: 10.1016/S1473-3099(12)70121-4
11. Centers for Disease Control and Prevention. 2014-2016 Ebola Outbreak in West Africa. (2017). Available online at: https://www.cdc.gov/vhf/ebola/history/2014-2016-outbreak/index.html (accessed February 12, 2019).

12. Partlow J. As Zika virus spreads, El Salvador asks women not to get pregnant until 2018.

13. Washington Post. (2016). Constenla D, Garcia C, Lefcourt N. Assessing the economics of dengue: results from a systematic review of the literature and expert survey. Pharmacoeconomics. (2015) 33:1107–35. doi: 10.1007/s40273-015-0294-7

14. Pooran A, Pieterson E, Davids M, Theron G, Dheda K. What is the cost of diagnosis and management of drug resistant tuberculosis in South Africa? PLoS ONE. (2013) 8:e54587. doi: 10.1371/journal.pone.0054587

15. Thorpe KE, Joski P, Johnston KJ. Antibiotic-resistant infection treatment costs have doubled since 2002, now exceeding $2 billion annually. Health Aff. (2018) 37:662–9. doi: 10.1377/hlthaff.2017.1153

16. Laxminarayan R, Matsoso P, Pant S, Brower C, Rottingen J-A, Klugman K, et al. Access to effective antimicrobials: a worldwide challenge. Lancet. (2016) 387:168–75. doi: 10.1016/S0140-6736(15)00474-2

17. Garrett L. Ebola's lessons: how the who mishandled the crisis. Foreign Aff. (2015) 94:80–107. Available online at: https://www.foreignaffairs.com/articles/west-africa/2015-08-18/ebolas-lessons

18. Aguilar-Toalá J. E., Garcia-Varela R., Garcia H. S., Mata-Haro V., González-Córdova A. F., Vallejo-Cordoba B., et al. (2018). Postbiotics: An evolving term within the functional foods field. Trends Food Sci. Technol. 75, 105–114. doi: 10.1016/j.tifs.2018.03.009

19. Agus A., Planchais J., Sokol H. (2018). Gut Microbiota Regulation of Tryptophan Metabolism in Health and Disease. Cell Host Microbe 23, 716–724. doi: 10.1016/j.chom.2018.05.003

20. Al Kassaa I., Hober D., Hamze M., Chihib N. E., Drider D. (2014). Antiviral Potential of Lactic Acid Bacteria and Their Bacteriocins. Probiotics Antimicrob. Proteins 6, 177–185. doi: 10.1007/s12602-014-9162-6

21. Aiello A., Farzaneh F., Candore G., Caruso C., Davinelli S., Gambino C. M., et al. (2019). Immunosenescence and its hallmarks: How to oppose aging strategically? A review of potential options for therapeutic intervention. Front. Immunol. 10, 1–19. doi: 10.3389/fimmu.2019.02247

22. De Filippo C., Cavalieri D., Di Paola M., Ramazzotti M., Poullet J. B., Massart S., et al. (2010). Impact of diet in shaping gut microbiota revealed by a comparative study in children from Europe and rural Africa. Proc. Natl. Acad. Sci. 107, 14691–14696. doi: 10.1073/pnas.1005963107

23. Krautkramer K. A., Kreznar J. H., Romano K. A., Vivas E. I., Barrett-Wilt G. A., Rabaglia M. E., et al. (2016). Diet-Microbiota Interactions Mediate Global Epigenetic Programming in Multiple Host Tissues. Mol. Cell 64, 982–992. doi: 10.1016/j.molcel.2016.10.025

24. Marín A. C., Gisbert J. P., Chaparro M. (2015). Immunogenicity and mechanisms impairing the response to vaccines in inflammatory bowel disease. World J. Gastroenterol. 21, 11273–11281. doi: 10.3748/wjg.v21.i40.11273

25. Miller L. E., Lehtoranta L., Lehtinen M. J. (2019). Short-term probiotic supplementation enhances cellular immune function in healthy elderly: systematic review and meta-analysis of controlled studies. Nutr. Res. 64, 1–8. doi: 10.1016/j.nutres.2018.12.011

26. Pedersen P. B., Hrobjartsson A., Nielsen D. L., Henriksen D. P., Brabrand M., Lassen A. T. (2017). Prevalence and prognosis of acutely ill patients with organ failure at arrival to hospital: Protocol for a systematic review. Syst. Rev. 6, 1–5. doi: 10.1186/s13643-017-0622-4

27. Xie Y, Choi T, Al-Aly Z. Postacute Sequelae of SARS-CoV-2 Infection in the Pre-Delta, Delta, and Omicron Eras. N Engl J Med 2024; 391:515.

28. Curtis MR, Epstein RL, Pei P, et al. Cost-Effectiveness of Strategies for Treatment Timing for Perinatally Acquired Hepatitis C Virus. JAMA Pediatr 2024; 178:489.

29. Chi-Chung Cheng V, Fuk-Woo Chan J, FN Hung I, Yuen KY. Viral Infections, an Overview with a Focus on Prevention of Transmission. Reference Module in Biomedical Sciences. 2016:B978-0-12-801238-3.90174-0. doi: 10.1016/B978-0-12-801238-3.90174-0.

30. Lee FEH, Treanor JJ. Viral Infections. Murray and Nadel's Textbook of Respiratory Medicine. 2016:527–556.e15. doi: 10.1016/B978-1-4557-3383-5.00032-4.