WHY DOES COVID-19 SPREAD RAPIDLY AND WIDELY?

Tran Dinh Binh[1*], Tran Thanh Loan[2]

[1] *Department of Infection Control, Hospital of Medicine and Pharmacy, Hue University*
[2] *Department of Immuno-Pathophysiology, University of Medicine and Pharmacy, Hue University*

SUMMARY

Coronavirus (SARS-CoV-2) spreads quickly because it can be easily transmitted via respiratory droplets in the air and on surfaces. A person becomes infected when the viruses invade the body through the mouth, nose, or eyes and then begin to multiply. Viruses can be transmitted via droplets from a sick person either by inhaling or by touching the face with unwashed hands. Researchers estimate that with each COVID-19 patient, the virus could possibly be spread to two or three additional people. More than 215 countries and regions around the world reported COVID-19 cases with nearly 26,800,000 people infected and nearly 900,000 deaths (until September 06, 2020). Many causal groups can be linked to the rapidly and widely spread of COVID-19. In this review article, we summary three important groups of causes: the causative agent, the epidemiology of the disease, and the socioeconomic factors. Until now, the therapeutic strategies for COVID-19 are only supportive, therefore, prevention aimed at reducing transmission in the community is the best weapon.

Keywords: Agents, COVID-19, epidemiology, SARS-CoV-2, socioeconomic, pandemic.

INTRODUCTION

The novel coronavirus disease - COVID-19 has become a global pandemic through all continents, except Antarctica, with more than 215 countries and regions around the world reported cases. Until September 06, 2020, according to the global WHO statistics report, a total of 26,800,000 people were infected with nearly 900,000 deaths. The US has the highest number of infected patients (865.300), followed by Brazil (125.000) and India (69.000) (WHO, worldometers.info 06/9/2020). Compared with influenza, seasonal flu, or closer to severe acute respiratory syndrome SARS-CoV-1 (SARS-CoV 2003), COVID-19 spreads at a terrifying rate both in space and time. Many studies have been performed in an effort to explain the spread of COVID-19 disease (https://covid19.who.int/). This article attempts to systematically gather the causes of the spread of COVID-19 to partially apply in preventing the transmission of COVID-19 in particular and the other unpredictable diseases caused by emerging viruses in general.

A variety of reasons are associated with the wide and rapid spread of COVID-19. In general, three main groups were determined: the causative agent, the epidemiological factors of the disease, and the socio-economic factors of the community. Various appropriate strategies have been performed based on that, such as early detection, rapid isolation, reasonable zoning, propaganda for personal hygiene measures, and combination with community actions... These prevention strategies, which were drastically and precisely implemented, have effectively prevented the spread of COVID-19 to its present level. Otherwise, the risk of a global pandemic with a high number of infections and deaths could be much terrible (https://www.communitymedical.org/about-us/News/How-easily-does-coronavirus-spread).

Up to now, there are more than 1050 patients of COVID-19 in Vietnam with 35 deaths. Many strategies have been conducted in an effort to control the virus from widely spreading in the community (https://ncov.moh.gov.vn/06/9/2020).

VIROLOGY AND PATHOGENESIS

The causative agent of COVID-19 is SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2), a member of *Betacoronavirus*. It is an enveloped positive-sense RNA virus which characterized by club-like spikes that project from their surface, an unusually large RNA genome, and a unique replication strategy. With outer structure made by glycoprotein, it can be susceptibly destroyed by common organic solvents and disinfectants such as Chloramine B, Ether, Deoxycholate, soap, or essential oil (Chen *et al*., 2020). SARS-CoV-2 cause a variety of diseases in mammals and birds ranging from enteritis in cows and pigs, and upper respiratory tract and kidney disease in chickens to lethal human respiratory infections. Most recently, the novel coronavirus or SARS-CoV-2, which was first identified in Wuhan, China in December 2019, is the cause of a catastrophic pandemic, COVID-19, with more than 26 million infections diagnosed worldwide by September 2020 (Wang *et al*., 2020).

ABILITY TO SURVIVE IN THE ENVIRONMENT

Recent studies have shown that SARS-CoV-2 can exist quite a long time in the environment when exiting the host (Chen *et al*., 2020; Heimdal *et al*., 2019). Scientists at the National Institute of Allergy and Infectious Diseases (NIAID) have sought to simulate how the virus is transferred from an infected person to household objects or hospitals. Research shows that, in droplets shot when a person with COVID-19 coughs or sneezes, the virus can survive and still be able to infect others for at least 3 hours. On plastic and stainless steel, the virus can survive up to 3 hours. On the hard cover, the virus cannot survive after 24 hours. In the field, it took 4 hours for the virus to be inactivated. With a long shelf life in droplets and on surfaces, SARS-CoV-2 can easily spread to many people over a relatively long period of time. This is an important factor for SARS-CoV-2 to spread quickly and broadly to the community (Neeltjeet *et al*., 2020).

Many studies suggest that high temperatures and high humidity can shorten the duration of the virus, but in fact SARS-CoV-2 has now spread globally regardless of the region's temperature and humidity (Chan *et al*., 2011).

EPIDEMIOLOGY AND TRANSMISSION

Patients with COVID-19 during the incubation period or in the early stage when more than 80% of them are asymptomatic or mild symptoms can still spread SARS-CoV-2. In fact, the transmission mechanism of SARS-CoV-2 is more similar to H1N1 or flu than SARS-CoV-1 (Zhu *et al*., 2020; Li *et al*., 2020; Rothe *et al*., 2020). This means that these patients can spread SARS-CoV-2 before it can be detected. Therefore, the number of COVID-19 infections continues to increase, an "unprecedented spread" (Heimdal *et al*., 2019).

Early spread during the incubation period and throughout the illness without symptoms makes it contagious. When an infected person is still healthy, still working, and able to walk, the virus will spread widely. This is also the time when the diagnostic test may not have the results, especially the antibody test, the real-time RT-PCR test may also be falsely negative because of the small amount of virus in site sampling (Heimdal *et al*., 2019).

It is estimated that each COVID-19 patient can infect at least 3 or 4 others. Dangerously, we only prevent the spread when the infection was confirmed. An infected person without symptoms could makes the virus spread without attention. Therefore, the experience of many countries such as Vietnam, China, Singapore… is early detection, rapid isolation, wide isolation in a local or the whole region which showed effectiveness in preventing COVID-19 widespread (Li *et al*., 2020).

In addition, COVID-19 has clinical symptoms that are quite similar to seasonal flu or the common cold. Therefore, patients or physicians may overlook or neglect the symptoms. At that time, they are the ones who develop virus transmission and makes the disease much widely spread in hospitals or health facilities.

SOCIAL ECONOMY AND COMMUNITY CONSCIOUSNESS

There are some main reasons for the rapid spread of SARS-CoV-2 in all over the world by social – economy activities: extensive trade activities across the globe, international and domestic tourism, the use of public transport... Besides, many social activities usually hold in large numbers such as festivals, religious activities, social events… or demand various social habits (embrace, shaking hands ...) which favorably create conditions for SARS-COV-2 spread through droplets, airborne as well as direct or indirect contacts. Most of the countries have proposed restricting meetings, gathering crowds to limit the spread of COVID-19 inside the countries and regions (Rothe *et al*., 2020), as well as suspended and restricted circulation to and from epidemic areas, countries that are currently epidemic or close their borders. Nevertheless, these strategies were carried out not soon enough to prevent the spread of COVID-19 in time. More seriously, many infected people without symptoms around the world are still working or traveling, leading to the wider and faster spread of the disease (Heimdal *et al*., 2020).

In response to the COVID-19 epidemic, WHO, national and local health sectors have made many recommendations on personal hygiene (masks, hand-washing), public hygiene, isolation, gathering crowds, reducing travel, traveling when not needed, early medical examination to avoid spreading to others ... Besides the government and individuals efforts, there still have some groups of people who do not pay attention to the disease prevention, be subjective and disregard the disease, ignore the recommendations of the authorities, which make the situation more difficult to control (Zhu *et al*., 2020).

Shortly after SARS-CoV-2 emerged and caused the COVID-19 pandemic, scientists all over the world have researched this virus thoroughly and extensively, providing a lot of knowledge and application in diagnosis, treatment, and prevention. Many definitive screenings and diagnostic tests have been used, many prophylactic

vaccines have been studied and testing. Hopefully, the spread of COVID - 19 would be controlled soon. Meanwhile, the most effective strategy is still initiative prevention by taking full precautions as recommended by the health sector.

In conclusion: *A variety reasons of society and community that are associated with the wide and rapid spread of COVID-19. Up to now, the therapeutic strategies to deal with the SARS-CoV-2 infection are only supportiveness, therefore prevention aimed at reducing transmission in the community is our best weapon.*

REFERENCES

Neeltje D, Dylan HM, Phil M, Holbrook MG (2020). Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *N Engl Med* 17: 1-3. https://www.nejm.org/doi/10.1056/NEJMc2004973.

Chan K, *et al* (2011). The effects of temperature and relative humidity on the viability of the SARS coronavirus. *Adv Virol* 734690.

Chen Y, Liu Q, Guo D (2020). Emerging coronaviruses: genome structure, replication, and pathogenesis. *J Med Virol* 92(4): 418-423.

Heimdal I, Moe N, Krokstad S, *et al* (2019). Human Coronavirus in Hospitalized Children ưith Respiratory Tract Infections: A 9-Year Population-Based Study from Norway. *J Infect Dis* 219: 1198.

Li Q, Guan X, Wu P, *et al* (2020). Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia. *N Engl J Med* 382: 1199-1207.

Rothe C, *et al* (2020), Transmission of 2019-nCoV Infection from an Asymptomatic Contact in Germany. *N Engl J Med* 382: 970-971.

Zhu N, Zhang D, Wang W, *et al* (2020). A Novel Coronavirus from Patients with Pneumonia in China, 2019. *N Engl J Med* 382: 727-733.

Yuhang W, Matthew G, Stanley P (2020). Coronaviruses: An Updated Overview of Their Replication and Pathogenesis. *Methods Mol Biol* 1-29.

https://www.communitymedical.org/about-us/News/How-easily-does-coronavirus-spread

https://covid19.who.int/?gclid=EAIaIQobChMIr6n7zaXR6wIVkpvCCh2WpwNiEAAYASAAEgI6evD_BwE

https://ncov.moh.gov.vn/06/9/2020

TẠI SAO BỆNH COVID-19 LÂY LAN NHANH VÀ RỘNG?

Trần Đình Bình[1*], Trần Thanh Loan[2]

[1] Khoa Kiểm soát nhiễm khuẩn, Bệnh viện Đại học Y Dược Huế
[2] Bộ môn Miễn dịch-Sinh lý bệnh, Trường Đại học Y Dược, Đại học Huế

TÓM TẮT

Coronavirus (COVID-19) lây lan nhanh và khá dễ dàng, bởi vì chúng có thể truyền qua giọt bắn nước bọt trong không khí và trên các bề mặt. Người bị nhiễm trùng khi virus xâm nhập cơ thể qua miệng, mũi, mắt và chúng nhân lên tại những nơi này. Virus có thể xâm nhập cơ thể qua giọt bắn từ người mắc bệnh hoặc tay tiếp xúc với mặt, mũi mà chưa được vệ sinh. Bài báo này đánh giá các yếu tố có thể làm cho các cá thể bị lây nhiễm COVID-19 và virus lây lan cho nhiều người khác. Cho đến nay (ngày 06 tháng 9 năm 2020), đã có hơn 215 quốc gia và vùng lãnh thổ trên thế giới có người mắc COVID-19 với tổng số ca mắc hơn 26,800,000 triệu người với gần 900,000 người tử vong. Nhiều nhóm nguyên nhân có thể góp phần làm gia tăng nguy cơ lây lan của COVID-19… Theo nhiều báo cáo và nghiên cứu gần đây, tổng hợp lại, chúng ta có thể thấy 3 nhóm nguyên nhân quan trọng là tác nhân gây bệnh, dịch tễ học của bệnh và các yếu tố kinh tế xã hội. Từ đó để nhận xét các chiến lược dự phòng hợp lý là phát hiện sớm, cách ly nhanh, khoanh vùng hợp lý, các biện pháp vệ sinh cá nhân, hoạt động cộng đồng… quyết liệt, chính xác đã ngăn chặn hiệu quả việc lây lan COVID-19 như mức độ hiện tại. Nếu không, nguy cơ một đại dịch toàn cầu với số người mắc và số người tử vong sẽ khủng khiếp hơn nhiều.

Từ khóa: Tác nhân, covid-19, dịch tễ học, SARS-Cov-2, kinh tế xã hội, đại dịch.

[*] Author for correspondence: Tel: +84.913363930; Email: tdbinh@huemed-univ.edu.vn