Fighting Against COVID-19: What We Have and What to Do Next

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Abstract: In 2019, the coronavirus disease outbreak changes our normal lifestyle and became the main contributor to health departments' overburden. The government has implemented relevant policies in many countries to reduce patients and slow down the spread of COVID-19. Through reading some research, we reviewed the status quo of hygiene pandemic prevention we have and gave some advice and expectations to ameliorate the condition. Status quo of hygiene pandemic prevention including vaccine and detection methods of COVID-19 and global cooperation, mental health problem of children, teenagers, health care workers, and patients during this pandemic diseases, complex health care, fair manner of the vaccine and health disparities. Advice and expectations including future testing methods of COVID-19, some practical recommendations for governments to mitigate psychological problems and health disparities, and the use of remote health care.

1. Introduction

COVID-19, a pandemic disease, still has a huge impact on the global public. COVID-19 is caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoVer-2), an RNA virus with a high mutation rate [1]. COVID-19 cases caused by variants of SARS-CoV-2 have appeared in different countries. These variants have been a big challenge to the traditional public health strategy of a pandemic. At this stage, the most effective measure to prevent COVID-19 is vaccination. Various countries and organizations around the world have developed different vaccines and make emergency authorization. Based on the existing summary of known treatments, vaccine measures, and complex care since the COVID-19 pandemic, this article reviews and discusses possible future treatments for COVID-19, vaccine distribution issues, health care, and mental health problems in the post-pandemic era.

2. COVID-19 Detection and Vaccination

2.1 Detection Methods

Monitoring COVID-19 patients timely is one of the effective ways to prevent the widespread of COVID-19. Real-time reverse transcription polymerase chain reaction (RT-PCR) is currently a common detection method for COVID-19 [2]. RT-PCR detection method uses samples collected from the upper respiratory tract. However, several variants of SARS-CoV-2 appeared in some countries, which may lead to false-negative detection results. The more accurate detection for the new variants SARS-CoV-2 is genome sequencing which can detect the changed sequencing of the variants. The genome sequencing method is expensive, and the whole process will take a long time, which cannot be used widely [2]. There are also other methods for the further detection of pulmonary diseases caused by SARS-CoV-2. In the clinical laboratory, diagnostic imaging of the lower respiratory tract will detect

the appearance of pneumonia symptoms [3]. The diagnostic imaging detection of the lower respiratory tract has always been controversial. Some investigations and studies have shown that the diagnostic imaging sensitivity of high-prevalence and low-prevalence populations is different, affecting the diagnosis results. Diagnostic imaging is still used as an auxiliary evaluation method when the patient showed symptoms of COVID-19 [3].

2.2 COVID-19 Vaccine

2.2.1 Vaccine Types

Although there is no specific treatment for COVID-19, the vaccine will be the most effective preventive intervention. The human body can produce antibodies against specific microorganisms through the immune system. This defense mechanism will work when the body accepts this antigen again [4].

The current research ideas for SARS-CoV-2 virus vaccines mainly include the following aspects: live attenuated vaccines, inactivated vaccines, protein-based vaccines, nucleic acid vaccines, and viral vector vaccines [4]. Live attenuated vaccines are affordable to most countries and can be quickly produced, and they may mutate during virus replication and require cold chain transportation. The effectiveness and safety of live attenuated vaccines need further experiment. Inactivated vaccines are safer and do not require cold chain transportation, and their cost is expensive. Protein subunit-based vaccines will make the body produce an immune response, it requires multiple doses, and its effectiveness needs further study. RNA vaccines have some allergic reactions to certain people, which have not yet been verified. Vaccines developed by recombinant DNA technology are considered safe. They need repeated vaccination to get long-term immune protection [4].

2.2.2 Different Routes of Administration

Vaccination routes will also affect the protective efficacy of vaccines. The body will have different immune responses to these administration routes [5]. So far, most of the vaccines are injected intramuscularly. This route has certain limitations. The intramuscular route of administration only initiates the IgG response of the lower respiratory tract, while the IgA response that protects the upper respiratory tract will not be initiated. Vaccines administered intranasally may provide double protection for the body [4]. Researchers found that a viral vector vaccine injected intramuscularly can induce the whole-body fluid and cell-mediated immune response in an animal experiment involving human ACE transgenic mice. In contrast, the same vaccine injected intranasally can induce whole body, IgA, and T cells immune response. These results show that the intranasal route of the vaccine has both protection on the upper and lower respiratory tract [5].

2.2.3 Vaccine Distribution

Vaccine distribution will be challenging after vaccines are licensed. There will be a huge amount of requirements for vaccines worldwide. The limited supply of vaccine raw materials and different production capacity levels may lead to related issues. Many organizations have begun planning for these possible problems [5].

A plan called "COVAX" was initiated by the World Health Organization, the Vaccine Alliance (GAVI), and the Epidemiological Innovation Alliance (CEPI) to promote global vaccine distribution. This plan will make vaccines available in low-income countries [5]. The Developing Countries Vaccine Manufacturers Network (DCVMN) collaborates with global health organizations and vaccine developers to promote the production and supply of vaccines. Global Vaccine Action Plan (GVAP) improves the monitoring and accountability of vaccines to advance specific strategies for global immunization. The monitoring and evaluation of vaccines also positively impact some of the public who have negative attitudes towards vaccine effectiveness and safety [4].

The future treatment of COVID-19 needs the cooperation of countries all over the world. The development of the SARA-CoV-2 vaccine remains many problems. From the ideas of vaccine research to the final large-scale production and use of the vaccine, the average time cycle of vaccine development is about 10-11 years [5]. Many aspects need to be considered when developing the

vaccine, time and economic cost, vaccine distribution, allergic reactions, and other potential challenges. WHO has proposed a new experimental concept, "Solidarity Vaccine Trial," to speed up the vaccine development process. This experimental concept is to recommend rolling trials for the candidate vaccines. Vaccines that fail one of the trials will no longer be tested. It will shorten the evaluation time of the vaccine, but this experimental concept has not been implemented [5].

3. COVID-19 and Impact of Mental Health

3.1 Negative Impact on the Psychological Condition

Because there is a human-to-human transmission character in COVID-19, the speed of spreading is becoming faster. To calm down such transmission and decline the cases of COVID-19, the government decided to take measures. However, these measures bring lots of side-effects like anxiety, headache, insomnia, and depression, even had some reports about suicide [6]. Some regions, such as Wu Han, decide to lock down the city. During the period of lockdown, people's lifestyles changed incredibly. For example, in a lock-down city, citizens are asked to stay at home and keep social distance, children have to study at home and lose freedom. Meanwhile, people who have possibly been exposed to the COVID-19 must be quarantined. Notably, some studies found that the mean post-traumatic stress scores of children and their parents who were in quarantine are four times higher than those not in quarantine. 28% of quarantined parents in this study reported enough symptoms to support a mental health disorder diagnosis associated with trauma. And another study group found that most quarantined people can be diagnosed with depression[7]. For nurses and other health care workers, some potential factors, including the fear of infection, the prospective rationing of care, the possible lack of PPE(personal protective equipment), the death of patients and coworkers, and the challenge of balancing personal life and work can become the contributor of the psychological disorder[8]. According to research, people in different groups usually suffer different conditions, which could cause sorts of psychological disorders.

3.1.1 Children and Adolescents

In this special stretch, children often lack a natural outlet such as outdoor sports and hope to relieve stress through their parents or caregivers, and not all the parents and children respond to stress in the same way. Children will express anxiety, distress, and social isolation. Professions conclude children's behavior including excessive crying and irritating behaviors, up-going sadness, worry or depression, hard to concentrate on one thing, avoiding or behave that they absorbed in the past, often feel unexpected headache and pain through their body and changing their eating habits. The living environment is one important factor [6].

Besides, some differences in adolescents have been studied in high school or college. Compared with children, adolescents have more stress with the study. Therefore, except for disorders in their social relationship, and physical health, they also face negative influences in education. A study claimed that routine disruption, lack of creative idea when to join in some academic and unscientific activities, and boredom could attribute to stay at home and absence of structural setting of the school for a long time [9]. Adolescents and children may refuse to go to school after the home confinement and find it is difficult to get along with their teachers. In other words, there are some special groups like children or adolescents who have special needs(neurodevelopmental, behavioral, or emotional difficulty), their intolerance is uncertainly, and due to implementation of lockdown and the unfriendly environment, which is different from their daily routine, their behavior could be aggressive [9]. Meanwhile, some of them face difficulty in understanding the situation of pandemics and following instructions, which could contribute to aggravation in the symptoms. Those factors could trigger disharmony between children and parents and temper tantrums [9].

In some underprivileged areas, poor families tend to translate frustration and family conflict to their children because of poor economic conditions and unset society. Violence and abuse increase children's rates of depression, anxiety, and suicide. The Deputy Director of 'CHILDLINE 1098' said

that since the enforced lockdown of the city, the helpline of the phone has been received was ascended 50 percent in India in 2020.

3.1.2 Patients and Quarantined People

As a special group that was diagnosed infected SARS-CoV-2 or suspected infected SARS-CoV-2 become the source of infection, they are in an awkward position in society. Patients with pneumonia or people who are released from quarantine often experience stigmatization. Almost everyone felt it difficult to get along with others through the investigation after finishing their quarantine [6]. They were pushed aside by their friends, beloved ones, and family members and experienced social distancing -- general people have potential fears of contracting an infection through interaction with them. Hence, those patients suffer sadness, anger, and frustration. Besides, during confinement, people suffer mixed emotions, including anger, depression, avoiding, and show post-traumatic stress symptoms due to several factors. Firstly, long-time quarantine makes people lose their usual routine, reducing social communication and sports activity directly, frequently leading to boredom, frustration, and a sense of isolation from the world [7]. Secondly, due to limited conditions, relevant instructions usually can not supply sufficient supplies(water, food, accommodation, or clothes) in time. Unable to get adequate care and lack of variety social communication makes people who were quarantined continue feeling anxiety and frustration. This situation will deteriorate as quarantine time become longer [7].

3.1.3 Nurses and Professions

As a front-line to fight with COVID-19 pandemic, health care workers and nurses all undertake huge pressure. Therefore, they are more susceptible to get disorders in mental health such as depression, anxiety, insomnia, and distress [10]. According to recent research, several factors are associated with mental health disorder symptoms of nurses and other health care workers. Subjectively, working burden, working condition, sex of worker, family income, age, and the number of family stressors could be important factors [10]. For example, women(usual nurse), age<40, and have one or more than one child in the family experience more stress and have a higher potential to show mental disorders than men who without a couple. People working in front-line(high-risks and stressful) and frequent contact with patients with COVID-19 usually mean higher scores on changes in well-being than people working in lower-risk settings. Most of them show depression, fears of catching a disease, and more work exhaustion. Besides, people with a household income of< $70,000 are much easier to show stress, anxiety, and depression [10,11]. A study in China found that compared with working in second-line positions, working in the front-line directly treating patients with COVID-19 appeared to be an independent risk factor for all psychiatric symptoms after adjustment. More than 70% of participator reported psychological distress [11]. Additionally, isolation of family members and friends, death of their colleges after infecting COVID-19, and negative health condition of their patients also become a trigger of psychological disease.

4. The Probable Biology Mechanism of COVID-19 Caused Mental Disease

As a novel coronavirus, SARS-CoV-2, neurotropism is a common character. This character is demonstrated in the central nervous system (CNS) and in the cerebrospinal fluid [12]. Some research also claimed that the main influence that SARS-CoV-2 can cause on the brain is through inflammation [13]. However, the SARS-CoV-2's impact on the central nervous system and mental health remains unclear [12]. But through study, the mental symptoms of patients with COVID-19 for a long time can find further information on this novel virus's neurological effects and biology mechanism of COVID-19 caused mental disease.

A study showed that neurological manifestations were expressed in 36.4% of COVID-19 patients. Patients with severe illness have higher potential to develop neurological symptoms (88%), especially acute cerebrovascular disease, conscious disturbances, and muscle injury [12]. In 40,469 patients diagnosed with the COVID-19 infection, 22.5% of them expressed neuropsychiatric symptoms,

including headache (3.7%), insomnia (3.4%), encephalopathy(2.3%), cerebrovascular disease (1%), depression (3.8%) and suicidal ideation (0.2%) [12].

5. Suggestions to Ameliorate the Condition

Due to pandemic brings huge burden on society and a huge challenge in the population's usually routine, psychological effects of COVID-19 in the long term could be serious. Therefore, relevant departments must plan strategies to ameliorate conditions during this special time. For children and adolescents, parents play an important role in their life. Thus, parents should spend more time in the company and interact more frequently with their children to help them release pleasure. Teachers in school can help students learn about COVID-19 and teach them how to protect themselves by using guidelines. Meanwhile, the government needs to provide adequate supplies and keep quarantine time as short as possible. Relevant departments need to give enough information about the pandemic in time to calm people down [7].

6. Fair Manner and Health Disparities within the Development

6.1 Fair Manner about Vaccine

The impact of the COVID-19 pandemic on society is enormous. Although the spread of the virus can be mitigated by maintaining physical distance, wearing a face mask, testing, and tracking, and possibly treatment, the risk of outbreaks and destruction of economic and social life may persist until effective vaccines are given to most areas. In this regard, people have made many positive interventions, and among them, one of the most effective and most valued interventions is the COVID-19 vaccination. In 2021, many kinds of vaccines have been developed, clinically tested, and promoted for production. But this plan has not been smooth sailing. The country's disparities and the country's health disparities within the country will affect and change the distribution of vaccines, thereby changing the pandemic trend.

6.1.1 Fair Manner about the Vaccine Globally

One of the key points of concern when facing vaccine production and distribution is establishing mechanisms to ensure the affordability and sustainable financing of COVID-19 vaccines in low- and middle-income countries, with approximately 85% of the world's population. And there may be a lack of resources to purchase sufficient quantities of vaccines [14]. On April 24, 2020, the WHO issued an appeal confirming its commitment to equitable access to safe, high-quality, effective, and affordable COVID-19 diagnosis, treatment, and vaccines worldwide [15]. However, the current situation of sharing global vaccine research and development and acquisition is not optimistic.

The public's support for basic research and early drug development has always been widespread. The urgent need to develop a COVID-19 vaccine and expand supply has stimulated the drive to help research, development, and production activities and gain extensive participation from private companies. Governments and non-profit organizations provide funding for clinical trials, invest in the construction and expansion of production facilities, and establish contract manufacturing and distribution networks to quickly launch successful vaccines. But even so, when major developers establish relationships with contract manufacturers, the production capacity caused by technology transfer restrictions is inevitable, whether from the perspective of enterprises or the country.

At present, few countries have the domestic ability to produce COVID-19 vaccines autonomously and rapidly, and companies need to actively share knowledge, technology, and data with domestic manufacturers. [16] The fairness brought about by the framework distribution is better than the invitation, but the implementability is weaker. Development and clinical testing capabilities and purchasing capabilities occupy a major part of the oligopoly of COVID-19 vaccines in today's society. This has also led to developing countries becoming the most important regions for fair vaccine distribution. Suppose developing countries, or divided according to other forms, it takes several years for low- and middle-income countries (LMIC) to obtain vaccines. In that case, the SARS-CoV-2 virus

may produce strains, rendering some vaccines ineffective and prolonging the epidemic. Popularity. At least, this shows that after a prudent government vaccinates people within its territory, it should also distribute vaccines to other countries out of its interests. In fact, during global health emergencies, governments have cross-border responsibilities [17]. In vaccine distribution, entities that develop vaccines, treatments, and diagnostics should be involved and support centralized procurement in low- and middle-income countries, open cooperation, and evidence-based, health-driven distribution.

6.1.2 Fair Manner About the Vaccine Within Countries

The definition of medical care itself is the ability to benefit from medical care services, such as disease prevention, diagnosis, treatment, rehabilitation, and hospice care [18]. Like the fair manner of vaccine allocation between countries, most of the time, people's ability to obtain medical care is related to socioeconomic, and personal affordability is crucial in the early stage of vaccine allocation. The impact of socioeconomic disparities on COVID-19 is like any other disease. After efforts to distribute vaccines due to the pandemic and focus on vigorously supporting rural and poor areas, interventions are needed to help high-risk groups with health disparities with the main population. The elderly, the homeless, children, disabled, etc., are all people who need more follow-up care. It is also the most difficult for these people to obtain appropriate and fair health care services in the community. During a pandemic, the nature of the vaccine and storage conditions will affect these people's access to get the vaccine. The main means to prevent COVID-19 will also have a negative impact on these people, whether it is isolation or social distancing, which is unsustainable for the population that relies on medical care for a long time.

In this special period of COVID-19, the direct high risks and the upstream social determinants that lead to differences in health should be considered. Therefore, when vulnerable groups are associated with a higher risk of infection, it is necessary to give priority to those belonging to the vulnerable groups. It is not enough to protect vulnerable communities based on geographical divisions and calling for active vaccination in such a situation. Only more active and specific interventions can effectively help this population. The health department should cooperate with non-profit organizations to vigorously promote door-to-door, key area promotion, telephone reminders, and other measures and help them to obtain vaccination access by targeting the characteristics of vulnerable groups.

6.2 Remote Health Care

At present, the biggest impact of COVID-19 on the existing healthcare system is system reform, and telemedicine is one of them. Telemedicine has shown gradual growth in recent years, with only 8% of Americans using it in 2019. The main barriers to wider adoption include limited reimbursements, patients' and providers' lack of comfort with telemedicine technology, and fundamentally speaking, there are few convincing cases to replace in-person care outside of rural medical care [19]. The emergence of the pandemic has changed this situation at an extremely fast speed. As the most convenient and effective intervention measures, social distancing and quarantine have made telemedicine widely concerned and used. It seems futuristic to speculate that telemedicine may take precedence over face-to-face care, but now it has become a reality in multiple healthcare systems worldwide. In mid-2020, when the number of COVID-19 cases increases, Americans are very interested in telemedicine. Of the 6,146 hospitals in the United States, 60.8% have deployed telemedicine, and 13.4% have remote ICU capabilities. The northeastern and western survey areas are more interested in telemedicine, while the central and western regions have more hospitals using telemedicine [20]. Providers and patients are required to adapt to a new normal while using telemedicine systems, which include video and voice communication. Telemedicine transfers prevention, treatment, care, and support from clinics to homes and mobile devices so that customers can be cared for without interruption. Many people, including insurance companies and the government, are full of confidence in this and believe that this is the path for the future development of the medical system.

But in fact, telemedicine also has great limitations. Not all populations can have access to telemedicine. The limitation of medical resources and the limitation of electronic equipment are fatal.

The universal applicability of infrastructure and network services caused by disparities of socio-economic status is open to question. Remote areas, age, and degree of informatization are all key factors that may affect telemedicine. Disabled, elderly, children, and other disadvantaged groups are also the keys to discussing telemedicine. Hearing and vision impairments may affect treatment through telemedicine technology, and age is another key factor related to telemedicine inequality [21]. Due to low socioeconomic status, low Internet skills, and low technology acceptance, the elderly and children have limited access to Internet-based services.

In addition, the requirements of telemedicine for doctors are also different from those of clinicians. Effective and fast training is very important. How to quickly use the Internet, mobile medical solutions, and electronic medical records to provide support for patient-centered healthcare to prevent and help control the COVID-19 pandemic is necessary [22]. However, we cannot ignore telemedicine's inequality and the global health gap that may exacerbate mental health problems [21].

7. Conclusion

With the development of science and technology and the deployment of different interventions, the world will usher in the post COVID period. The health care reform that this period brings is vital. Allowing patients to get tests quickly and increase supervision only when real-world needs arise contradicts the FDA approach before COVID-19, but when technology or diagnosis provides huge potential benefits, continuing to use this method and monitoring clinical data in real-time is a more effective method and would continue to be applied. The pandemic also gains focus on health disparities. Future treatment should also be embodied in areas other than medical care, provide health and care instead of just medical. Develop a people-oriented healthcare system, focus on improving population health, and pay attention to real health disparities and upper-level determinants of diseases and improve them. This may be the warning given to the society by COVID-19.

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