Research on the Ways to Improve COVID-19 Detection—Based on Divide and Conquer Philosophy

Weibo Sun[✉]

ZhenJiang Maple Leaf International School, ZhenJiang 212000, China
2019050073@students.mapleleafedu.com

Abstract. The study is based on the shortcomings of prevention and treatment methods for COVID-19, the current challenge facing the world. The topic of this study is how to use the divide-and-conquer philosophy of computer science to improve the efficiency of NUCLEIC acid testing for COVID-19. To complete this research, we need to use the concept of divide and conquer, divide a big problem into smaller problems, and solve the small problems one by one to solve the big problem. This research needs to use the information of Internet big data and the population information registered in the community. The most difficult part of this study is data collection. The data of this experiment mainly come from the basic information of owners provided by the community, users' dynamic travel chart of communication operators, and basic information provided by a questionnaire survey. Through this study, we found that the prevention and control process of COVID-19 is too complicated, and detection efficiency can be improved in many places.

Keywords: COVLD-19 · nucleic acid testing (COVID TEST) · susceptible/vulnerable population

1 Introduction

Novel coronavirus outbreaks have occurred in various parts of the world since late 2019. This virus and the previous SARS virus are different, it has been determined that the incubation period of the virus is one to fourteen days, can test droplets and confined space aerosol transmission, and fecal-oral transmission is also highly likely [1]. It is of great significance to quickly screen out infected people and to contain the spread of the epidemic for subsequent diagnosis and treatment of patients. At present, most detection methods are biological nucleic acid detection technology, and samples are collected by pharyngeal swabs, nasal swabs and other methods. At the moment, a lot of research is focused on how to more accurately detect whether a person is negative or positive. Either way, it takes a lot of time. And how to quickly control the spread of the epidemic and nucleic acid testing forms and procedures have not been paid attention to. Many communities are unable to perform nucleic acid testing quickly, safely and accurately. The topic of this study is how to use the concept of divide and conquer to carry out nucleic

Table 1. Basic information of COVID-19 patients

	The patient age	male/female	fever	cough	dyspnea	Abnormal chest CT	nucleic acid testing
1	65	male	yes	yes		yes	positive
2	56	male	yes	yes		yes	positive
3	46	male	yes			yes	positive
4	69	male	yes	yes	yes	yes	positive
5	67	male	yes	yes		yes	positive
6	69	male	yes			yes	positive
7	56	male	yes		yes	yes	positive
8	68	male	yes		yes	yes	positive
9	74	male	yes	yes	yes	yes	positive
10	74	male	yes	yes	yes	yes	positive
11	54	male	yes	yes		yes	positive
12	54	male	yes	yes		yes	positive
13	76	male	yes	yes		yes	positive
14	68	female	yes	yes		yes	positive
15	61	male	yes			yes	positive
16	84	female	yes	yes		yes	positive
17	41	male	yes	yes		yes	positive
18	60	female	yes	yes		yes	positive

acid detection quickly and improve the existing nucleic acid detection procedures. The question explored in this study is whether controlling the susceptible population can help improve the efficiency of nucleic acid testing. This study can help to improve the existing nucleic acid detection process is slow and tedious drawbacks. Further address the possibility of secondary infection.

2   Analysis of Vulnerable Populations

2.1   Status of Vulnerable Groups

Vulnerable groups need intensive protection and special management. Through questionnaires, we learned some basic information about COVID-19 (Table 1).

Through the survey of this hospital, we can know that the age of patients is generally over 40 years old. Patients between the ages of 50 and 70 are mostly affected. A small number of patients will have difficulty breathing and most will cough. All patients had a fever abnormal chest CT, and positive nucleic acid characteristics [2].

Fig. 1. Community nucleic acid testing operation model. *Original by the author

People's understanding of COVID-19 differs by gender, age, place of residence, and level of education. Those who are completely unaware of the disease and have misconceptions about COVID-19 need to be focused on [3].

Through surveys and analysis, we know that men respond less to symptoms of COVID-19 than women. The rural population aged 18–27 and those with less than a high school education are largely unaware of the symptoms and responses to COVID-19. Older people, with weakened immunity, are more likely to get sick and die from it. People with respiratory diseases, hypertension and diabetes are also susceptible to infection because of irregular work and rest. People with low immunity, or an underlying medical condition, are at high risk. People who frequent crowded places are also vulnerable to infection because there may be asymptomatic infections among people.

China has a population of 1.4 billion, with about 5000 people in a community, and about 3.3 billion people suffer from heart disease in China. It's about 0.2% prevalence. From this information, we know that there are about ten heart attack patients in a community. China's aging population is also very serious, with about 500 million Chinese aged over 65. By this calculation, there are about 175 senior citizens in a community. Respiratory disease affects about 67 million people, which translates to about 235 people in a community with respiratory disease.

And so by analogy, we can figure out how many people are susceptible in this way, and there are not a lot of them. If we can increase surveillance in these susceptible populations and reduce the frequency of surveillance in the general population, we can increase the speed of nucleic acid screening.

We can also use this method to identify centralized isolation sites, or to prepare facilities and supplies for testing in advance. This can also help us improve the efficiency of nucleic acid screening, which is very helpful for the prevention and treatment of COVID-19.

2.2 Infection Causes

After analysis, we got the characteristics of the susceptible population, and now we can analyze the cause of infection through the characteristics of the susceptible population. People with compromised immune systems need to be focused on. These people tend to be the elderly, the very young, and those with irregular sleep patterns. Students, those who often work overtime, those who stay up late, and the elderly have low immunity. Among these, students are less likely to get infected because they need to go to school. Those most at risk are workers and the elderly. Too much social interaction, a low immune system and a lack of basic protection can all contribute to the disease (Fig. 1).

Through the concept of divide and conquer, we can decompose the tedious procedure of nucleic acid detection in turn, and find areas that can be improved. Nucleic acid testing

has many steps. It is mainly divided into the following steps. These procedures must be performed by all personnel who come in for testing. The health code testing area requires two staff to check to ensure that no close contacts or people returning from high-risk areas are reinfected. At least two staff members are required to register at each checkpoint. At least two staff members are required for sample collection. And a crew member was needed to assist with the evacuation. A set of COVID-19 tests requires about 10 people, and because there are so many people to be tested, a community can assign at least two sets of nucleic acid testers [4]. Staff will spend a lot of time checking the identity information and health code status of those who come to test, which is essential [5]. A community needs to test each person at least three times, although this method can accurately screen the infected. But this routine detection is very slow. I think nucleic acid testing can be improved. We can speed up testing and save time by improving the way we operate. We can find infected people through nucleic acid testing, but this is very rare because the epidemic prevention measures are very strict. After the first round of testing, we can compare the susceptible population through the information registered in the community.

3   Discussion and Recommendation

Because most outbreak management is now community-based, we can ask the community to help. Communities should register their medical history when conducting nucleic acid testing, and disseminate basic information and prevention methods for COVID-19.

By comparing the collected information with previously identified characteristics, susceptible individuals can be identified and focused on management. When we complete the information comparison, the susceptible population is basically determined.

Due to the particularity of susceptible populations, special management is required. The best way to do this is to get those vulnerable people vaccinated first and report their temperature every morning, noon and night. Minimize contact between unvaccinated and vulnerable individuals. Arranging individual nucleic acid tests for susceptible people requires multiple tests. After a week of careful monitoring and everyone vaccinated, they can be removed from the susceptible list. Because the susceptible population has been isolated, the ideal susceptible population can be isolated and observed. So their identities are pre-recorded in big data. In this way, the step of checking the health code is omitted, and the speed of nucleic acid detection is greatly accelerated. At the same time, we can skip evacuation steps because there is enough space for group quarantine and fewer people are being tested than in the community. Skipping two steps can greatly improve the efficiency of nucleic acid detection, saving time and cost. It also saves manpower by having extra workers take shifts.

Ask where susceptible people go, and conduct extensive disinfection in places with the most people. If an infected person is found in the area, please close the premises as much as possible [6]. Ask susceptible people about their daily habits, correct wrong habits, and issue notices to warn others. Ask the susceptible people whether they have had close contact with others and if so, isolate the close contacts and conduct multiple nucleic acid tests.

People who are infected should be asked what their initial symptoms are, and if everyone knows the initial symptoms, they can be treated in the early stages of infection.

4 Conclusion

China's population base is very large and densely populated. Even if susceptible groups are identified, there is no guarantee that they will not be in contact with others and strict control cannot be carried out. At the same time, because of the large population base, the potentially infected people may have inadvertently spread the virus when the information of susceptible groups is compared. Information comparison does not work well. If a large number of vulnerable groups for special management may cause public opinion, discrimination, and other social conflicts. This is not good for unity in tackling COVID-19.

At the same time, the consequence of a large population is that the floating population is very large. When holidays come, many migrant workers return to their hometowns. Normally it would only cause traffic jams, but now it would give the disease a good chance to spread. Even if we can identify where the virus is concentrated based on information about vulnerable populations, we still can't stop people from traveling for long. Due to various reasons and limitations, this approach, although effective, is difficult to implement. So it's not feasible in China. We need to find better ways to speed up nucleic acid testing, and this approach is easier to achieve in countries with smaller populations. Smaller populations are easier to manage and can speed up the location of infected patients through a divide-and-rule approach. The COVID-19 pandemic is a very serious matter. There are many ways to prevent and treat it, but making sure you don't get it is the most important thing. People need to monitor themselves, otherwise no matter how sophisticated the prevention measures will be useless. Being responsible for your own health and the health of others is the most important thing.

References

1. Collection and management mode of community accounting with full coverage of residents 5. 30. 2021
2. Reflections on the collection of COVID-19 prevention and control records in medical institutions 16. 4. 2020
3. A survey on the public's knowledge of epidemic prevention and control during the COVID-19 epidemic period 5. 2021
4. Retrospective analysis of the characteristics of COVID-19 infected patients' mortuary in rehabilitation medicine department of some general hospitals in Wuhan 10. 2020
5. Novel coronavirus nucleic acid test results vary with time 28. 10. 2021
6. Collection and management of COVID-19 prevention and control files of CDC