problem analysis:

Question two requires us to detect asymptomatic infections and establish a mathematical model to find a reasonable way to reduce the number of asymptomatic infections in the population.

First of all, we must determine the method to reduce the impact of asymptomatic infections on the population. By consulting the literature, there are two ways to reduce the impact of asymptomatic infections on the population. The first is to carry out large-scale nucleic acid testing to find asymptomatic populations. Individuals carrying the new coronavirus in China; the other is a policy of restricting travel for residents who have not been checked.

Secondly, in order to integrate the above two solutions, this article considers dividing the entire population into asymptomatic people, confirming that the virus-carrying people and confirming that the healthy people who do not carry the virus, based on the SIR model in the infectious disease model, establishes a model for dealing with asymptomatic infections , The model relies on the transformational relationship between the three populations. The parameters in the transformation relationship were changed to simulate the control and treatment of asymptomatic people in the two programs, and the length of time when the number of asymptomatic people was in a small state was used as the standard of the quality of the program.

Finally, the parameter change ratios of the two programs are 30% and 60%. The larger the parameter change ratio, the wider the impact of the program. Therefore, compare the effects of different program strengths before and after the implementation, and explain how we should deal with this effect. Asymptomatic infections continue to spread the epidemic.

5.2 Problem three model

By consulting the literature, there are two ways to reduce the impact of asymptomatic infection on the population:

1. Conduct a large-scale nucleic acid test to find individuals who carry the new coronavirus among asymptomatic people.

2. Implement a travel restriction policy for residents who have not been inspected.

5.2.1 SIR-based asymptomatic transmission model

Before establishing the model, we first determine the type of population and the probability of asymptomatic population receiving nucleic acid testing. The specific discussion is as follows:

* Crowd type

In the spread of the epidemic, different types of people have different types of effects on the spread of the epidemic. After consulting the information, we found that the model can be compared to the SIR model, in which the population is divided into susceptible, infected, and cured. Similarly, we divide the population into three parts: S, I, and R, the specific meanings are as follows:

|  |  |  |
| --- | --- | --- |
| symbol | meaning | Abbreviation |
| S | Asymptomatic people (infected and healthy) | Asymptomatic |
| I | People diagnosed as positive | positive |
| R | People diagnosed as negative | negative |

The proportion of the negative population to the total population is r(t), and the initial value is recorded as ，,. Since the total population remains unchanged, the ratio of the three populations obviously has the following formula:

The probability of asymptomatic people receiving nucleic acid testing

When the government conducts large-scale nucleic acid testing, the probability of each asymptomatic population being tested is:

Where A represents the number of samples that can be tested per day, and M represents the overall number of people. In other words, the probability of the above formula is the proportion of the number of detectable samples in the total asymptomatic population. If the amount of testing is expanded, it means that A increases, and the probability of each asymptomatic sample being tested is higher.

5.2.2 Establishment of asymptomatic transmission model

First consider the relationship between asymptomatic population S, positive population I, and negative population R. Through analysis, the transformation relationship between the three is obtained. The schematic diagram of the transformation relationship is as follows:

