

Acid testing services in China in the context of COVID-19 epidemic normalization

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Abstract: In the context of the normalization of the COVID-19 outbreak, the demand for nucleic acid testing has surged. In response, the Chinese government has introduced a series of measures to ensure the availability of nucleic acid testing services. This study analyzed the satisfaction status of the public with nucleic acid testing services in Guangzhou, China. The survey results showed that the level of support for nucleic acid testing is high, but there is a gap between different nucleic acid testing services. Based on this, this study proposes to strengthen the publicity of nucleic acid testing, establish uniform standards for nucleic acid testing services, and integrate epidemic prevention and control applets.

1. Introduction

Since December 2019, COVID-19 has swept the world. COVID-19 is highly contagious and spreads rapidly. Rapid and accurate laboratory tests for this virus can accurately and timely detect COVID-19 virus infections, reduce the risk of transmission, and protect susceptible populations. Therefore, the development of nucleic acid virus testing is of great significance to achieve scientific prevention and control and precise prevention and control.

Currently, the growth of the COVID-19 outbreak outside of China continues, and there are localized outbreaks in some parts of the country, leading to a much higher demand for nucleic acid testing. On the one hand, China's epidemic prevention measures have mandatory requirements for nucleic acid testing, including mass nucleic acid testing screening in high-risk areas, the need to provide a negative nucleic acid test report within 72 hours to enter and exit medium-to-high-risk areas, and personal health QR codes information update. On the other hand, the public or enterprises will go to or organize the nucleic acid testing for their own health or to ensure work resumption.

In the context of the long-term nature and complexity of epidemic prevention and control, nucleic acid testing has become a regular outbreak prevention and control effort. The Chinese government's efforts have gradually shifted from the unannounced deployment of local manpower to organize large-scale virus nucleic acid screening to the provision of regular virus nucleic acid testing services while ensuring normal production activities as much as possible. For this reason, it is necessary to summarize the policies of the Chinese government to provide standing nucleic acid testing services during the epidemic, to understand the public's evaluation of the existing nucleic acid testing services, and to reflect on the weaknesses revealed during the period, so as to provide more theoretical support for building standing epidemic prevention and control efforts in the post-epidemic era.

2. Nucleic Acid Testing Policies

Through policy combing, this study divides the nucleic acid testing-related policies issued by the government into four areas: improving nucleic acid testing capacity, updating nucleic acid testing technology and methods, and macro coordination of resources and convenience services.

2.1 Improving nucleic acid detection capabilities

Since the outbreak of COVID-19, there has been an increasing demand for nucleic acid testing. In response, the Chinese government has sought to improve the capacity of nucleic acid testing by both expanding the capacity of public hospitals and introducing third-party independent medical testing laboratories.

(1) Expanding hospital capacity

Hospitals are often the mainstay of medical testing. However, at the beginning of the epidemic, most hospitals in China were not yet equipped with appropriate medical laboratories. In order to expand the capacity of nucleic acid testing in public hospitals, the Chinese government has continued to make renovation requests to hospitals.

On April 19, 2020, the State Council Medical Affairs and Medical Bureau issued the *Notice on Further Improving the Work Related to COVID-19 Virus Testing During the Epidemic*, which required that all tertiary general hospitals should establish clinical testing laboratories that meet biosafety level 2 or higher standards and have the ability to independently conduct novel coronavirus testing. As of October 2020, all tertiary hospitals, provincial and municipal CDCs, and most independent clinical laboratory in China already have nucleic acid testing capabilities. However, it is clear that it is not a long-term solution for tertiary hospitals to undertake nucleic acid testing alone. In order to relieve the pressure on tertiary hospitals, China further promoted the establishment of nucleic acid testing capacity in counties nationwide. On April 26, 2020, China's National Health and Wellness Commission proposed in a teleconference that all CDCs above the county and district level and general hospitals above the second level should be renovated urgently to develop nucleic acid testing capacity in a short period of time. On August 31, 2020, the Joint Prevention and Control Mechanism of the State Council proposed in the *Work Plan to Further Promote the Capacity Building of Nucleic Acid Testing for COVID-19 Virus* the requirement that all secondary general hospitals have nucleic acid sampling and testing capabilities by the end of 2020. As the work of hospital renovation continues to advance, more and more secondary and primary hospitals are equipped with nucleic acid testing capabilities. In Guangzhou, for example, as of August 2021, a total of 293 nucleic acid sampling sites have been set up, greatly improving the overall nucleic acid testing capacity of the city.

By combing through the policies, it can be seen that the Chinese government has continued to promote the sinking of nucleic acid testing capacity, and the requirement for hospital laboratory renovation has spread from tertiary hospitals to primary medical institutions. On the one hand, the expansion of nucleic acid testing sites has increased the number of testing facilities available to the public and greatly facilitated nucleic acid testing for the public. On the other hand, tertiary hospitals are often under tremendous pressure to provide daily care, while primary hospitals face the problem of fewer patients. By decentralizing nucleic acid testing to primary care institutions, the public can be directed to primary medical institutions, freeing tertiary hospitals from the pressure of nucleic acid testing, and thus better able to take on the task of treating difficult and complicated diseases. By expanding the nucleic acid testing capacity of hospitals at all levels, medical institutions at all levels can perform their respective duties and maintain normal treatment order during the period when the COVID-19 epidemic is relatively mild.

(2) Introducing Independent Clinical Laboratory

In the pre-epidemic period, medical testing in China was usually performed by hospitals. However, in the face of the sudden epidemic, the demand for nucleic acid testing instantly skyrocketed, making it difficult for hospitals to take on the demand for nucleic acid testing on their own. In addition, primary medical institutions face practical difficulties in building their nucleic acid testing capacity. Secondary hospitals and other primary medical institutions are short of funds and can hardly afford to build PCR laboratories, purchase large laboratory equipment, and train personnel. Therefore, the National Health Commission decisively introduced the power of independent clinical laboratory. On January 22, 2020, the General Office of the National Health Commission issued *The Notice on the Requirements for Medical Institutions to Carry Out Novel Coronavirus Nucleic Acid Testing*, clearly stating that "provinces can cooperate with qualified ICL to carry out testing by purchasing services". On February

4, 2020, a meeting of the Leading Group on Novel Coronavirus Infection in Pneumonia clearly stated that "*qualified ICLs are allowed to conduct nucleic acid testing*". On April 26, the National Health Commission proposed in a teleconference "*to support localities to cooperate with ICL to carry out nucleic acid testing when the testing capacity of public medical and health institutions cannot meet the demand, so as to enrich the testing power.*"

With the encouragement of the policy, ICL has actively participated in the epidemic prevention and control work in China, playing an important supporting role. Through combing, ICL's modes of participation in epidemic prevention and control work include: officially authorized laboratories, co-establishing laboratories with officially authorized institutions, providing technical talents and consumables and equipment, providing cold chain logistics services and co-establishing rapid response laboratories. At present, ICL has become one of the indispensable and important forces in the epidemic prevention and control work.

With ICL entering the market in a big way, the government continues to improve the management of ICL while encouraging its development. On August 3, 2020, the State Council Joint Prevention and Control Mechanism organized the development of the *Interim Measures for the Management of Medical Testing Laboratories*, which put forward specific requirements for medical testing laboratories around the country. On February 7, 2020, the General Office of the General Administration of Market Supervision issued *The Notice on the Key Work of Price Supervision and Competition in the Near Future*, making requirements for ICL's service charges.

Combing can be obtained that ICL plays an important role in the regular prevention and control of COVID-19 epidemic. From encouraging ICL to collaborate with medical institutions to requiring that medical institutions with insufficient nucleic acid testing capacity should collaborate with them, the Chinese government is becoming more receptive to them. In the context of the normalization of the COVID-19, the cooperation between medical institutions and ICL will be long-term. Therefore, while introducing policies to encourage cooperation, the government has introduced a series of management measures for ICL to provide a basis for long-term cooperation to be managed by law.

2.2 Update of nucleic acid detection techniques and methods

(1) Nucleic acid detection technology and testing standards

The improvement of nucleic acid detection capability is dependent on the upgrading of nucleic acid detection methods and kits, and the updating of methodologies can further improve the criteria for confirming the diagnosis of COVID-19 virus. The Chinese government has been encouraging research and development during the epidemic and has developed appropriate kit quality standards and updated diagnostic criteria based on methodological advances.

On February 8, 2020, the Chinese Ministry of Science and Technology released the *Ministry of Science and Technology's Guidelines on the Release of Emergency Projects for the R&D of Field Rapid Test Products for 2019-nCoV*, soliciting from the whole society for faster, more convenient and accurate field rapid test products for COVID-19 virus. The introduction of emergency approval means that product quality standards for new coronavirus nucleic acid test kits have been established. Companies have responded to the call of national policy and actively participated in the R&D and production activities of nucleic acid detection reagents. Nucleic acid test kits for qPCR, RT-PCR and POCT have been rapidly developed, and RT-PCR, which has the advantages of shorter detection time and convenient operability, has become a widely used nucleic acid test method in clinical practice. As of July 16, 2020, 44 COVID-19 virus test kits have been approved and marketed by the State Drug Administration of China. However, since COVID-19 is a new virus, there are problems in the development of its nucleic acid kit, such as: time constraint, lack of mastery of relevant technical points, and difficulty in obtaining sufficient amount of clinical samples. For this reason, the government combined with the existing experience and suggested that companies should pay attention to the points that may affect product performance and quality during the R&D process. On February 12, 2020, the Medical Device Technical Review Center released *2019 New Coronavirus Nucleic Acid Test Reagent Registration Technical Review Highlights (Trial)* and on February 25, 2020, *2019 New Coronavirus Antigen/Antibody Test Reagent Registration Technical Review Highlights (Trial)*. On

August 19, 2020, the *Technical Specification for 10-in-1 Mixed Viral Nucleic Acid Assays* proposed the requirement of "selecting kits with low detection limits and high sensitivity".

At the same time, the diagnostic criteria for COVID-19 virus have been continuously updated. From February 2020 to April 2021, the government has issued eight editions of the "Novel Coronavirus Pneumonia Treatment Protocol" to clarify the diagnostic basis for the diagnosis of novel coronavirus pneumonia.

By sorting out the policies, it can be seen that as the experience in preventing and controlling epidemics increases, the Chinese government's policy on nucleic acid testing methods is gradually changing from encouraging research and development to orderly management, and constantly updating its treatment protocols based on research on the virus.

(2) Nucleic acid detection methods

Mixed sampling of nucleic acid tests can significantly improve nucleic acid detection capabilities, enabling rapid detection to identify infected patients or asymptomatic carriers to control the spread of the epidemic. During the epidemic, the Chinese government introduced a series of measures to impose requirements on the process of nucleic acid testing. On February 9, 2020, the National Health Commission issued *The Notice on Further Improvement of COVID-19 Virus Nucleic Acid Testing Services*, proposing that in principle, people from low-risk areas can be tested with 10:1 mixed samples, medium-risk areas can be tested with 5:1 mixed samples, and high-risk areas and key populations must be tested with 1:1 single samples. On August 17, the Joint Prevention and Control Mechanism of the State Council formulated *The Notice on the Issuance of Technical Guidelines for Dilution Mixing Testing of COVID-19 Virus Nucleic Acid Screening* stipulating the scope of application and regulating the sample mixing process and other specific considerations. On August 19, 2020, the State Council issued *The COVID-19 Virus Nucleic Acid 10-in-1 Mixed Sampling Testing Technical Guideline* to regulate the mixing-sampling process.

With the accumulation of experience in responding to the epidemic, the Chinese government's policy has shifted from regulating the process to promoting mixed testing. On February 8, 2021, Joint Prevention and Control Mechanism of the State Council issued *The Notice on Further Improvement of COVID-19 Virus Nucleic Acid Testing Services*, which proposed to "encourage the provision of both single-sample testing and mixed-sample testing services for the public to choose."

In the long run, the provision of mixed sampling services to self-funded nucleic acid testing is an effort by the government to respond to the normalized epidemic. Due to the normality of the epidemic, some citizens often require multiple nucleic acid tests. The testing cost of mixed sampling is lower than that of individual sampling. This not only provides a variety of options for the public to pay for their own nucleic acid testing, but also reduces the financial burden on the public and reduces the impact on their daily lives.

2.3 Macro coordination of resources

(1) Area mobile support system

The prevention and control of the epidemic cannot be achieved without macroscopic deployment of resources. The Work Plan to Further Promote Capacity Building for COVID-19 Virus Nucleic Acid Testing proposes to establish an Area Mobile Support System. The country will be divided into 8 areas according to the comprehensive population, layout of medical and health resources and geographical transportation, etc. The public testing laboratories and larger ICL within the areas will be coordinated as mobile testing teams, and each area will have a mobile nucleic acid testing capacity of 500,000-70,000 copies/day to respond to unexpected situations within the areas.

On the one hand, the Area Mobile Support System can create a large amount of nucleic acid testing capacity in a short period of time to respond to unexpected epidemics. On the other hand, the "support system" means that there is no need to send permanent staff. During periods of relatively calm epidemics, the medical and nursing staff of each unit can carry out their work normally.

(2) Information Sharing

On June 8, 2020, the Joint Prevention and Control Mechanism of the State Council issued *The Implementation Opinions on Accelerating the Promotion of Nucleic Acid Testing of New Coronavirus*,

proposing to ensure the smooth information security of nucleic acid testing. On August 26, 2021, the Guangdong government issued *The Code of Practice for Virus Sampling Tube Coding (Implementation)*, a unified test tube identification code for COVID-19 virus nucleic acid testing institutions in the province, which condenses core information such as the test institution's territorial code, nature code, unique code, and unique number of nucleic acid test samples into a 14-word code. This move realizes the traceability of nucleic acid testing work, which helps to improve data quality and reporting efficiency, and also helps to achieve hierarchical and graded information management and data sharing, providing more powerful support for accurate prevention and control.

2.4 Nucleic acid testing convenience services

The government has made a number of efforts to make nucleic acid testing more accessible to the public. In order to make these efforts practically accessible to the public, the government has provided corresponding nucleic acid testing convenience services. These include a 24-hour nucleic acid testing kiosk and a nucleic acid service app.

(1) 24-hour Nucleic Acid Convenience Stations

Through the expansion of hospital nucleic acid testing capacity and the introduction of ICL, nucleic acid testing capacity has been greatly released, and medical institutions at all levels are able to meet the daily nucleic acid testing needs of the public. Based on this, the government has provided 24-hour nucleic acid testing services to the public. In Guangzhou, for example, as of September 2021, there are 57 24-hour nucleic acid testing service stations covering all districts in the city, and each district is equipped with at least one 24-hour nucleic acid testing service station. Therefore, citizens do not need to go to the service during working hours when they undergo nucleic acid testing, but are free to choose their own time according to their specific situation, so as to reduce the impact of nucleic acid testing on their daily studies and work.

(2) E-Government

According to China's epidemic prevention and control requirements, citizens are required to show their personal health QR codes for daily travel, which makes the WeChat applet to which the personal health QR code is attached one of the most commonly used applets. Taking this as an opportunity, the Chinese government has combined the personal health QR codes with e-government. In Guangzhou, for example, the personal health QR code for Guangzhou citizens is based on the *Guangdong Affairs* or *SuiKang* applet. The *Guangdong Affairs* is the first mobile government service platform in China that integrates high-frequency livelihood services based on WeChat innovation, covering nearly 800 high-frequency livelihood services such as public security, human resources, education and taxation. However, the promotion of new government service platforms often takes time and costs. The Guangdong government has added the personal health QR code to the *Guangdong Affairs*, so that citizens can understand the applet when using it on a daily basis, thus playing a role in promoting the government affairs platform and allowing more citizens to enjoy the results of Guangdong's E-government reform and construction. Similarly, the Guangzhou Municipal Government provides nucleic acid testing appointments, epidemic information and epidemic prevention knowledge in the *SuiKang* applet. On the one hand, the epidemic information can be publicized through the daily use of personal health QR codes by citizens. On the other hand, by concentrating the epidemic information and related services in the same applet, the government can reduce the tedium of using multiple applets at the same time for the convenience of the public. At the same time, in order to facilitate the public's daily travels and reduce the duplication of health information, Guangzhou has implemented the interchange of information between *Guangdong Affairs* and *SuiKang*. In March 2020, the *SuiKang* applet and the *Guangdong Affairs* applet have been connected to the system and data, so that citizens do not need to fill in health information repeatedly. This further facilitates the public to travel with the health QR code and reduces the red tape caused by the epidemic prevention and control requirements.

3. Empirical Analysis

3.1 Questionnaire Design and Reliability Analysis

In this study, a questionnaire survey was conducted with Guangzhou residents as the target population. A total of 130 questionnaires were distributed, and the main contents of the questionnaire included basic information, nucleic acid testing situation, and satisfaction with nucleic acid testing. The survey data were analyzed to further understand the satisfaction level of nucleic acid testing in Guangzhou, which was classified into five levels: very dissatisfied, dissatisfied, average, satisfied and very satisfied.

In this paper, the reliability of the questionnaire was measured using Cronbach's alpha coefficient. The results showed that the Cronbach's α coefficient of this questionnaire was $0.820 > 0.8$, indicating that the reliability of this questionnaire was good and could provide a reliable basis for this survey.

3.2 Basic situation of the sample

A total of 130 valid questionnaires were collected in this study, among which 52 residents had not participated in self-pay nucleic acid testing and 78 residents participated in mass nucleic acid screening and self-pay nucleic acid testing. Therefore, the questions about self-pay nucleic acid testing in this questionnaire were answered only by the 78 residents who had experience with mass nucleic acid screening and self-pay nucleic acid testing. The distribution of the sample is shown in Table 1, and the sample nucleic acid testing is shown in Table 2.

The views of the public on nucleic acid testing showed that more than half of the public were willing to cooperate with nucleic acid testing and recognized the important role of nucleic acid testing in outbreak prevention and control. The top three considerations for residents in choosing a testing facility were queuing time, cost of testing, and proximity. This indicates that the residents chose the nucleic acid testing institution more for their own convenience.

Table 1. Distribution of sample

Distribution of sample				
Items	Options	Frequency	percentage(%)	Cumulative percentage(%)
Gender	Female	76	58.5	58.5
	Male	54	41.5	100
Age	<20	27	20.8	20.8
	21-30	61	46.9	67.7
	31-40	29	22.3	90
	41-50	4	3.1	93.1
	51-60	5	3.8	96.9
	≥ 61	4	3.1	100
Education	Junior high school and below	2	1.5	1.5
	High School / Vocational High School	7	5.4	6.9
	Undergraduate / Specialist	93	71.5	78.5
	Graduate and above	28	21.5	100
Work Status	Current Students	55	42.3	42.3
	Employed	65	50	92.3
	Freelance	3	2.3	94.6
	Farming	3	2.3	96.9
	Unemployed	4	3.1	100

Table 2. Nucleic acid testing status of sample

Nucleic acid testing status of sample				
Items	Options	Frequency	percentage(%)	Cumulative percentage(%)
Views on nucleic acid testing				
Attitude towards nucleic acid testing	Had to cooperate due to mandatory policy	35	26.9	26.9
	Proactive cooperation	87	66.9	93.8
	Vague attitude	8	6.2	100
Opinion on the role of nucleic acid testing in outbreak prevention and control	Very small effect	6	4.6	4.6
	Average	46	35.4	40
	Significant effect	72	55.4	95.4
	Unclear	6	4.6	100
Top 3 factors to consider when choosing a nucleic acid testing facility (multiple choice)	Distance	69	53.08	
	Cost	72	55.38	
	Queuing time	74	56.92	
	Waiting time for nucleic acid tests report	61	46.92	
	Institutions popularity	37	28.46	
	Institutions rank	42	32.31	
	Institutions type	35	26.92	
Usage of the Prevention of Epidemics applet				
Which function of Guangdong Affairs /Suikang applet has been used (multiple choice)	Schedule Nucleic Acid Test / View Nucleic Acid Test Report	47	36.15	
	appointment for COVID-19 vaccination	55	42.31	
	Health Reporting	55	42.31	
	Epidemic Prevention and Control Itinerary Card	47	36.15	
	Learn about epidemic prevention	69	53.08	
	Learn about Epidemic Policy	50	38.46	
	Others	0	0	
	Not used	0	0	
Mass Nucleic Acid Testing Status				
Impact of Mass Nucleic Acid Screening on Daily Life	Little to no impact	31	23.85	23.85
	Average impact	72	55.38	79.23
	Great impact	27	20.77	100
Self-pay nucleic acid testing status				

Nucleic acid testing status of sample				
Items	Options	Frequency	percentage(%)	Cumulative percentage(%)
Whether have performed self-pay nucleic acid testing	Yes	78	60	60
	No	52	40	100
Reason for self-funded nucleic acid testing (multiple choice)	Outbound Policy Requirements	34	43.59	
	Resumption of work and school policy requirements	37	47.44	
	Hospital Admission Certificate	34	43.59	
	Health self-examination	38	48.72	
	Other	0		
The main selection of detection methods	Pharyngeal swabs	66	84.62	84.62
	Nasal swabs	12	15.38	100
The main selection of sampling methods	10: 1 mixed sampling	13	16.67	16.67
	5: 1 mixed sampling	20	25.64	42.31
	Individual sampling	37	47.44	89.75
	Unclear	8	10.26	100

3.3 Satisfaction with nucleic acid testing

Citizens evaluated their satisfaction with nucleic acid testing, and higher evaluation scores indicated higher satisfaction levels. Based on the survey data, this study used the average method to calculate the citizen satisfaction index, and the results are shown in Table 3.

The overall satisfaction index of the citizens with the epidemic prevention program was 3.21, and the standard deviation was 0.887, indicating that the overall satisfaction of the citizens with the epidemic prevention program was between "average" and "relatively satisfied", and the result was in favor of "average" is more favorable. For mass nucleic acid screening, the overall satisfaction index was 3.92 with a standard deviation of 0.989, indicating that people's overall satisfaction with mass nucleic acid screening was close to "relatively satisfied". Among the secondary indicators, the highest satisfaction rating was given to the on-site order of mass nucleic acid screening, and the lowest satisfaction rating was given to the queuing time. The overall satisfaction index for self-pay nucleic acid testing was 3.58, with a standard deviation of 1.455, indicating that people's overall satisfaction with self-pay nucleic acid testing was between "average" and "relatively satisfied". Among the secondary indicators, people's satisfaction with the report time of self-pay nucleic acid testing was the highest, and satisfaction with the appointment and on-site guidance was the lowest. Overall, the overall satisfaction level of mass nucleic acid screening was higher than that of self-pay nucleic acid testing, and its dispersion was lower than that of self-pay nucleic acid testing, indicating that the overall service level of mass nucleic acid testing was higher than that of self-pay nucleic acid testing, and the self-pay nucleic acid testing service was uneven.

Table 1. Satisfaction with nucleic acid testing

Satisfaction with nucleic acid testing				
Items	Options	Average	Standard deviation (\pm)	Variance
Satisfaction with the epidemic prevention and control applet Satisfaction with mass nucleic acid screening	overall satisfaction	3.21	0.887	0.786
	Overall satisfaction	3.92	0.989	0.977
	Satisfaction with queuing time	3.75	0.951	0.904
	Satisfaction with on-site order	3.85	1.028	1.056
	Satisfaction with appointment and on-site guidance work	3.78	0.980	0.961
	Satisfaction with waiting time for report	3.80	0.984	0.967
Satisfaction with self-pay nucleic acid testing	Overall satisfaction	3.58	1.455	2.117
	Satisfaction with queuing time	3.58	1.490	2.221
	Satisfaction with on-site order	3.56	1.517	2.301
	Satisfaction with appointment and on-site guidance work	3.51	1.492	2.227
Satisfaction with the epidemic prevention and control applet Satisfaction with mass nucleic acid screening	Satisfaction with waiting time for report	3.91	1.479	2.187
	overall satisfaction	3.21	0.887	0.786
	Overall satisfaction	3.92	0.989	0.977
	Satisfaction with queuing time	3.75	0.951	0.904
	Satisfaction with on-site order	3.85	1.028	1.056

4. Research Conclusions and Suggestions

4.1 Research conclusions

This study presents the basic status of the Chinese government's nucleic acid policy in response to the normalized epidemic and the satisfaction of Guangzhou citizens with nucleic acid testing through policy combing and descriptive statistical analysis, and the specific findings are analyzed as follows.

(1) The government provides normalized nucleic acid testing services

Through policy review, the Chinese government's policies on nucleic acid testing are divided into four main areas: improving nucleic acid testing capacity, updating nucleic acid testing technology and methods, macro coordination of resources, and nucleic acid testing convenience services.

By combing through the above government measures, we can summarize the ideas of the Chinese government in providing nucleic acid testing services in the context of the normalization of epidemics. First, to meet the demand for nucleic acid testing in the context of a normalized epidemic. Through hospital laboratory renovation and the introduction of ICL, the capacity of nucleic acid testing was transferred from being held by tertiary hospitals only to being sunk to medical institutions at all levels. On the one hand, it increases the number of nucleic acid testing sites and improves the supply of nucleic acid testing services. On the other hand, it maintains the normal order of treatment and reduces the impact on the daily treatment work of hospitals, especially tertiary hospitals. Secondly, lead to an orderly nucleic acid testing process.

The normalization of epidemics implies the long-term and repetitive nature of nucleic acid testing work. Therefore, by standardizing and managing all aspects of nucleic acid testing work, including nucleic acid testing kits, testing procedures, and emergency response to unexpected outbreaks, in order to respond to local outbreaks in the country in an orderly manner. Finally, make nucleic acid testing services convenient for the public. By providing a variety of nucleic acid testing services and e-government services, the above efforts by the government will be effectively enjoyed by the citizens.

(2) High level of public support for nucleic acid testing

China's epidemic prevention and control measures are relatively strict, and many nucleic acid testing-related policies are mandatory, such as having to provide a negative nucleic acid test report within 24 hours of going out, mass nucleic acid screening, and so on. The questionnaire data showed that more than half of the citizens were willing to cooperate with the nucleic acid testing policy voluntarily, i.e., most of the citizens responded positively to the nucleic acid policy proposed by the government. This may be related to the level of public awareness of nucleic acid testing. The questionnaire data indicate that more than half of the citizens believe that nucleic acid testing plays a significant role in epidemic prevention and control. It is reasonable to assume that since the public is aware of the importance of nucleic acid testing in outbreak prevention and control, they are willing to implement the government's nucleic acid testing policy spontaneously for their own health and that of others.

(3) Disparity between mass nucleic acid screening and self-pay nucleic acid screening services

In terms of satisfaction scores, the overall satisfaction of mass nucleic acid screening was higher than that of self-pay nucleic acid testing. In terms of the degree of dispersion, the overall satisfaction of self-pay nucleic acid testing and the degree of dispersion of satisfaction of secondary indicators were both higher than mass nucleic acid screening. Citizens' overall satisfaction with mass nucleic acid screening was close to "relatively satisfied", while their satisfaction with self-pay nucleic acid testing was between "average" and "relatively satisfied". The satisfaction level of self-pay nucleic acid testing was between "average" and "relatively satisfied". In addition, the public's satisfaction with mass nucleic acid screening is more concentrated, reflecting that the government organized mass nucleic acid screening has a more uniform level of service. On the contrary, citizens' evaluation of self-pay nucleic acid testing was mixed, reflecting that the level of self-pay nucleic acid testing services was uneven.

4.2 Improvement measures

The analysis shows that there is a high level of public support for nucleic acid testing, but there are gaps in satisfaction with different nucleic acid testing services. Based on the above findings, the following suggestions are made.

(1) Strengthening the publicity of the importance of nucleic acid testing for epidemic prevention and control

From the research analysis, it can be seen that the public is more cooperative with the government's nucleic acid testing work and recognizes the important role of nucleic acid testing in epidemic prevention and control. The long-term nature and complexity of the epidemic means that nucleic acid testing is a long-term task. Therefore, the government still needs to emphasize the importance of nucleic acid testing in future publicity and raise residents' awareness of epidemic prevention.

(2) Improve the level of primary health care services and establish uniform standards for nucleic acid testing services

From the analysis of the study, it was found that residents were less satisfied with self-pay nucleic acid testing than mass nucleic acid screening, which is contrary to the common sense that "cheap is not good, good is not cheap". Combined with the preference of residents to choose nucleic acid testing institutions with short queuing time, low cost, and close proximity, it is reasonable to assume that residents tend to prefer the nearest primary medical institutions when performing self-pay nucleic acid testing. In China, the service level of primary medical institutions has been criticized for a long time, mainly due to patients' distrust of primary medical and poor professionalism of medical staff. However, combined with the findings of this study, it can be concluded that residents give less

consideration to the grade, type, and popularity of the institution itself when choosing a nucleic acid testing institution. Therefore, residents' dissatisfaction may not lie in their distrust of primary medical institutions, but in the fact that their service level has not yet reached the residents' satisfaction standard. Specifically, residents were least satisfied with the appointment and on-site guidance for self-pay nucleic acid testing. For this reason, primary medical institutions should improve their own service level and awareness, especially to enhance the appointment and on-site guidance work. Since most of the nucleic acid testing sites in primary medical institutions have been renovated later, residents are not familiar with them. Therefore, it is necessary to set up reasonable signage and strengthen on-site guidance.

In addition, residents' evaluation of self-pay nucleic acid testing is more discrete than that of mass nucleic acid screening, which reflects that self-pay nucleic acid testing has not yet formed a unified service standard and different medical institutions. This reflects that there is no unified service standard for self-pay nucleic acid testing, and there is a gap between the service levels of different medical institutions. Therefore, relevant service standards should be developed so that the level of self-pay nucleic acid services tends to be uniform.

(3) Promoting the construction of e-government services and integrating various epidemic prevention applets

The research analysis shows that the satisfaction rating of residents with epidemic prevention and control applets is average, reflecting that there is great room for them. In the process of epidemic prevention and control, the government keeps launching new epidemic prevention and control applets. In Guangzhou, for example, applets such as *SuiKang*, *Guangdong Affairs* and *Yue-Nucleic Acid* have emerged. *Yue-Nucleic Acid* even changed its version several times due to the overwhelming number of users and insufficient carrying capacity during mass nucleic acid screening, which caused inconvenience to the public. In the context of the normalization of epidemic, the epidemic prevention applet has become one of the most commonly used applets for residents, who have also developed the habit of using the existing epidemic prevention applets. Therefore, the next step for the government should be to integrate various types of epidemic prevention applets, improve the functions of existing epidemic prevention applets, and reduce the tedium of using multiple similar applets for the public.

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