

Development and Application of Regional Level Complete Inspection Management Platform

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Abstract: **Objective:** To solve the problems associated with the multi-sectoral management of key populations in the regular fight against the epidemic, a platform for the management of due diligence was developed. **Methods:** an inspection due diligence management platform based on overall management, fine management, and process optimization was established to ensure the effective and scientific development of regional inspection due diligence. **Results:** The platform provided a good system to support the regional inspection work and solved the four major problems in management, including reporting process, data standard, data display, and data sharing. **Conclusion:** In normal epidemic prevention and control, the inspection management platform should be irreplaceable in department supervision, process optimization, data sharing, data accuracy, and other aspects.

1 INTRODUCTION

Nucleic acid testing is an important means for the prevention and control of novel coronavirus infection pneumonia. According to the requirements of the National Health Commission on COVID-19 prevention and control, to ensure that tens of millions of large-scale nucleic acid testing tasks can be completed within the prescribed time with quality and quantity, and 'early detection, early isolation, early diagnosis, and early treatment' can be realized. Based on the requirement of national policy requirements and epidemic prevention and control in the region, Gulou District has established a district-level all-testing management platform to ensure all nucleic acid testing for vulnerable key populations, improve the overall control ability of corresponding all-testing data, promote the integration and sharing of data resources, and improve the quality and efficiency of nucleic acid testing and service level (Xia, 2021).

2 PLATFORM POSITIONING

The establishment of the nucleic acid test

management platform, the platform architecture is shown in Figure 1 below, to optimize the integrated management of key population management departments at higher levels of supervision, to achieve the refinement of key population management departments on key populations, and improve the sampling agencies to optimize the process of sampling key populations. The platform can enhance the regional government's overall ability to control the data of the inspection and exhaustion work, ensure that the regional inspection and exhaustion work is carried out effectively and scientifically, and improve the regulation of key populations with information technology.

The platform architecture is shown in Figure 1 below. The platform provides data support by sampling agency interface, sampling agency equipment, nucleic acid testing interface, vaccine information interface, SMS interface, etc., and carries out several services such as data statistics, visual display, personnel registration management, personnel transfer, etc., and finally provides services to the society by way of PC-Web platform, inspection due to inspection applet and sampling applet.

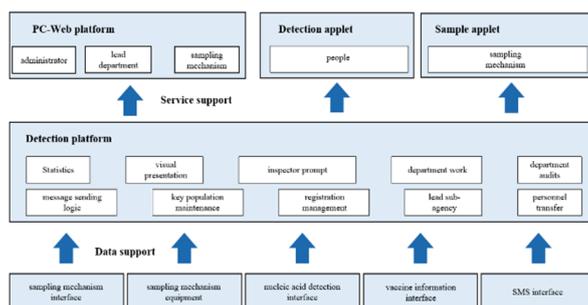


Figure 1: Architecture diagram of the complete inspection management platform.

2.1 Clear Department Responsibilities and Simplify Business Processes

It is required to implement the rights and responsibilities of each department through the construction of the platform. Through the hierarchical design of the platform account and authority, the management responsibilities will be delegated from top to bottom and implemented layer by layer, and the monitoring data will be reported from bottom to top and evaluated layer by layer. Through the role definition, the oversight of the department of health, the lead agency director duties, grassroots organization management responsibilities for the distribution platform, managing their hierarchy of data platform, the data flow between the layers by the platform automatically, each department only focus on the completion of the assessment criteria for the department and completes the corresponding supervision work, The business working relationship of each department is shown in Figure 2 below.

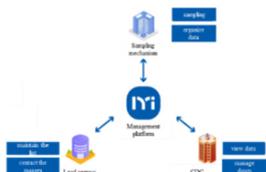


Figure 2: Business working relationships.

2.2 Define the Objects to Be Inspected and Implement all Inspection Requirements

Request through multiple channels (PC and mobile terminal), multiple users (administrator and key crowd people), multimode (entry, the declaration in advance, after the collection), such as dimension precision maintenance to the key crowd background library provides rich, favorable platform tools, every

link of guarantee business focus groups can be dynamically maintenance, to ensure not to miss any key personnel.

The system daily real-time statistics of the nucleic acid test completion rate of each department and each port, through periodic completion rate notification, implementation of management responsibilities of each subject, through the platform message and short message platform function, to achieve timely nucleic acid test message reminder, improve the department completion rate, to achieve the goal of complete testing.

2.3 Accurate Data Acquisition to Help Command and Decision Making

The platform is required to ensure the accuracy of the personnel base, the accuracy of nucleic acid detection records and the accuracy of nucleic acid detection results, the timely maintenance of the personnel base, the synchronization of sampling records, and the flexibility and real-time statistical screening, to ensure the accuracy, timeliness, and omnidirectional of the decision-making basis of leadership management under normal management and emergencies.

2.4 Closed-Loop Process Management to Improve Supervision Quality

The Request platform to carry out the applicants should do screening closed-loop management goal, input, nucleic acid from focus groups records on the results of sampling, nucleic acid and qualified rate statistical department to inspection personnel not remind and dynamic maintenance personnel, the implementation of the whole business process node regulation, to provide transparent regulatory tools to health authorities, led by data appraisal organization management ability, the ability to execute the grassroots agencies, The platform provides the

design of key quality control indicators and data collection, providing strong system capabilities for high-quality epidemic prevention and control.

3 PLATFORM FUNCTIONS

The main functions of the platform include information maintenance and management of key groups, nucleic acid sampling identity verification of key groups, verification and notification of people who should be checked and not checked, nucleic acid testing of key groups and real-time statistics of vaccines, business reports, and data tablet of 'leadership cockpit'.

3.1 Maintenance and Management of Key Group Information

The multi-level account authority is set up, and the second-level sub-account of the account of the leading department is set up to solve the problem that it is difficult for the community to obtain the list of key groups in the community. The community uses the second-level sub-account to input data by itself and is managed by the community. Carry out self-registration of registration code, and solve the input problems of floating population in transportation, streets, and Marketing Department through the mode of self-registration of small program users and review by the leading department; Implement user migration management, solve the problem of multiple departments managing the same user through user migration mechanism; Do batch entry and single record, support batch import user list, and single record entry; Realize automatic data verification, solve the problem of poor quality of data imported by the leading department through perfect data entry verification mechanism, and ensure that the imported data are accurate and standard; Support dynamic maintenance of personnel status. Supports In and Outstate Settings.

3.2 Identification Verification for the Nucleic Acid Sampling of Key Groups

Support ID card verification should be fully checked information, has been maintained sampling personnel can swipe their ID cards through the device, and voice broadcast is the key personnel has been maintained into the platform, to quickly

determine the type of users; Support QR code verification to complete the inspection information. A small program can be used to retrieve the platform registered in the management personnel should check the check code, conducive to the sampling site to determine the type of users.

3.3 Real-Time Statistics of Nucleic Acid Detection and Vaccination of Key Populations

Establish a list of nucleic acids and vaccines, manage all anti-epidemic data entered by the department, export the list of unqualified persons by custom filtering, and comprehensively controls the completion of nucleic acids and vaccines.

3.4 Check and Notify the Uninspected Personnel

Support one-click screening, screening should check the untested personnel, and focus on follow-up; To achieve batch message push, support the setting of directional message push (public account message or mobile phone short message), and support hierarchical supervision; The implementation of grid precision management, centralized follow-up units, to avoid multiple follow-ups.

3.5 Business Report

Automatic generation of accurate data report, quickly realize daily data reporting; Set up rich condition screening function, through diverse screening, remarks, so that the leading organization can query the list of people under any conditions, and further automatically send SMS reminders, or export the previous sampling records of these people; For data backtracking analysis, the sampling agency can log in the platform to query the sampling record of the local point every day, automatically compare the type and quantity of sampling objects, and carry out data analysis.

3.6 'Lead Cockpit' Data Tablet

To create a customized data tablet, the display content of the information tablet can be customized according to the actual business situation of each district, as shown in Figure 3 (a). The multi-terminal view can be realized on PC and mobile terminals. With a mobile phone, you can view the real-time



Figure 3: Customized tablet.

and department-based statistical data of all required checks in the whole area, as shown in Figure 3 (b) below. The performance assessment of the work required to be inspected is carried out, and the completion rate of the work required to be inspected is implemented in all departments. It can be seen that the overall completion rate of the work required to be inspected is completed in the whole district, as well as the work completion rate of each leading department. Accurate statistics of work.

4 APPLICATION STATUS AND EFFECTIVENESS

The work of responding to the epidemic prevention and testing of key populations is a huge systemic project that requires a powerful information system to support the entire command. In terms of platform architecture, advanced cloud computing, big data, and internet technologies are used to build, with front and back-end separation. The overall design integrates information collection, operation, personnel nucleic acid testing, and big data testing, covering the whole process of business and management of key people who should be tested. The front-end uses lightweight applications, and the back-end big data support features can meet the needs of epidemic prevention, and control should be detected and tested.

4.1 Applications

The platform is applied to a variety of epidemic prevention scenarios such as government, hospital, and community; so far, the platform has been connected to nearly 800 management departments in Nanjing Xuanwu District, Yuhuatai, and Gulou District, landing the application of more than 30

sampling points, cumulatively managing 250,000 key people and covering more than 1,300 lead institutions and sampling departments; Jiangbei, Gaochun and other areas of Nanjing, including Jiangsu Provincial People's Hospital 260 medical institutions, providing an average daily service volume of 20,000, and the platform has accumulated more than 1.6 million accounting test data generating more than 10,000 effective reminders; 25 smart districts that have been landed and applied in areas such as Gulou District, with an average daily service of more than 2,000 times.

4.2 Effectiveness of the Use

4.2.1 Reminders of Uninspected Work

For the inclusion of the inspection of key populations and various management agencies, the formation of a supervisory delivery mechanism, which realizes the docking with the SMS platform to accurately notify personnel who are due for testing and not yet tested. It also realized the docking with the SMS platform, to accurately notify the person who should be tested and tested; notify the corresponding management departments and supervisors to supervise in time, to realize the supervision of the person who should be tested and not tested to complete the testing, enhance the rate of testing and testing and improve the management efficiency, and reduce the workload of the grassroots epidemic prevention and control personnel.

4.2.2 Reminders of Uninspected Work

The platform achieves data standardization of the background database data collected from key people through multiple channels (PC and mobile), multiple users (administrators and individuals of key people), and multiple ways (advance entry, on-site

declaration, and post-facto supplemental entry), which guarantees that key people can be maintained dynamically in all aspects of the business and ensures that no key person is missed(Zhao, 2022). Standardized data processing solves the previous problem of "information silos" between departments and realizes the goal of implementing the management responsibilities of each subject through periodic notification of completion rates; persons due for inspection but not yet inspected are promptly reminded through system messages and SMS platform functions.

4.2.3 Visualization of Inspection Platforms

The platform supports PC and mobile data overviews, and management can view the nucleic acid scores of key populations for each institution. It can grasp the management data of key populations in the region at any time and anywhere to improve the quality of management(Wang, 2021). The platform operation has achieved the three major data accuracy design goals of ensuring accurate personnel base, accurate nucleic acid testing records, and accurate nucleic acid testing results; three major data timeliness goals of timely personnel base maintenance, timely sampling record synchronization and flexible real-time statistical screening.

4.2.4 Closed-Loop Management Process

The platform achieves the goal of closed-loop management work of due testing, from key population entry, nucleic acid sampling, nucleic acid result recording, and departmental pass rate statistics to untested personnel reminders and personnel dynamic maintenance, realizing nodal supervision of the whole business process, providing transparent supervisory tools for health supervisory departments, assessing the management capacity of the leading institutions and the implementation capacity of grassroots institutions by the data, and the platform achieves the effect of bottom-up aggregation of value epidemic prevention and control-related surveillance data and top-down accurate management of nucleic acid testing of key populations through accurate data capture, effective data maintenance, timely message reminders and regular business supervision(Han, 2020).

5 DISCUSSION

To solve the various problems in the regular fight against the epidemic regarding the multi-sectoral management of key populations for due diligence, this platform functions as a big data platform for regional epidemic prevention and control, which is used to solve four major problems in the management of the reporting process, data standards, data presentation, and data sharing; using information technology as a grip to unify the management of the data of due diligence members in the region. The most crucial aspect of regional epidemic prevention and control is to screen all susceptible key populations for nucleic acid testing, and to do so is to do the outermost layer of defense against the epidemic.

5.1 The Need to Build a Platform for due Diligence

At present, siloed management leads to duplicate cooperation of the population, multiple management, and inconsistent data redundancy (Zheng, 2021). To make the inspection work in an organized and orderly manner, the full realization of information management has become the primary goal. The platform can achieve the coordinated management of the key population management departments at higher levels, the refined management of the key population management departments, and the process optimization of the sampling agencies for the key population sampling, to ensure that the regional inspection work is carried out effectively and scientifically, and the data can provide strong support for the regional inspection work.

5.2 the Need to Manage the Maintenance of Information on Key Populations

Maintenance and management of information on key populations. By opening a secondary sub-account of the lead department's account, it solves the problem that the streets have difficulty in accessing the list of key people in the district, and the district uses the secondary sub-account to enter data on its own and is managed by the streets; through the mode of self-registration of users in the small program + audit by the lead department, it solves the problem of entry of mobile people by the Ministry of Transport, the streets and the marketing department; through the

user migration mechanism, it solves the problem of multiple departments managing the same user. A perfect data entry verification mechanism solves the problem of poor quality of data imported by the lead department and ensures that the imported data are all accurate and standardized.

5.3 The Need for Identity Verification of Nucleic Acid Sampling in Key Populations

Nucleic acid sampling identity verification of key populations. The current multi-sectoral identification of key population identity information at nucleic acid sampling sites is laborious and ineffective (Ning, 2021). Support for ID card verification of inspection information has been maintained into the sampling personnel can brush ID card through the device, voice broadcast whether it is maintained into the system of key personnel, to quickly determine the type of user. Support two-dimensional code to verify the inspection due diligence information, you can use the applet to retrieve the platform to register in the management of personnel inspection due diligence code, to facilitate the sampling site to determine the type of user. Support the sampling point site voice broadcast personnel sampling mode, for staff to quickly guide the target channel for the relevant personnel. Support for the two stations personnel set up a separate ID card machine, swipe the card directly into the personnel information, and recorded it into a sampling record.

5.4 The Need for Verification and Notification of Uninspected Persons

Through a key screening, screening should be inspected uninspected personnel, focus on follow-up; through the bulk message push, and support the setting of targeted message push (public message or cell phone SMS), to solve the problems associated with the existence of traditional sampling information lag. Support for hierarchical supervision, and grid-based precision management. Categorize follow-up units to avoid multiple follow-ups(Xue, 2021).

5.5 The Need for Data Sharing

Data sharing and improving the function of the personnel mapping system. The platform provides a

page for residents to fill in the code for medium and high-risk persons coming to Ning to fill in the relevant information, and supports the uploading of trip card information into the pending claim database for the person in charge of each lead agency to claim the relevant persons; provides a small application for residents to punch in their daily health cards and provides a page for residents to punch in the management on the PC terminal; supports the connection with the public security system to obtain medium and high-risk persons coming to Ning and provides the following functions on the PC terminal and mobile terminal The information confirmation and completion function is available on PC and mobile. Solve the problem of high workload and duplication of work in the manual data processing.

6 CONCLUSION

The prevention and control of the epidemic is a major test of national and city governance systems and capabilities. The continued global spread of COVID-19 and the continuous mutation of the virus have further highlighted the importance and urgency of strengthening the public health system. Taking a dialectical view of the challenges and opportunities faced and summarizing the lessons learned from the current epidemic, there is no substitute for the supporting role of information technology in building up a stronger public health system. We will further develop the key role of the testing system in the prevention and control of the epidemic, firmly establish the idea of "one piece of chess" for the whole province and provide working experience for national epidemic prevention.

REFERENCES

- Xia Han. (2021). Design and construction of whole-process nucleic acid detection management system for a large population [J]. *Chinese Journal of Health Information Management*, 18(5):6.
- Zhao Y D. (2021). Design and implementation of nucleic acid detection information management system based on B/S structure [J]. *Digital Technology and Applications*, 39(4):4.
- Hao Yan, Zhou Weiwei. (2018). Construction practice of regional health emergency platform in Jiangsu province. *Chinese Journal of Health Information Management*, 15(004):421-423,456.

- Joint prevention and control mechanism medical treatment. Notice on Further Strengthening the Organization and Management of Whole-staff nucleic acid Testing [EB/OL].[2021-9-2].
- Zhao Dongxu, Zhao Jianya. (2022). Weihai integration of epidemic prevention and control system design [J/OL]. Big data: 1-9.
- Wang Zhihong, Mo Hongmei, Yang Kai, Gong, Fang Fang, Sun Xizhuo. (2021). Construction and optimization of nucleic acid detection information management system based on 'Internet +' [J]. *China Digital Medicine*, 16(7):104-107.
- Han Yuanfeng, Zhang Yue, Sun Yanchao, Chen Hui. (2020). Based on the Internet of things the epidemic prevention and control of auxiliary tracing and management platform [C]. *Proceedings of 2020 China's information communication conference (CICC)*, 2020:228-234.
- Zheng Kuo, Wang Xiulei. (2021). Research on the digital transformation of community governance under normal epidemic prevention and control [J]. *Administration and Law*, 2021(11):42-50.
- Ning L W, Hao Y H, Liu Z, et al. (2021). Study on the importance of influencing factors of high compliance behavior among Chinese public in the context of normalized COVID-19 prevention and control: based on random forest model [J]. *Chin J Public Health*, 37(7):1096-1100.
- Xue Fengping. (2021). Construction of information sharing platform in epidemic prevention and control system [J]. *Party School of Qingdao Municipal Committee of the Communist Party of China. Journal of Qingdao school of administration*, 2021 (05): 53-60.
- Chen S. (2020). Interpretation of political science on COVID-19 epidemic prevention and control [J]. *Reference of Middle School Political Teaching*, No.779(29):88-89. (in Chinese with English abstract).