

# Key Points of Railway Police Work based on Bayesian Passenger Flow Forecast Method under the Normalization of COVID-19 Prevention and Control

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## **Abstract:**

China has entered the stage of normalized COVID-19 prevention and control, but the pressure of overseas COVID-19 input continues to increase, and the railway COVID-19 prevention and control police work is still facing a major test. This paper analyzes the characteristics of railway passenger flow under the influence of the COVID-19 situation, establishes a passenger flow forecasting method based on Bayesian theory, and puts forward the key points of railway police work by improving the police mode, strengthening daily police, optimizing smart policing, relying on mass prevention and mass treatment, It provides a theoretical reference for the railway public security organs to effectively control the public health risks and social security risks under the normalization of COVID-19 prevention and control, effectively maintain the railway operation order, and strive to ensure the safe travel of passengers.

**Keywords:** *Railway Police; Normalization of COVID-19 Prevention And Control; Bayesian Theory; Passenger Flow Forecast.*

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## I. INTRODUCTION

COVID-19 is one of the most serious infectious diseases in the past hundred years. It is the most serious epidemic since the Spanish influenza in 1918. [1] It is also the most serious public health emergencies since the end of the cold war. After the outbreak of the COVID-19, China began to take the most stringent, comprehensive and thorough prevention and control measures. Wuhan has implemented comprehensive traffic control since January 23, 2020. On April 17, 2020, under the premise of taking protective measures, it gradually restored normal social order and production and life, and began to enter the stage of normalized COVID-19 prevention and control, however, the overseas COVID-19 situation is not optimistic [2-6]. Railway is the main

means of transportation between cities in China, and an important driving force for the restoration of social and economic order. Under the COVID-19 prevention and control task of "external anti import, internal anti-proliferation", its safe operation and order management are facing a severe test. How to coordinate the normalized police work and daily service work of COVID-19 prevention and control, maintain the safety and stability of railway operation, and ensure the safety of people's lives and property is the top priority of railway police work under the normalization of COVID-19 prevention and control.

Railway passenger flow is the passenger flow formed by people using the railway to reach the destination, including the flow, flow direction, velocity and other elements of passenger flow. Railway large passenger flow refers to the fact that in a certain period of time, due to the occurrence of emergencies, the concentration of passenger flow is serious, and exceeds the maximum capacity that the infrastructure can carry. In practice, the main performance of large passenger flow is that the waiting area is crowded, the internal space of transport vehicles exceeds the basic carrying capacity, and the flow speed of passenger flow is slow. The change of passenger flow is easy to cause the risk of public security prevention and control. Scientific prediction of railway passenger flow is the basic work to improve the level of railway public security prevention and control.

## **II. FORECAST METHOD OF RAILWAY PASSENGER FLOW UNDER THE INFLUENCE OF COVID-19 SITUATION**

China has built the most modern railway network and the most developed high-speed railway network in the world. By the end of 2020, the operating mileage of railway has reached 146,000 km, an increase of 5.3% over the end of last year. Among them, the operating mileage of high-speed railway is 38,000 km, and the number of railway passengers is 2.203 billion, ranking first in the world, gradually playing the role of economies of scale and network economy.

### **2.1 Railway Passenger Flow under the Influence of COVID-19 Situation**

Affected by the COVID-19 and the temporary control measures of local governments, the development of railway passenger transport is most significant. The COVID-19 incubation and outbreak period significantly inhibited the demand of railway spring transportation. In order to stop the COVID-19 from the source of transportation and reduce the risk of COVID-19 in densely populated places such as stations and carriages [7-9], the central government and local governments of China have urgently issued policies and arrangements such as extending the Spring Festival holidays and taking off peak trips. During the Spring Festival transportation in 2020, the number of railway passengers sent across the country has decreased significantly, Provinces and regions with more developed economy and high-speed rail network operation have obvious characteristics of peak delay and low-level operation. With the decline and

extinction of the COVID-19 in China, the social order has gradually returned to normal, and the railway travel has begun to pick up. However, the pressure of imported cases from abroad still exists. Accurately mastering, tracking and locating the situation of every railway passenger will make the railway passenger handling the COVID-19 more orderly and calmly, and the way of the COVID-19 spreading through the railway will be more clear.

## 2.2 Bayesian Method for Railway Passenger Flow Forecast

The idea of railway passenger flow forecasting is to find the relevant prior information from the historical data of passenger flow, process, count and analyze, and get the posterior distribution, which is consistent with the basic idea of Bayesian theory. The idea of Bayesian theory is to treat any unknown quantity as a random variable, which is a prior distribution that can be described by a probability distribution. By using Bayesian formula, the new distribution of unknown quantity, that is, a posterior distribution, is obtained by combining the population distribution, the obtained samples and the prior distribution. On the basis of the posterior distribution, the statistical inference of variables is carried out. The Bayesian formula of continuous random variables is shown in equation 1.

$$\pi(\theta|X) = \frac{p(X|\theta)\pi(\theta)}{\int p(X|\theta)\pi(\theta)d\theta} \quad (1)$$

The passenger flow forecast model based on historical data is shown in equation 2.

$$P(G_i|S_\phi) = \frac{P(G_i)P(S_\phi|G_i)}{\sum_{j=1}^n P(G_j)P(S_\phi|G_j)} \quad (2)$$

When the event  $E_\phi$  occurs, the passenger flow forecast model based on the data of the sold tickets in the pre-sale period is shown in equation 3.

$$P(G_i|E_\phi) = \frac{N(|E_\phi G_i) + d_i^{E_\phi}}{\sum_{j=1}^n N(|E_\phi G_j) + d^{E_\phi}} \quad (3)$$

## III. KEY POINTS OF RAILWAY POLICE WORK

Public security organs are a non professional epidemic prevention and control team. While doing their own work well, they still need to invest a lot of police force to stick to the first line of

railway security under the normalization of COVID-19 prevention and control.

As an industrial public security organ, the railway public security organ shoulders the public security work of the national railway transportation safety. Due to the differences between the railway public security organ and the local public security organ in the jurisdiction area and business functions, and the adoption of the central vertical management mode, the daily cooperation with local departments is less, the railway public security organ's police work during the COVID-19 period presents a certain particularity.

In order to ensure the safety of railway operation, the railway public security organs have set up 18 railway public security bureaus in China according to the jurisdiction of each railway operation company. Each public security bureau has several public security departments, and each public security department has a business detachment and a police station. The two departments also have a functional brigade and a police district respectively, forming a three-level public security organization, that is, a Regional Railway Public Security Bureau is set up in the city where the railway bureau is located, The railway public security department shall be set up in the concentrated areas of railway stations and depots, and the public security police station shall be set up in the third class or above railway stations. This kind of jurisdiction area divided according to the distribution of railway lines, stations and depots and their interrelationships is different from the administrative area division in China, which usually leads to the situation of "one bureau managing multiple places, one place managing multiple bureaus". According to the regulations of China's emergency management measures for public health emergencies, the Provincial Administrative Region shall coordinate and direct the emergency handling of public health emergencies in its own administrative region. The particularity of the division of the jurisdiction of the railway public security organ makes it unable to effectively connect with the local government.

### **3.1 Improve the Police Mode and Innovate the Service System**

It is not suitable for the tactics of relying on huge quantity and huge consumption to gain advantages in the COVID-19 prevention and control work. How to use the police scientifically and accurately and maximize the efficiency while maximizing the release of police force has increasingly become the concern of practical departments[10]. First, through in-depth analysis of the type, time and section of the cases in the same period over the years and at present, key train numbers and key personnel should be designated, and station and train arrest should be targeted. Second, in view of the train outage and the sudden drop of passenger flow during the COVID-19 period, in addition to the business units undertaking direct tasks, we should timely adjust the service mode of police officers, timely carry out rotation rest, timely reduce unnecessary duty preparation, and ensure that front-line police officers have sufficient rest time as far as possible. Third, we should make full use of big data, artificial intelligence and other technologies [11], according to the dynamic changes of the COVID-19 situation, the spatial distribution of the

COVID-19 situation, the COVID-19 trend curve and other spatiotemporal data sets, make the spatiotemporal evolution map of the COVID-19 data, and analyze and study the flow direction and change trend of the population, so as to carry out targeted prevention and control work. By combining the risk of COVID-19 input with the risk change of COVID-19 transmission in the city, the cluster calculation is carried out, and the hierarchical evaluation is carried out in various places, so as to provide support for the efficient implementation of police input, material allocation and transportation, and the delineation of key areas.

### **3.2 Strengthen Daily Policing to Ensure the Resumption of Work and Production**

As the key force to maintain railway safety and stability, railway public security organs constantly strengthen daily police work and implement railway security. First, daily public security prevention and control work. The railway public security organs should focus on the main police force in the daily public security prevention and control work, maintain the order of riding, solve the social security problems such as passenger disputes, pickpocketing and obscenity, mob disturbances and group incidents, and create a good railway public security environment during the normal COVID-19 prevention and control period. Second, the investigation of major criminal cases. Including the traditional types of large amount of theft, fraud, robbery and other cases, as well as non-traditional types of information theft, compulsory indecency, obstruction of public affairs and other cases. In the stage of normalized COVID-19 prevention and control, the railway public security organs should improve the combat effectiveness of their own team, increase the crackdown on crimes, and ensure the safety and stability of railway operation order. Third, police patrol investigation. By continuously optimizing the operation mode, the railway public security organs strengthen the interrogation and inspection of suspicious articles and persons within their jurisdiction, and timely discover and quickly control suspicious persons and dangerous articles. Fourth, information collection, research and judgment. The railway public security organs monitor the information of passengers in and out of the station in real time through the big data platform, and use face recognition and other related technologies to collect, study and exchange information related to confirmed cases, terrorist activities, key objects, personal extreme behaviors, etc. Fifth, emergency disposal. Railway public security organs constantly improve the emergency response plan, regularly organize relevant drills, strengthen physical fitness, strengthen security forces, and take precautions. Sixth, to serve the masses. In the normalized police work of COVID-19 prevention and control, we should always care for the people and solve their problems.[12]

### **3.3 Optimize Smart Policing to Prevent the Spread of COVID-19**

In order to promote the smooth development of various policing work under the normalized COVID-19 prevention and control, the public security organs use intelligent prevention and control to optimize the policing mode, closely combine the cutting-edge technologies such as big

data and artificial intelligence with the actual combat needs of the public security, conduct intelligent monitoring and early warning on Railway passenger flow, improve the efficiency of dealing with COVID-19 related police, and reduce the risk of infection during the COVID-19 prevention and control. Through the installation of intelligent alarm device, whole process contactless human body security inspection machine and thermal imaging infrared temperature measurement and other equipment in the station, the massive information can be quickly locked, accurately positioned and accurately attacked. While reducing the risk of cross infection of personnel during the COVID-19 prevention and control period, the police force is greatly liberated and the current situation of police tension is alleviated, At the same time, it also improves the work efficiency of finding COVID-19 situation and rapid disposal.

The spatial structure of railway is very easy to cause the spread of new coronavirus, and induce the serious consequences of mass, large-scale and multi regional cross infection. It is difficult to identify the source and infection of railway passengers one by one, and the public security environment in the station is complex and changeable. In the railway police work under the normalization of COVID-19 prevention and control, the public security organs should rely on the police big data sharing platform, increase the passenger flow prediction and monitoring, and continuously optimize the smart policing mode through advanced technologies such as face recognition, data analysis, tracking and traceability, and smart security inspection. Artificial intelligence technology is used to collect and analyze the data of receiving and dealing with the alarm, personnel screening, temperature detection, rapid positioning, patrol prevention and control. Once the confirmed patients, re positive patients, close contacts or suspected patients with infectious diseases are found, early warning and rapid isolation are needed to prevent such personnel from entering the station and reduce the risk of cross infection with other passengers. The track tracking work of public security organs for COVID-19 related personnel occupies an important part of the railway COVID-19 prevention and control work. In order to prevent the further spread of the COVID-19 and reduce the risk of large-scale infection, public security organs must timely lock the identities of suspected patients, confirmed patients and asymptomatic patients, and quickly check the basic personal information, health status, activity track and close contact history, Identify all kinds of close contacts related to it, work accurately and operate efficiently.

### **3.4 Relying on Mass Prevention and Control, Strengthening Security Forces**

In the railway police work under the normalization of COVID-19 prevention and control, the railway public security organs should strengthen the fight against COVID-19 related crimes, strengthen their own security forces, and also rely on the mass prevention and treatment forces. First, we should build a mechanism of co construction, CO governance and sharing, and carry out co construction between police and enterprises. Through the construction of joint service linkage mechanism, relying on the platform jointly built by police and enterprises, combining

social forces, reasonably allocating human resources, carrying out various police work, such as railway COVID-19 prevention and control, public security rectification, anti-terrorism and stability maintenance, emergency drills, etc. Through the integration of various social forces, the minimum combat unit is constructed to deal with the early disposal of various emergencies such as COVID-19 disputes, stampede of large passenger flow, mob disturbances, violent terrorist attacks in a short time, so as to prevent the situation from further expanding, so as to reduce the pressure of public security in the station area under the normalization of COVID-19 prevention and control, and purify the public security environment in the station. By carrying out the police enterprise cooperation drill, we can cultivate the spirit of cooperation, and constantly improve the ability of railway emergency response under the normalization of COVID-19 prevention and control. Second, relying on the strength of mass prevention and mass governance, improve public participation. Railway public security organs mobilize the people to establish a close cooperative relationship between the police and the people. With the joint participation of auxiliary police, station affairs, security guards, security inspectors, cleaning volunteers, health and COVID-19 prevention personnel, they comprehensively carry out railway patrol prevention and control work, share the police work pressure of public security organs, alleviate the current problem of insufficient police force, and enhance the public's social participation and sense of responsibility, We will jointly contribute to the prevention and control of railway COVID-19 situation and order management. Through the construction of grid COVID-19 prevention and control team, the railway grid fine COVID-19 prevention and control mode is built. In the aspect of grid management, we should implement the responsibility system, one-to-one real-time control of negative public opinion information, do a good job in resolving disputes related to COVID-19 diseases and daily supervision of station order. Once risks are found, we should report them in time and intervene as soon as possible, so as to achieve accurate prevention, accurate strike and accurate governance, and implement detailed prevention and control measures.

#### **IV. CONCLUSION**

As the key force to maintain the safe operation of railway, railway public security organs must fully understand the impact of passenger flow changes on public security prevention and control, carefully analyze the public health risks and social security risks under the normalization of COVID-19 prevention and control, and strengthen daily policing by improving the policing mode, We should optimize smart policing, rely on methods and measures such as mass prevention and treatment, pay close attention to the prevention and control of railway normalized COVID-19 situation, effectively prevent and correctly respond to public health emergencies, and provide strong guarantee for people's life and property safety and comprehensive recovery of economic and social order.

## ACKNOWLEDGEMENTS

This paper is the phased research results of Research project of Henan Federation of Social Sciences in 2021 and Social science research project of Zhengzhou in 2021.

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