

Thoughts on Using Statistical Thinking to Do a Good Job in COVID-19 Prevention and Control

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Abstract: Coronavirus disease 2019 (COVID-19) is an international public health emergency that is of widespread concern around the world. Its global prevalence has had an impact on human society. After a period of active prevention and control, the spread of the epidemic has been effectively controlled in China. However, due to the continuous mutation of the virus, the task of epidemic prevention and control is still arduous. This paper considers how to effectively carry out epidemic prevention and control from the perspective of using statistical thinking, and gives some thoughts and suggestions on normalized observation of epidemic development, analysis of epidemic data, policy formulation and scientific research. It provides new inspiration for further improvement and strengthening of epidemic prevention and control.

Keywords: Statistical investigation, Epidemic prevention and control, Statistical model

1. Introduction

At the end of 2019, the coronavirus disease 2019 (COVID-19) quickly swept the world, changing and affecting people's lives^[1]. In the early stage of the global spread of the epidemic, due to the lack of anti-epidemic materials and related therapeutic drugs, and the vaccine has not yet come out, many countries had to order blockades, and the phenomenon of shutdown and production shutdown occurred. Countries have subsequently introduced relevant policies to deal with the impact of the new crown pneumonia. With the advent of vaccines, the restart of the global economy, and the availability of protective equipment, human society is gradually recovering. With the advent of 2022, the global pandemic of the new crown enters its third year. But not only has the global epidemic not eased, but it is accelerating its spread.

Thanks to China's active epidemic prevention measures, the spread of the epidemic has been effectively controlled in China. However, due to the increased infectivity caused by the mutation of the virus, the current epidemic prevention and control situation at home and abroad is still severe and complicated. The task of epidemic prevention and control is still arduous. In order to consolidate the hard-won results of epidemic prevention and control, and improve the ability of epidemic prevention and control. Respond to all possible emergencies. We should actively explore new methods on the basis of existing epidemic prevention measures. In the current normalized epidemic prevention and control work, statistics should be fully used to carry out scientific analysis, prediction and judgment on epidemic-related data. Master the changing laws of relevant data in the context of the epidemic, understand the development of the epidemic, and avoid excessive panic. In order to provide professional data analysis for medical, emergency, transportation, public security and other related departments. It will help relevant departments to make correct judgments and decisions, and speed up the epidemic prevention and control work. This paper considers how to efficiently carry out epidemic prevention and control from the perspective of using statistical thinking, and gives thoughts and suggestions on normalized observation of epidemic development, analysis of epidemic data, guidance for policy formulation, and scientific research.

2. Use statistical thinking to carry out epidemic prevention and control work

2.1. Normalize the use of statistical thinking to observe the development of the epidemic

At present, in accordance with the relevant mechanism of joint prevention and control of the State

Council of the People's Republic of China, all localities have strictly implemented normalized epidemic prevention and control measures, and have achieved remarkable results in curbing the spread of the epidemic^[2]. With the continuous mutation of the virus, the infectivity of the COVID-19 has a tendency to increase significantly. According to the statistics of the new crown epidemic of Johns Hopkins University, by the beginning of February 2022, the cumulative number of confirmed new crown cases in the world has reached 400 million. At present, the spread of the Delta variant and the Omicron variant in some areas has once again become the focus of epidemic prevention and control. In order to effectively curb the spread of the virus, it is a race against time. In areas with COVID-19 epidemics, nucleic acid testing is carried out for key groups of people. The mutation and rapid spread of viruses have brought great challenges to statistical work.

The 2022 coronavirus pandemic enters its third year. The number of confirmed cases of the new crown worldwide is still rising rapidly. We should observe the development of the epidemic as a normalized work, establish a normalized epidemic statistical work mechanism, improve statistical efficiency, and grasp the relevant situation of the epidemic as soon as possible. Statistical thinking should be used to observe the development of the epidemic. Finding regularity from randomness is the basic idea of statistics.

The spread of the virus is uncertain, which is related to the infectivity of the virus, the environment, the physical condition of the potentially spreading people, and policies. We use statistical probability, uncertainty, time series and many other basic concepts and model methods to arbitrarily change the trend and spread of the epidemic. For example, by analyzing the incubation period data of different mutant strains with statistical knowledge, we can obtain the probability of the incubation period length of any case, which has important guiding significance for the targeted formulation of isolation and observation policies. Another example is that we use statistical methods to analyze the symptoms of new mutant virus cases and the probability of sequelae, grasp the mutation trend of the virus, accurately prevent and control the epidemic, and ensure the orderly progress of production and life. In addition, I want to clarify the connotation and generation process of statistical indicators. For example, the number of confirmed cases, imported cases, the first secret, the second secret, the third secret, etc.

2.2. High-quality use of statistical methods to analyze epidemic data

In the process of epidemic prevention and control, various statistical data such as epidemiological investigations, close contact tracing and management, screening of risk groups, and nucleic acid testing of all employees have come one after another. We need to use time series, maximum likelihood estimation, multiple regression and other methods to analyze various statistical data. The COVID-19 is very easy to mutate, but according to the experience of virus transmission over a period of time, the transmission conclusions of mutant strains in the laboratory are often inconsistent with real-world observations. We should focus on analyzing the observed data of viruses in the real world, using a variety of mathematical knowledge such as probability theory, uncertainty, etc. to establish analytical models, and for specific virus characteristics such as toxicity, transmissibility, etc., comprehensively consider different epidemic prevention policies, personnel flow Laws, environmental changes and other factors, to grasp the inherent laws of the development of the epidemic.

We need to deeply integrate statistical methods with new technologies such as big data and cloud computing, integrate and mine the massive data collected every day, and make effective use of epidemic data. Divide these data from the two dimensions of time and space, and through simple data statistics, the development trend of the epidemic in a specific area can be obtained. Further, we use statistical methods to analyze and mine the relationship between confirmed patients, which can more accurately count information on risk personnel such as close contacts. For the management and control of cases and close contacts, methods such as demographics and information statistics are needed. For example, under effective statistical analysis, relevant departments use mobile communication technology^[3] to estimate the infection risk of relevant personnel based on individual travel trajectories in a short period of time, and then use it as the basis for taking restrictive measures. The relevant rules and isolation measures for risk assessment are gradually becoming more rational and effective, and differentiated and targeted prevention and control measures can be adopted for people with different risk levels, which greatly reduces economic and social costs.

The disclosure of statistical information will help the masses eliminate panic, stabilize their mentality, and work and live with peace of mind. The most intuitive to the masses are some key statistics. For example, the number of confirmed cases in a region, the number of suspected cases, the number of close contacts, the number of risk areas, etc., requires the use of incremental statistics. Statistical information

related to the epidemic has a strong timeliness, which means that planners need to improve statistical efficiency to release relevant and accurate statistical information in a timely manner. Establishing an information statistics platform and building a statistical database can not only help integrate information but also improve statistical efficiency. Accurate prediction of the development trend of the epidemic requires accurate statistics. Predictive models need accurate statistical data support, and comprehensively consider the impact of key information such as ambient temperature, humidity, and epidemic prevention and control measures on the spread of the epidemic. Using the methods of epidemiology and health statistics to research and analyze the normalized epidemic control is the foundation of formulating effective prevention and control policies.

2.3. Use statistical surveys and statistical models to guide policy formulation

The COVID-19 has hit socio-economically^[4], creating real scientific and real-world problems that need to be addressed. During the epidemic, the catering industry, tourism industry^[5], and film industry have been significantly affected. We must learn to use data survey models to conduct scientific research in specific fields, and predict the degree of impact according to the epidemic analysis model combined with the characteristics of each industry, and then guide the formulation of response policies. The epidemic has also promoted the development of some industries, such as online office, online education, Internet of Things and other related supporting industries.

Statistics provide an effective basis for policy research, such as materials and logistics for epidemic prevention and control. It is necessary to quickly collect a large amount of data, analyze and analyze the data, and quickly propose solutions. Personnel control issues require the support of demographic and informational methods.

2.4. Use statistical thinking to carry out scientific research related to the epidemic

Scientific research plays a key role in major public health emergencies. The epidemic has also promoted the development of public health disciplines. The application of statistical thinking is inseparable from the scientific research related to the epidemic.

For example, accurate real-time COVID-19 epidemic statistics can provide data support for COVID-19 epidemic scale prediction and parameter estimation of incubation period distribution. For example, statistics also play an important role in clinical trials. The reasonable setting of the sample size of a clinical trial is directly related to the success of the trial, as well as to the efficiency of the trial. We need to learn to use statistical methods to reasonably set the sample size, such as calculating the required sample size by controlling the probability of making Type 1 errors. In the test, we can estimate and infer the survival time or cure time of each group of patients under different drugs and treatment measures through classical statistical methods. Through statistical analysis, we can grasp the impact of the epidemic on human society in a timely manner, find a balance between epidemic prevention and control and recovery and development, and accurately grasp the opportunities and challenges of the epidemic era.

3. Conclusion

At present, the spread of the epidemic is not over yet. We must correctly understand the current situation, earnestly strengthen our sense of responsibility and urgency, continue to do a good job in epidemic prevention and control, and consolidate the hard-won results of epidemic prevention and control. Making good use of statistical thinking in epidemic prevention and control can effectively improve the efficiency of epidemic prevention. We must establish a normalized epidemic development observation mechanism based on statistical methods, and use statistical surveys and statistical models in combination with big data to deeply study the relationship and laws between data, carry out scientific research efficiently, provide a basis for government decision-making, and effectively serve all walks of life.

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