

Analysis of Epidemic Situation of New Coronavirus Infection at Home and Abroad Based on Rescaled Range (R/S) Method

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Abstract

Background The outbreak of the new coronavirus infection broke out in Wuhan City, Hubei Province in December 2019, and has spread to 97 countries and regions around the world. Apart from China, there are currently three other severely affected areas, namely Italy, South Korea, and Iran. This poses a huge threat to China's and even global public health security, challenges scientific research work such as disease surveillance and tracking, clinical treatment, and vaccine development, and it also brings huge uncertainty to the global economy. As of March 11, 2020, the epidemic situation in China is nearing its end, but the epidemic situation abroad is in the outbreak period. Italy has even taken measures to close the city nationwide, with a total of 118,020 cases of infection worldwide. 1.2

Method This article selects the data of newly confirmed cases of COVID-19 at home and abroad as the data sample. Among them: the data of newly confirmed cases abroad is represented by Italy, and the span is from February 13 to March 10. The data of newly confirmed cases at home are divided into two parts: Hubei Province and other provinces except Hubei Province, spanning from January 23 to March 3, and with February 12 as the cutting point, it is divided into two periods, the growth period and the recession period. The rescaled range (R / S) analysis method and the dimensionless fractal Hurst exponent are used to measure the correlation of time series to determine whether the time series conforms to the fractal Brownian motion, that is, a biased random process. Contrast analysis of the meaning of H value in different stages and different overall H values in the same stage. 1.3 Results Based on R / S analysis and calculated Hurst value of newly confirmed cases in Hubei and non-Hubei provinces, it was found that the H value of Hubei Province in the first stage was 0.574, which is greater than 0.5, indicating that the future time series has a positive correlation and Fractal characteristics; The H value in the second stage is 1.368, which is greater than 1, which indicates that the future epidemic situation is completely preventable and controllable, and the second stage has a downward trend characteristic, which indicates that there is a high probability that the future time series will decline. The H values of the first and second stages of non-Hubei Province are 0.223 and 0.387, respectively, which are both less than 0.5, indicating that the time series of confirmed cases in the future is likely to return to historical points, and the H value in the second stage is greater than that in the first stage, indicating that the time series of confirmed cases in the second stage is more long-term memory than the time series of confirmed cases in the first stage. The daily absolute number of newly confirmed cases in Italy was converted to the daily growth rate of confirmed cases to eliminate the volatility of the data. The H value was 1.853, which was greater than 1, indicating that the time series of future confirmed cases is similar to the trend of historical changes. The daily rate of change in cases will continue to rise. 1.4

Conclusion According to the different interpretation of the H value obtained by the R / S analysis method, hierarchical isolation measures are adopted accordingly. When the H value is greater than 0.5, it indicates that the development of the epidemic situation in the area has more long-term

memory, that is, when the number of confirmed cases in the past increases rapidly, the probability of the time series of confirmed cases in the future will continue the historical trend. Therefore, it is necessary to formulate strict anti-epidemic measures in accordance with the actual conditions of various countries, to detect, isolate, and treat early to reduce the base of infectious agents.