How will the COVID-19 Pandemic Affect the Asian Games? A Joint Analysis of Olympic and Pandemic Big Data

2022 7th International Conference on Signal and Image Processing (ICSIP) | 978-1-6654-9563-9/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICSIP55141.2022.9886275

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***Abstract*—The outbreak of the COVID-19 pandemic has seriously affected the development schedule of international sports. The postponement of the Asian Games has brought more concerns to the development of Asian competitive sport. Still, there is no quantitative conclusion on the impact of the pandemic on the Asian Games as a whole. Regarding this, we use big data technology to analyze the Tokyo Olympics and the COVID-19 pandemic data to explore the impact of the pandemic on the development of Asian competitive sport and large-scale comprehensive sports events. Our results suggest that the medal share of each country is significantly correlated with the pandemic.**

Keywords—Asian Game, the COVID-19 pandemic, big data

I. INTRODUCTION

On May 6, 2022, the Olympic Council of Asia officially announced the postponement of the Hangzhou Asian Games because of the COVID-19 pandemic[1]. At present, the COVID-19 pandemic has seriously affected the development schedule of international sports[2]. Since the 2020 Tokyo Olympics and Paralympics have been postponed to 2021 for the first time[3], some scientific institutions and sports organizations have strongly opposed the holding of such large-scale sports events[4, 5]. Although the Tokyo Olympics and the Beijing Winter Olympics have been successfully held in the context of the COVID-19 pandemic, the uncertainty of the COVID-19 pandemic caused by the Omicron variant since November 2021[6] will undoubtedly bring a lot to the Asian Games challenge[7]. Some groups even suggested the cancellation of the Asian Games. But these concerns are all derived from theoretical derivation or partial experience. There is no quantitative conclusion on the impact of the COVID-19 pandemic on the development of Asian competitive sport and large-scale comprehensive sports events.

In fact, the impact of the COVID-19 pandemic on competitive sport has attracted the attention of academia. Before the Tokyo Olympic Games, the physical and mental health and training activities of athletes[8] in various countries were affected to varying degrees[9], and there were also many literatures that raised concerns and doubts about the holding of the Olympic Games[10, 11]. After the Tokyo Olympic Games, studies have shown that the COVID-19 pandemic has caused varying degrees of decline in track and field and swimming performance[12] at the Tokyo Olympic and Paralympic Games[13]. The experience and data of the Tokyo Olympic Games provide a basis for us to quantitatively evaluate the impact of the COVID-19 pandemic on Asian competitive sport and predict the Asian Games in Hangzhou[14].

At present, big data technology has played a crucial role in the prediction of the new crown pneumonia pandemic and the tracing of close contacts[15]. We can also use the advantages of big data analysis technology to explore the internal relationship between the COVID-19 pandemic and the development of the Asian Games, and predict the impact of the COVID-19 pandemic on the Hangzhou Asian Games. Therefore, this paper uses big data technology to analyze the historical big data of the Tokyo Olympics cycle and the COVID-19 pandemic data to deduce the short-term trend of the development of the Asian Games in the post-pandemic era, and then explore the impact of the COVID-19 pandemic on the development of Asian competitive sport and large-scale comprehensive sports events.

II. METHODOLOGY

In order to study the relationship between the new cycle Asian Games and the COVID-19 pandemic, we expect to use the Tokyo Olympic cycle data and the COVID-19 pandemic data to infer the short-term impact of the Asian Games.

A. Data and Variables

First, we obtained the medal table data of 103 winning countries, regions or organizations in the Rio and Tokyo Olympic Games from the official website of the International Olympic Committee. Subsequently, in the World Population Prospects 2019 released by the United Nations Population Division Department of Economic and Social Affairs in August 2019, the total population (2020) data of the winning countries or regions in the two Olympic Games were collected, with a total of 100 items. In addition, the total population of Serbia and Kosovo was obtained on the Eurostat official website.

Subsequently, We obtained cumulative confirmed COVID-19 cases and the number of confirmed deaths in 100 countries or regions that won medals in the two Olympic

Games before July 16, 2021(the seventh day before the Opening Ceremony of the Tokyo 2020 Olympic Games) from the COVID-19 pandemic data released by the center for systems science and Engineering (CSSE) at Johns Hopkins University(JHU)[16].At the same time, we obtained cumulative confirmed COVID-19 cases and cumulative confirmed COVID-19 deaths in 37 medal-winning countries or regions in the Jakarta Asian Games before May 1, 2022. In addition, we counted cumulative confirmed COVID-19 cases and cumulative confirmed deaths on all continents at these two-time points in JHU. The delegation of independent Olympic athletes is excluded.

B. Statistics Analysis

We expect to make a joint analysis of the data changes in the medal lists of the Rio and Tokyo Olympic Games and the COVID-19 pandemic data to judge the impact of the COVID-19 pandemic on the Asian Games. First, we calculate the share of gold, silver, bronze and medals of 102 winning countries or regions in the Rio Olympic Games and Tokyo Olympic Games, and then introduce the variable weighted score of medal proportion (Score), that is, calculate the weighted score of medal proportion of each country or region in the two Olympic Games according to the order of gold, silver and bronze medals. The formula is as follows:

$$Score = g + s * 0.001 + b * 0.001 * 0.001 \quad (1)$$

As Eq(1) shows, the Score represents the weighted score of each country's medal proportion, g represents the proportion of gold medals won by each country or region in the current Olympic Games, s represents the proportion of silver medals, and b represents the proportion of gold medals. The share of gold, silver and bronze medals and the weighted score of the proportion of medals can represent the overall strength of competitive sport in the current country or region, and its data change represents the development trend of the country or region.

Then, we use the collected the COVID-19 pandemic data and the total population to calculate the number of confirmed COVID-19 cases and deaths per unit population in each country or region as of July 16, 2021. Considering the impact of home advantage of host countries, Brazil and Japan are excluded from the statistics. At the same time, remove the abnormal value of the delegation of independent Olympians. Then the correlation analysis between Olympic variables and the COVID-19 pandemic variables is carried out.

Taking the change of weighted score as the dependent variable, the COVID-19 pandemic variable with the strongest correlation with it was selected as the independent variable for linear regression. The regression formula is corrected according to the fact that the sum of the regression results of various countries is zero. Thus, the regression model of the impact of the pandemic situations on the weighted score change of Olympic medals is obtained.

Next, the regression formula of the first correction will be transferred to the Asian Games. Bring the COVID-19 pandemic data of 36 award-winning countries to the Jakarta Asian Games and correct the sum of the results to 0. The final result of the impact of the COVID-19 pandemic on Asian Games countries was obtained, that is, the degree to which the medal proportion of countries in the Hangzhou Asian Games cycle was affected by the COVID-19 pandemic. Spss26.0 statistical analysis software was used.

III. RESULTS

According to the short-term trend, the correlation analysis results showed that there were three COVID-19 pandemic variables significantly correlated with the score: cumulative confirmed COVID-19 cases ($r(100) = -0.451$, $p<0.001$), cumulative confirmed COVID-19 deaths ($r(100) = -0.396$, $p<0.001$) and the number of deaths per unit population ($r(100) = -0.199$, $p<0.05$), the specific correlation analysis results are shown in Table Ⅰ.

TABLE Ⅰ. CORRELATION ANALYSIS RESULTS OF OLYMPIC RELATED DATA

		Number of confirmed COVID-19 cases as of July 16, 2021	Number of COVID-19 deaths as of July 16, 2021	Total population	Number of confirmed cases per unit population	Number of COVID-19 deaths per unit population
The variable weighted score of medal proportion	Pearson correlation	-.396**	-.451**	.185	-.140	-.199*
	Significance (double-tailed)	.000	.000	.065	.166	.047
	Cases	100	100	100	100	100

The cumulative confirmed COVID-19 deaths are the most significant, so we use it as the independent variable for regression analysis and correct the regression formula:

$$OG = -4.23e^{-8}\beta + 1.30e^{-3} \quad (2)$$

Among them, the sum of 45 countries in Asia is 0.0075. The value of China affected by the COVID-19 pandemic in the Olympic Games is 0.0011, that of Japan is 0.00067, and that of the Republic of Korea is 0.0012. Figure 1 shows the regression result of the Olympic data. The scatter points are the corresponding relationship between the weighted scores of 100 national medals and the number of confirmed deaths by July 16, 2021. The slash represents the corrected regression formula. This suggests that both the overall competitive level of Asia and the competitive level of China, Japan, and the Republic of Korea are relatively less affected by the COVID-19 pandemic than the world average level.

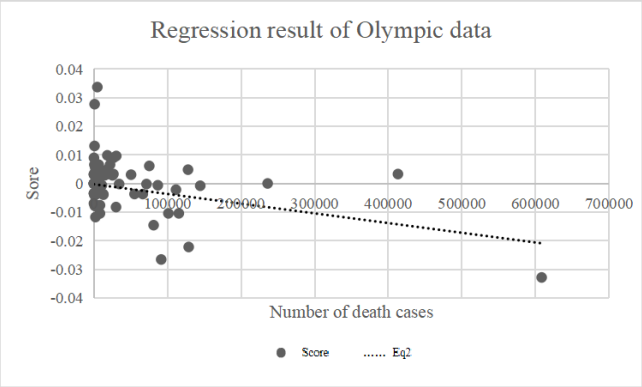

Fig Ⅰ.Regression results of Olympic data. The score and number of deaths are directly from Olympic data, Eq2 regression line is the correction result of the Olympic regression formula.

This formula was transferred to the Asian Games and brings in the data of the cumulative confirmed COVID-19 deaths in 36 countries, makes the correction that the sum is zero, and get the formula:

$$AG = -4.23e^{-8}\beta + 1.44e^{-3} \quad (3)$$

As shown in Table Ⅱ, the affected value of China is 0.0012, that of Japan is 0.00019, and that of the Republic Of Korea is 0.00047.

TABLE Ⅱ. THE PREDICTIVE VALUE OF THE COUNTRIES OR REGIONS AFFECTED BY THE COVID-19 PANDEMIC IN THE ASIAN GAMES IN HANGZHOU

National Olympic Committees	Change in medal share	National Olympic Committees	Change in medal share
PEOPLE'S REPUBLIC OF CHINA	1.23E-03	PHILIPPINES	-1.11E-03
JAPAN	1.89E-04	UNITED ARAB EMIRATES	1.34E-03
REPUBLIC OF KOREA	4.70E-04	KUWAIT	1.33E-03
INDONESIA	-5.17E-03	KYRGYZSTAN	1.31E-03
UZBEKISTAN	1.37E-03	JORDAN	8.46E-04
ISLAMIC REPUBLIC OF IRAN	-4.53E-03	CAMBODIA	1.31E-03
CHINESE TAIPEI	1.40E-03	SAUDI ARABIA	1.06E-03
INDIA	-2.07E-02	MACAU, CHINA	1.44E-03
KAZAKHSTAN	6.37E-04	IRAQ	3.74E-04
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA	1.44E-03	LEBANON	1.00E-03
BAHRAIN	1.38E-03	TAJIKISTAN	1.44E-03
THAILAND	2.30E-04	LAOS PEOPLE'S DEMOCRATIC REPUBLIC	1.41E-03
HONG KONG, CHINA	1.05E-03	TURKMENISTAN	1.44E-03
MALAYSIA	-6.31E-05	NEPAL	9.36E-04
QATAR	1.41E-03	PAKISTAN	1.56E-04
MONGOLIA	1.35E-03	AFGHANISTAN	1.12E-03
VIETNAM	-3.80E-04	MYANMAR	6.19E-04
SINGAPORE	1.38E-03	SYRIAN ARAB REPUBLIC	1.31E-03

TABLE Ⅲ.THE PROPORTION OF CHANGES IN THE NUMBER OF CONFIRMED CASES AND DEATHS ON ALL CONTINENTS AT TWO-TIME POINTS

Continent	Proportion of confirmed COVID-19 cases		Proportion of confirmed COVID-19 deaths	
	As of July 16, 2021	As of May 1, 2022	As of July 16, 2021	As of May 1, 2022
Oceania	0.0005	0.0141	0.0003	0.0017
Asia	0.3085	0.2900	0.2060	0.2291
Africa	0.0324	0.0227	0.0384	0.0405
Europe	0.2642	0.3753	0.2748	0.2916
North America	0.2133	0.1875	0.2229	0.2294
South America	0.1812	0.1104	0.2576	0.2076

IV. DISCUSSION

With the help of big data technology, this study not only provides evidence and answers to the question of whether

the Asian Games will be affected by the COVID-19 pandemic but also supplements the quantitative analysis of the development process of the Asian Games and the development level of Asian competitive sport in the post-pandemic era. We observe the data values of the three countries with relatively high levels of Asian competitive sports in China, Japan and South Korea affected by the COVID-19 pandemic at two-time points, and we can see that the development of competitive sport in the three countries is less affected by the COVID-19 pandemic. At the same time, compared with the two-time points, the proportion of the number of confirmed COVID-19 cases in Asia worldwide has increased, and the proportion of confirmed cumulative deaths has decreased till May 1, 2022 , as shown in Table Ⅲ. The total medal share of the 45 Asian countries

affected by the COVID-19 pandemic is 0.0075 in the Tokyo Olympiad, which shows that the COVID-19 pandemic has less affected Asian compared to the global competitive sport. Consequently, we can conclude that Asian competitive sport still performs well in the post-pandemic development stage.

However, there are two major uncertainties about our work.

First, regarding the pandemic. Currently, variant Omicron has replaced variant Delta[17], which spreads faster but induces milder symptoms[18]. The current pandemic variation.

The other uncertainty comes from the games. Tokyo Olympics was held without spectators[19], The Beijing Winter Olympics is also a closed-loop management measure, but the Asian Games may be open to the spectator[20]. Spectators have brought new uncertainties to the development of competitive sport in various countries and the normal holding of the Asian Games. How to formulate more perfect pandemic prevention measures to ensure the normal progress of various events, so as to reduce the risk of pandemic transmission caused by the admission of spectators[21], has become an urgent problem to be solved by the official organizations of various countries and events.

V. CONCLUSION

The COVID-19 pandemic has impacted the development of global sports again and again. We have given the answer of how the COVID-19 pandemic affects the Asian Games through quantitative means. The results show that the impact of the COVID-19 pandemic on the Asian Games and Asian competitive sport is relatively small, but we still cannot ignore some harmful effects brought by the COVID-19 pandemic. Therefore, in the complex pandemic environment, we hope to strengthen the COVID-19 pandemic prevention and control with the help of big data technology and promote the higher development of the Asian Games and world sports. We will continue to track the world championships and World Cup large-scale sports events, and conduct a joint analysis of Olympic and pandemics big data, so as to constantly enrich our data, optimize our conclusions, and provide more reliable references for decision makers.

ACKNOWLEDGMENTS

This work is supported by the China National Sprint & Relay Team prepares for the Tokyo Olympics in scientific and research and technical service project 2021 (2021TJ01001) and the National Natural Science Foundation of China (Grant No. 62106159).

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