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Comparison in the trends between monkeypox spread and coronavirus disease spread among countries: A longitudinal study*

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Monkeypox began to spread in various countries worldwide in May 2022. We aimed to identify the trends of monkeypox spread at national and continental levels and contextualize it to that of the coronavirus disease 2019 (COVID-19) spread worldwide, classify the degree of risk by country, and identify the national indicators affecting the spread of both diseases. This longitudinal study was conducted using the data published by the WHO and World Bank to compare the trends of COVID-19 and monkeypox spread across six continents. Spearman's correlation analysis was performed using the 91-day data. Feasible generalized least squares (FGLS) regression analysis was performed. The Spearman's correlation analysis indicated a strong positive correlation between the spread of monkeypox and that of COVID-19. The FGLS regression analysis showed that the region, Universal Health Coverage (UHC), sociodemographic index (SDI), and population aged ≥65 years had a significant effect. To prevent the spread of monkeypox, preparations should be made based on the national infectious disease management system for COVID-19. However,

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some cases require a different approach. Therefore, a response policy that can promote the citizens' initiative to apply preventive strategies should be established. Second, international quarantine measures that focus on the distribution of vaccines primarily in low-income African countries should be implemented. Third, people should be actively educated on the different methods for preventing monkeypox infection.

[Key Words: COVID-19; monkeypox; outbreak; pandemic, infections transmission, comparison study; longitudinal panel study]

Ⅰ. INTRODUCTION

Since the first case of coronavirus disease 2019 (COVID-19) was reported in Wuhan, China, in December 2019, the disease has already spread to 229 countries as of August 4, 2022. For two and a half years, COVID-19 has severely affected the public health and global economy. Following the declaration of COVID-19 as a pandemic in March 2020 by the World Health Organization (WHO), different countries have devised various infectious disease management strategies, including epidemiological investigation systems, social distancing policies, public health education, city lock downs, and vaccine dissemination. Despite these efforts, the fight against infectious diseases including COVID-19 is practically limited (Sanchez et al, 2022). Fortunately, as a result of the efforts made by the international organizations such as the WHO and the Ministry of Health of each country (such as the development of vaccines, quarantine systems, antiviral agents, and other treatment modalities), the COVID-19 pandemic has been gradually alleviated, despite the limitations of these measures (Lai et al., 2022a; Lai et al., 2021; Lin et al., 2022b; Shao et al., 2022). Nevertheless, the 2022 outbreak of monkeypox possesses another global health security threat. In fact, studies on the relationship between COVID-19 and monkeypox are lacking.

According to a previous study, COVID-19 has symptoms similar to those of monkeypox such as fever, respiratory pain, and erythema. However, the formation of blisters is a unique symptom of monkeypox, and further studies are warranted to examine the relationship between COVID-19 and monkeypox (Lai et al., 2022a). In particular, monkeypox is using a similar infectious disease management system, including response and monitoring systems based on the COVID-19 infectious disease response system. As a result, the COVID-19 response system and related indicators are impacting the spread of monkeypox(Petersen et al., 2021).

Monkeypox has infected 26,223 people in 74 countries as of August 4, 2022, following its first intercontinental transmission to the United Kingdom that occurred on May 6, 2022. The earliest cases of monkey infection were discovered in Denmark in 1958. Monkeypox is a zoonotic virus belonging to the Orthopoxvirus genus isolated from pox-like lesions (Kukreja et al., 2022). The first monkeypox infection in humans was reported in the Democratic Republic of Congo in 1970, and it remained endemic in Central and West African countries such as Nigeria and the Democratic Republic of Congo (Shanmugaraj et al., 2022). However, monkeypox began to spread worldwide in 2022, including Europe, South America, and Asia, through intercontinental transmission (Venkatesan, 2022). Hence, the WHO declared monkeypox as the seventh Public Health Emergency of International Concern (PHEIC) on July 23, while the United States declared it as a health emergency on August 5 (Wenham & Eccleston-Turner, 2022).

Human-to-human transmission of monkeypox occurs via physical contact with an infected person, direct contact with lesions and contaminated objects, and exposure to respiratory droplets (Pan et al., 2022). Confirmed cases have been reported in men visiting homosexual clinics; therefore, sexual activity may also cause transmission. Nevertheless, transmission through exposure to body fluids such as semen or vaginal secretions during

sexual activity has not yet been scientifically proven (Lai et al., 2022a). Monkeypox is not as contagious as COVID-19, but the WHO is responding to this outbreak with high priority to prevent the occurrence of another pandemic (World Health Organization, 2022a). Epidemiological investigation of the early cases of monkeypox reported in 2022 by the WHO did not reveal a direct connection to the current infection and reported that the onset was atypically different from the existing infectious diseases; therefore, various studies should be conducted to develop appropriate approaches(World Health Organization, 2022b).

A comprehensive understanding of the causative agent, transmission methods, epidemiological investigation, risk factors, clinical symptoms, treatment, and prevention methods of monkeypox is urgently required. To minimize initial intercontinental transmission, each country should establish a quarantine policy. Unlike COVID-19, only a few confirmed monkeypox cases have been reported, thereby limiting the number of individual studies. Therefore, the factors contributing to the spread should be identified by continent and country through national-level research, and appropriate responses should be devised. The stringency of government response, medical insurance service, national economic level, education level, life expectancy, population structure, and continents affected the spread of COVID-19 (Allel et al., 2020; Durmus, 2021; Ma et al., 2021; Verguet et al., 2021). Likewise, analysis of the factors affecting the spread of monkeypox and implementation of country-specific responses should be based on the significant national variables during the initial spread of COVID-19. In this regard, the WHO emphasized the need to establish a comprehensive national response based on the results of active research. Despite each country's maintenance of the existing infectious disease monitoring system that is similar to that of COVID-19, studies and data related to monkeypox are limited (World Health Organization, 2022).

This study aimed to identify the trends by analyzing the data regarding the spread of monkeypox at national and continental levels and to compare the status of monkeypox spread with that of COVID-19 spread worldwide. Furthermore, we aimed to classify the degree of risk by comparing it by country and to identify the national indicators affecting the spread of monkeypox and compare them with those affecting the spread of COVID-19. The results of this study will serve as a basis for developing future preventive policies by identifying the degree of spread and effect of monkeypox worldwide.

Ⅱ. Methods

1. Study Design

This longitudinal study was conducted using panel data to compare the trends in COVID-19 and monkeypox spread across six continents. To ensure that the data period of COVID-19 matches with that of monkeypox, the 91-day data were analyzed (COVID-19: December 31, 2019 to April 1, 2020; monkeypox: May 6 to August 4, 2022).

2. Data sources

This study used the national-level data on confirmed cases of COVID-19 in 237 countries and those of monkeypox in 74 countries across six continents. Data on the confirmed cases of COVID-19 and monkeypox were analyzed based on the data published by the WHO, while the national indicators were analyzed based on the data published by the World Bank.

3. Confirmed cases of COVID-19 and Monkeypox

For monkeypox, we used panel data on the daily number of new confirmed cases that occurred from May 6 to August 4, 2022, (i.e., 91 days) in 74 countries. For COVID-19, we used panel data on the daily number of new confirmed cases that occurred from December 31, 2019 to April 1, 2020 in 237 countries to match the data period of monkeypox.

4. Country data

Data of the target countries were collected from the World Bank Open Data and analyzed. The national indicators used in the analysis were OxCGRT stringency index (STR), universal health coverage index (UHC), gross domestic product (GDP), human development index (HDI), sociodemographic index (SDI), data on people aged ≥65 years, and daily number of new COVID-19 cases 〈Table 1〉.

STR is an index that determines the degree of policy response of each country's governments to the spread of infectious diseases and is rated on a 100-point scale, with higher values representing more stringent government responses (Hale et al., 2021). UHC measures the coverage of essential medical services using 4 components and 14 indicators and is rated on a scale of 0 to 100 points. Essential medical care for infectious diseases is one of the four components (The World Bank, 2022a). GDP is an indicator of the market value of all goods and services produced and exported to other countries and represents the country's economic level (The World Bank, 2022b).

HDI is calculated and published by the United Nations Development Program (UNDP); it is an index that measures the three key dimensions of human development: life expectancy, education level, and national income of each country. It is rated from 0 to 1.000 (UNDP Human Development

Reports, 2022).

SDI is the average of the ranking of per capita income, average educational background, and fertility rate in all areas of the Global Burden of Disease study of the Institute for Health Metrics and Evaluation. It is rated from 0 to 1.000, and a higher average indicates a higher per capita income, a higher education level, and a lower fertility rate (Piri et al., 2020). To identify the trends in the regional spread of monkeypox and COVID-19, the WHO regional offices to which each country is affiliated were identified: European Regional Office (EURO), African Regional Office (AFRO), Eastern Mediterranean Regional Office, Pan American Health Organization (PAHO), South-East Asia Regional Office (SEARO), and Western Pacific Regional Office (WPRO).

〈Table 1〉 Abbreviations and country data

Abb.	Full Sentence	Range	Data Source
STR	The Oxford COVID-19 Government Response Stringency index	16.2-84.8	Oxford OxCGRT
UHC	Universal Health Coverage Index	0-89.0	World Bank
GDP	Gross domestic product	808.1-116, 935.6	World Bank
HDI	Human Development Index	0.48-0.957	UNDP
SDI	Sociodemographic Index	0-0.918	IHME
Aged≥65 years	Population aged 65 years and older	1.1-27.0	World Bank
COVID-19 NCC	COVID-19 new confirmed case	0-223, 254	WHO
Regions	WHO regional office		WHO

5. Statistical analysis

To compare the trends in the international spread of monkeypox and COVID-19, an analysis was conducted using the panel data of countries that experienced outbreaks for a 180-day period.

First, to visually illustrate the global spread of monkeypox, the daily panel data of 74 countries that experienced outbreaks from May 4 to August 4, 2022 were used to highlight the areas on the world map in order of occurrence. An online map published by the Centers for Disease Control and Prevention was used (Centers for Disease Control and Prevention, 2022).

Second, Spearman's correlation analysis of each country was conducted to determine the correlation between monkeypox and the countries affected in similar period (91 days) after the onset of COVID-19. The correlation was visually indicated by linearly depicting the correlation on a scatter plot. If the trend of monkeypox spread was higher than that of COVID-19 spread, the country was considered to be at the risk level; if it were lower than the COVID-19 trend, the country was considered to be at the caution level. Other countries without monkeypox cases were considered to be at the preparation level.

Third, feasible generalized least squares (FGLS) regression analysis was performed using panel data to compare the indicators by country that affected the daily confirmed cases of monkeypox and COVID-19. FGLS regression analysis was selected as the numbers of monkeypox cases worldwide were limited, and data on the standard error of the spread by country were inadequate. Hence, the information related to the proportional relationship between the error and the independent variable was inadequate. Therefore, FGLS analysis was used in this study, which is a non-parametric estimator regression analysis (Bai et al., 2021; Liu et al., 2016).

Equation 1 (Monkeypox)	$E(Y_t \mid X_i, Countryi) = \beta_0 + \beta_{regions}x + \beta_{STR}\chi + \beta_{UHC}\chi + \beta_{GDP}\chi + \beta_{HDI}\chi + \beta_{SDI}\chi + \beta_{>65aged}\chi + \beta_{COVID-19\,NCC}\chi + \epsilon_i + u + e$
Equation 2 (COVID-19)	$E(Y_t \mid X_i, Countryi) = \beta_0 + \beta_{regions}x + \beta_{STR}\chi + \beta_{UHC}\chi + \beta_{GDP}\chi + \beta_{HDI}\chi + \beta_{SDI}\chi + \beta_{>65aged}\chi + \epsilon_i + u + e$

Represents the daily number of new confirmed cases, i refers to the country, and t refers to the date. In the regression equation of monkeypox (Equation 1), the number of new confirmed cases since the onset of COVID-19 was added.

Correlation analysis and visualization data analysis were performed using R 4.2(R Foundation for Statistical Computing, Vienna, Austria), while FGLS regression analysis of panel data was performed using STATA 26.0 (Stata Corporation, College Station, TX, USA).

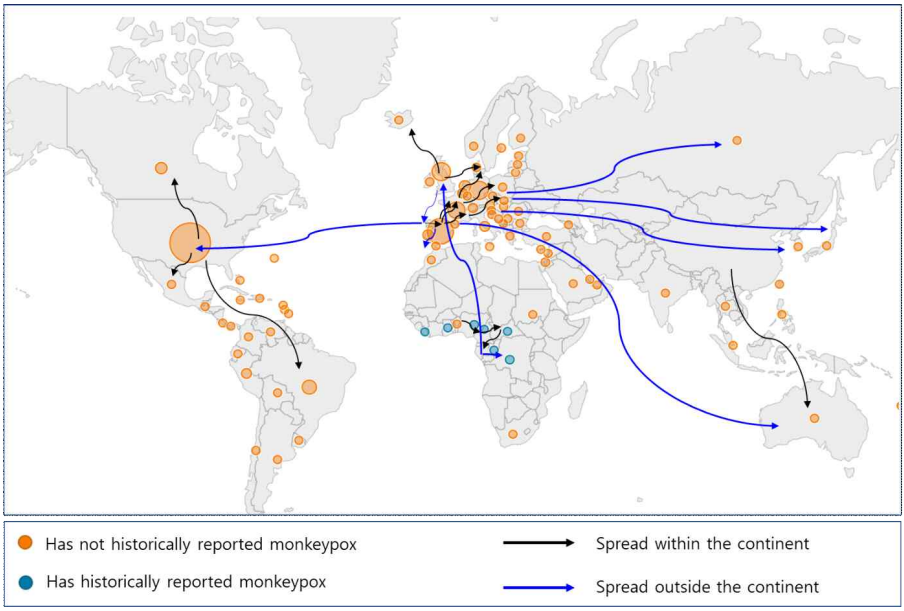
Ⅲ. Results

1. Global dispersion of monkeypox

The first transmission of monkeypox from Nigeria to the United Kingdom was confirmed on May 6, 2022. The disease continentally migrated from Africa to Europe. From May 18, it spread throughout Europe, including Portugal, Sweden, Belgium, Switzerland, Israel, Spain, Germany, and France. On the same day, an intercontinental spread occurred from Europe to the United States. On August 1, further intercontinental transmission occurred in Asia and other countries worldwide 〈Figure 1〉.

In 2022, monkeypox, which was endemic and limited to Africa, spread to other countries with no previous transmission history.

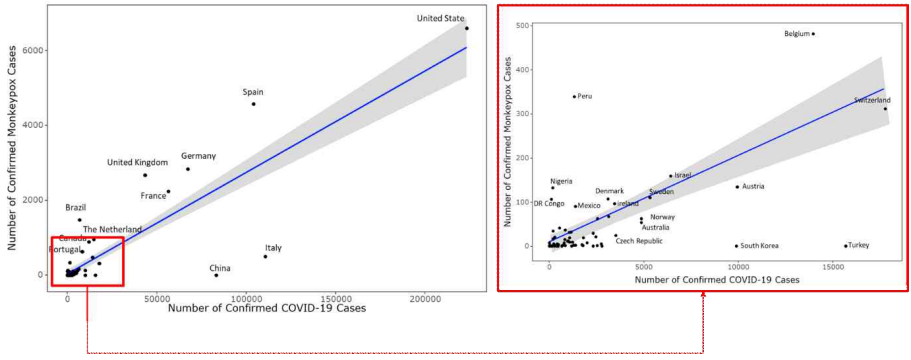
〈Figure 1〉 Global spread of monkeypox



2. Correlation between monkeypox and COVID-19 by country

To compare the degree of international spread of monkeypox with that of COVID-19, a Spearman's correlation analysis was performed using the panel data of each country within 91 days after the first case was reported. As a result, the Spearman's correlation coefficient (r) was confirmed to be 0.584 (P 〈 .001), which indicated a strong positive correlation 〈Figure 2〉.

〈Figure 2〉 Correlation between monkeypox and COVID-19 spread



If the spread of monkeypox in a country was faster than that of COVID-19 within 91 days after the first confirmed case of monkeypox, the country was considered to be at the risk level; if it was slower, the country was considered to be at the caution level 〈Table 2〉. The countries at the risk level include the United States, Spain, Germany, the United Kingdom, France, Italy, the Netherlands, Canada, and Portugal in order of the number of confirmed monkeypox cases. In these countries, monkeypox is spreading faster compared with COVID-19 in the first 91 days. On the contrary, the countries at the caution level include Italy, Norway, Australia, Czech Republic, China, Turkey, and South Korea. In these countries, monkeypox is spreading at a slower rate compared with that of COVID-19 in the first 91 days of its onset. Other noninfected countries are at the preparation level and are preparing for the outbreak of monkeypox.

〈Table 2〉 Comparison of the spread of monkeypox and COVID-19

Level	Country	Within 91 days following the onset			
		Monkeypox		COVID-19	
		Cumulative confirmed cases	Ranking	Cumulative confirmed cases	Ranking
Risk level	United States	6,599	1	223,254	1
	Spain	4,577	2	104,118	3
	Germany	2,839	3	67,366	5
	United Kingdom	2,673	4	43,398	7
	France	2,239	5	56,362	6
	Italy	1,475	6	6,836	16
	Netherlands	957	7	14,697	10
	Canada	892	8	12,023	12
	Portugal	633	9	8,251	15
Caution level	Italy	505	10	110,574	2
	Norway	63	23	4,863	19
	Australia	54	25	4,862	20
	Czech Republic	25	32	3,508	21
	China	2	60	83,224	4
	Turkey	1	66	15,679	9
	South Korea	1	66	9,887	14
Preparation level	Other countries without infection cases				

3. FGLS regression

FGLS regression was conducted using panel data and national indicators of countries wherein monkeypox and COVID-19 have been confirmed after 91 days of their onset 〈Table 3〉.

FGLS regression analysis of national indicators on the spread of monkeypox revealed that region, UHC, SDI, and population aged ≥ 65 years had a significant effect. In terms of regions, the AFRO region had a

significantly higher number of cases at 12.046 patients than the EURO region (β = 12.046, P = .008), and the WPRO region had a significantly lower number of cases at -11.283 patients (β = -11.283, P < .001). For each increase of 1 point in UHC, 0.927 confirmed cases significantly increased (β = -0.927, P < .001). In SDI, each 0.1-point increase significantly decreased 8.6068 confirmed cases (β = -86.068, P < .001). In addition, when the proportion of the population aged 65 and over increased by 1%, the number of confirmed cases significantly increased by 1.001 (β = 1.001, P < .001).

As a result of analyzing the effect of national indicators on the spread of COVID-19 on the basis of 91 days of onset, the following variables were found to be significant: regions, STR, and population aged 65 and above. In terms of regions, the PAHO region had a significantly lower number of cases at 49.348 patients than the EURO region (β = -49.348, P = .001), and the cases were significantly less with 51.532 patients in the SEARO region (β = -51.532, P = .019). For each 1-point increase in STR, the number of confirmed cases of COVID-19 significantly increased by 3.920 (β = 3.920, P < .001). For every 1% increase in the proportion of people > 65 years old, the number of confirmed cases increased significantly by 10.219 (β = 10.219, P < .001).

〈Table 3〉 FGLS regression analysis of monkeypox and COVID-19 cases

Variables	Monkeypox				COVID-19			
	Univariate		Multivariate		Univariate		Multivariate	
	β	P	β	P	β	P	β	P
Region								
EURO	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
AFRO	-7.657	.004**	12.046	.008**	-138.291	<.001***	-1.44	.934
EMRO	-8.093	.005**	-0.070	.985	-133.161	<.001***	-21.134	.229
PAHO	4.360	.014*	-4.854	.080	-128.034	<.001***	-49.348	.001**
SEARO	-7.947	.248	-2.998	.619	-129.701	<.001***	-51.532	.019*

WPRO	−7.896	.006**	−11.283	<.001***	−21.049	.222	−20.336	.248
STR	0.006	.773	0.005	.734	4.044	<.001***	3.920	<.001***
UHC	0.248	<.001***	0.927	<.001***	2.028	<.001***	0.109	.745
GDP	0.001	<.001***	0.001	.147	0.001	<.001***	0.000	.832
HDI	31.579	<.001***	12.470	.508	222.747	<.001***	−47.298	.276
SDI	15.799	<.001***	−86.068	<.001***	214.392	<.001***	−9.813	.790
Aged ≥65 years	0.632	<.001***	1.001	<.001***	10.918	<.001***	10.219	<.001***
COVID-19 CC	0.001	<.001***	−6.920	.220				
Constant term			−22.744	.070			−60.149	.012
Log likelihood			−15997.42				−84019.79	
Chi2 (p)			144.68(<.001)				1050.02	

Ⅳ. Discussion

This study compared the international spread of monkeypox with the spread of COVID-19 by using panel data and national data to analyze the effect of country-specific indicators on the spread of monkeypox.

The primary aim of this study was to analyze and identify the spread of monkeypox on a daily basis by country and continent in the first 91 days following the first reported case of monkeypox. There were 26,223 confirmed cases in 75 countries. Accordingly, the WHO declared a PHEIC on July 23, 2022, and the United States declared a public health emergency on August 4, 2022. Monkeypox was first reported in the Democratic Republic of Congo in Africa in 1970 and was endemic to Africa, including countries such as Benin, Cameroon, Central African Republic, Democratic Republic of Congo, Gabon, and Ghana. Monkeypox was first transmitted to the United Kingdom in 2022 and has become an important issue affecting international health security because it is spreading exceptionally in nonendemic countries worldwide, such as the Americas and Asia. In other words, the main difference is that the

first case of COVID-19 was reported the in China and it spread mainly in Asia. But Monkeypox started in Europe and spread to America including the United States (Saied et al., 2022). However, compared with COVID-19, monkeypox exhibits lower transmission efficiency between continents. Although 91 days have elapsed since the onset, there have been 26,223 confirmed cases in 75 countries, which is significantly lower than the 488,693,965 confirmed cases of COVID-19 in 151 countries on day 91 following its onset. The first potential reason is that because of COVID-19, quarantine systems, policies, and citizens' awareness of infectious diseases are heightened in each country. Second, there are two existing vaccines for monkeypox that are based on smallpox, namely, "JYNNEOS" and "ACAM2000," thus presenting a different situation to that of COVID-19 (Guarner et al., 2022; Rao et al., 2022; Rizk et al., 2022). Third, monkeypox is transmitted through more close contacts than COVID-19. Therefore, the rate of spread of monkeypox is lower than that of COVID-19. For example, the infection rate in households is less than 10% (Farahat et al., 2022). Fourth, many people worldwide wore facemasks due to the COVID-19 outbreak. Therefore, the infection rate of monkeypox was lower than that of COVID-19 (Fahrni et al., 2022).

Although monkeypox has spread to Europe and pan-America, it is expected to show a relatively modest increase in spread to Southeast Asia, the western Pacific region, and the entire eastern Mediterranean region. In particular, in the western Pacific region, there are many countries that maintain travel restrictions because of COVID-19, thereby minimizing the possibility of spread in those countries (Akhmetzhanov et al., 2022). Accordingly, if the COVID-19 outbreak focused on global quarantine, the monkeypox situation should focus on vaccine support to low-income countries in Africa and continuous epidemiological monitoring in each country (Zarocostas, 2022).

Correlation analysis was conducted using panel data on day 91 following onset to compare the relationship between the spread of monkeypox and the spread of COVID-19 at the national level, which is the second purpose of this study. It was found that there is a strong correlation between the spread of COVID-19 and the spread of monkeypox by country based on 91-day data following the onset. In other words, although the number of confirmed cases of monkeypox is relatively lower than the number of confirmed cases of COVID-19, the trend of confirmed cases at the national level is showing a similar pattern. The WHO and other entities are emphasizing that monkeypox will not develop into a pandemic like COVID-19 (Zarocostas, 2022).

Unlike COVID-19, monkeypox shows a relatively low fatality rate with nine deaths as of August 5 (Hale et al., 2021; Mathieu et al., 2022). However, with the rapid case increase in the PAHO region from July, the governments of each country, centered on the WHO offices in each region, should continuously monitor monkeypox and operate a warning system. In particular, the first- to ninth-ranked countries with the highest numbers of confirmed cases of monkeypox were also ranked within the top 15 for the number of confirmed cases of COVID-19 at 90 days following onset. Therefore, these countries were identified as vulnerable to the spread of diseases; therefore, it is necessary to classify them into risk levels and manage them accordingly. Nevertheless, given that an outbreak has occurred, it is necessary to be careful, and a quarantine system in terms of entry measures should be implemented in countries at risk. In addition, it is believed that governments need to customize and individualize management protocols for each country by garnering learnings from the trends and factors associated with the spread of COVID-19 after 90 days. On the other hand, although Italy, China, and Turkey ranked in the top 10 for the spread of COVID-19, the spread of the monkeypox virus was low in these countries.

Nevertheless, given that an outbreak has occurred, it is necessary to be careful, and the quarantine system should be reorganized to address the confirmed trend of countries at risk regarding entry management and quarantine measures.

We also identified indicators affecting the spread of monkeypox, and factors that are different from the national indicators affecting the spread of COVID-19 were revealed. First, the effect on the spread varies according to the level of quarantine stringency of the government. Government stringency refers to the strength of "lockdown style" policies in which the government restricts the actions of citizens as the epidemic spreads (Hale et al., 2021). At day 91 following the onset of COVID-19, the governments' containment policies were effective in containing the spread. By contrast, monkeypox was different from COVID-19 in that the government's stringency index had no significant effect on preventing the spread. The reason is that, at the time when monkeypox was spreading, the government's epidemic prevention and control system was systematized in most countries because of COVID-19. As a result, the stringency index of each country improved to a similar level, which would not have been significant.

In addition, the proportion of the national elderly population exhibited less effect on the spread of monkeypox than on the spread of COVID-19. For each 1% increase in the proportion of the elderly in a country, the number of confirmed cases of COVID-19 increased by 10.219, but that for monkeypox only increased by 1.0001, which is approximately one-tenth of the increase in COVID-19. According to previous research on monkeypox, the median age of the confirmed patients was 38 years old; this younger age group tends to be associated with high social activity (Patel et al., 2022; Vivancos et al., 2022). According to the epidemiological study of monkeypox, the focal areas of transmission are clubs, bars, private parties (58%), and overseas travel (21%), which are relatively easy routes for young people to spread (Selb et al., 2022).

At day 91 following the onset of monkeypox, the SDI was found to significantly affect the spread of the monkeypox compared with COVID-19. This index is related to per capita income, education level, and total fertility rate (John Snow Lab, 2022). Income and education level are known as important factors affecting the spread of infectious diseases according to case studies of various international infectious diseases, including COVID-19 (Abedi et al., 2021). As such, the results of this study also suggest that a higher SDI is correlated with a lower spread of monkeypox. In fact, even in the study of COVID-19, prevention education lowered the spread, and a higher income leads to a lower spread because of preventive products, active facility isolation, and use of medical facilities (Bazaid et al., 2020; Rozenfeld et al., 2020).

This study has some limitations. First, there is a difference between the number of panel countries and the number of confirmed cases at day 91 of the onset of monkeypox and COVID-19. Therefore, there is a possibility that an inherent error occurred in the analysis because it was not possible to conduct the analysis with the same panel countries. Second, at the time of the monkeypox outbreak, a number of countries already had operational quarantine systems because of COVID-19. Therefore, nonsampling errors may have occurred when comparing the COVID-19 period when quarantine systems were insufficient. Third, there may be some errors in the results because some national indicators were actually data from three to four years ago rather than current data from 2022. Finally, the accuracy and reliability of the system of reporting infected cases differs from country to country. As result, this data may have nonsampling errors.

V. Conclusions

To prevent the spread of monkeypox, preparations should be made on the basis of the national infectious disease management system equipped with COVID-19. However, some require a different approach. First, although the government's response to COVID-19 was effective in preventing the spread, monkeypox has a low government response effect. Therefore, rather than the government's stringent policy, it is necessary to prepare a response policy that can induce citizens' initiative in prevention activities. For example, active health education at the government level, publicity, and provision of information on monkeypox would be relevant. Second, monkeypox spreads slower than COVID-19, and the fatality rate of monkeypox is low because vaccines already exist for this disease. Therefore, although COVID-19 has focused on global quarantine, to prevent the international spread of monkeypox, it is necessary to focus on international quarantine that supports vaccines mainly in low-income African countries. Third, monkeypox is different from COVID-19 in that it mainly spreads among young people. Therefore, unlike COVID-19, which designates the elderly as a vulnerable group and requires special management, people should be actively educated on the prevention of monkeypox infection, such as precautions for overseas travel and precautions in daily culture (e.g., education on sex life), particularly for young people.

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국문초록

전 세계의 원숭이두창 및 코로나19 확산 추이 분석: A longitudinal study

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2022년 5월, 전 세계는 코로나19 판데믹 시대의 원숭이두창이 전 세계로 확산되었다. 이에 본 연구는 국가 및 대륙 차원에서 원숭이두창 확산 추이를 파악하고 이를 코로나19 확산과 비교하고 국가별 위험도를 분류하여 두 질병의 확산에 영향을 미치는 국가적 지표를 파악함에 목적이 있다. 이 연구는 WHO, World Bank 데이터를 사용하여 6개 대륙에 걸쳐 확산된 COVID-19와 원숭이두창의 추세를 비교하였다. 두 전염병이 발병된 후 91일 동안의 데이터를 사용하여 Spearman의 상관관계 분석과 FGLS(Feasible Generalized Least Squares) 회귀 분석을 수행하였다. 그 결과, 원숭이두창의 확산과 COVID-19 사이에 강한 양의 상관관계가 있음을 파악하였다. 본 연구의 결과에서는 두 질병의 확산에 영향을 미치는 중요한 요인변수로 지역, UHC(Universal Health Coverage), SDI(Social Demographic Index) 그리고 65세 이상의 인구 수가 중요한 요인임을 파악하였다. 현재 전 세계는 코로나19 국가감염병 관리체계를 바탕으로 원숭이두창에 대비하고 있다. 그러나 원숭이두창은 경우에 따라 코로나19와 다른 접근 방식이 필요하다. 원숭이두창은 시민의 이니셔티브를 촉진하는 대응을 기반으로 정책을 수립할 것을 제안하며, 또한 저소득 아프리카 국가를 중심으로 백신 보급에 초점을 맞춘 국제적 방역 조치를 시행하고, 원숭이두창 감염 예방을 위한 적극적인 보건교육이 국민들을 대상으로 필요하다.

[주제어: COVID-19; 원숭이두창, 판데믹, 비교연구]

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