

# Possibility of COVID-19 Infections due to Transmission of Air Pollution Crossing the Border and a Joint Inter-Korean Response

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There has been no confirmed cases of COVID-19 in North Korea since it comprehensively closed its borders in January, 2020. This study focuses on the possibility of transmission of air pollution crossing the border resulting in infections and the spread of COVID-19 in North Korea. Specifically, the study first reviews foreign studies on the long-distance airborne transmission of the COVID-19 virus and discusses the likelihood of COVID-19 spreading to North Korea. Second, this study examines the possibility of the virus spreading due to fine dust produced domestically in North Korea. In particular, this study assesses the spacial characteristics of areas vulnerable against infectious diseases in the capital of Pyongyang, which considered to be the safest region in North Korea. In conclusion, rather than waiting for North Korea to announce its first confirmed case of COVID-19, this study emphasizes, from the perspective of the community of life on the Korean Peninsula, 1) South Korea's diplomatic efforts to secure a sufficient amount of vaccines that North Korea can trust, 2) the establishment of a joint inter-Korean integrated research governance to respond to various disasters on the Korean Peninsula, and 3) an active response by North Korea to proposals for cooperation by South Korea.

Soon after the COVID-19 pandemic began in the city of Wuhan in China in December 2019, the North Korean regime declared a state of national emergency on January 28, 2020, and has since closed all its borders both on the land and at sea. As can be seen in some analyses that have indicated how the North Korean economy has worsened due to its border closures, North Korea has maintained its status of being substantially closed off from the outside. Even though it is difficult to completely accept North Korea's official announcements that there have been no cases of COVID-19 so far, its rejection of vaccines offered by the international community can be interpreted as a sign that North Korea has been relatively successful in its efforts to counter the pandemic.

But in the *Rodong Sinmun*, the official newspaper of the Workers' Party of Korea (WPK), articles that emphasize emergency responses to the COVID-19 pandemic have been published daily. According to sources inside North Korea, clusters of deaths from unidentified causes have been reported to have occurred particularly at military bases, in contrast to the complete absence of confirmed cases of COVID-19 reported by North Korea. North Korea's rhetoric stressing the need to defend the "emergency prevention fortress" paradoxically suggests that confirmed cases of COVID-19 may exist in North Korea as well.

Information gathered through sources within North Korea is limited in assessing the overall situation in North Korea not only due to its credibility but also the fact that the information provided by sources is relevant only to the areas in which the informers operate. This study offers a new approach to understanding the COVID-19 situation in North Korea by evaluating the possibility of COVID-19 spreading in the country through the airborne transmission of air pollutants across the border. The purpose of this study is not to provide a scientific analysis based on rigorous results but rather to present a new alternative perspective and to stress the need for a joint response by the two Koreas to evaluate such possibilities.

## ■ Possibility of COVID-19 Virus Crossing the Border into North Korea from the Outside

On October 22, 2020, the North Korean government strongly advised that not only the citizens of North Korea but also officials working at embassies in Pyongyang and at international organizations should refrain from going outside. These measures were motivated by concerns that the COVID-19 virus may be transmitted from China through the Asian dust as its carrier. Upon hearing such news, media outlets in South Korea assessed the measure as an ‘overly sensitive’ and ‘unscientific’ response by North Korea based on how ‘a connection between COVID-19 and yellow sand had not yet been confirmed.’ But instead of merely paying attention to it out of curiosity, there is a need to more accurately assess North Korea’s action considering how the international scientific community and virologists in particular are currently conducting research on the impact that seasonal phenomena such as Asian dust or air pollutants have on the spread of the COVID-19 virus.

Infections caused when the COVID-19 virus attaches to and travels through solid particles or aerosols in the air have been confirmed in closed areas including hospitals or other prevention related institutions. However, it has not been sufficiently verified whether the COVID-19 virus can travel and be transmitted over long distances when attached to aerosols. Various relevant experiments and analyses are currently underway.<sup>1)</sup>

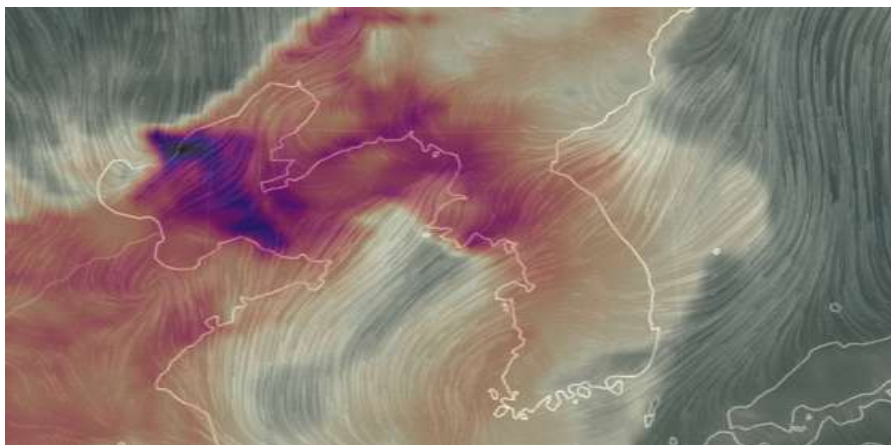
Respiratory droplets caused by sneezing or coughing are particles about  $5\mu\text{m}^2$  to  $10\mu\text{m}$  in diameter which fall to the ground nearby after being emitted from the body. But droplet nuclei, which are less than  $5\mu\text{m}$  in diameter, can travel longer distances through the air. Researchers estimate that the COVID-19 virus, ranging from  $60\text{nm}^3$

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- 1) There are various studies including, Arun Srivastava, “COVID-19 and Air Pollution and Meteorology—An Intricate Relationship: A Review.” *Chemosphere* (2020); Utpal Anand *et al.*, “A Review of the Presence of SARS-CoV-2 RNA in Wastewater and Airborne Particulates and Its Use for Virus Spreading Surveillance,” *Environmental Research* (2021).
  - 2) Micrometer ( $\mu\text{m}$ ): 1 millionth of a meter.
  - 3) Nanometer (nm): 1 billionth of a meter.

to 140nm in diameter, can be transferred through droplet nuclei and can especially travel longer distances when attached to fine dust.<sup>4)</sup> While the Middle East respiratory syndrome (MERS) virus, which belong to the same virus family as COVID-19 virus, can survive in the air for up to 1 hour, the COVID-19 virus can survive up to 3 hours.<sup>5)</sup> Moreover, the survivability of the virus increases on the surfaces of fine dust when it is attached to bioaerosol consisting of microorganisms such as viruses and bacteria that exist in the air.<sup>6)</sup> There have also been findings from empirical research that confirm the possibility of viruses travelling long distances through yellow sand. Researchers in Taiwan have shown, based on results from monitoring during January 1~May 31 in 2006, that the bird influenza virus that existed on the mainland reached Taiwan by crossing the 400km wide Taiwan strait through the yellow sand blowing from the Chinese mainland.<sup>7)</sup>

<Figure 1>

The Korean Peninsula Region Covered by High-density Fine Dust, March 5, 2019



Source: Earth Nullschool homepage, <https://earth.nullschool.net/> (accessed March 5, 2019)

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- 4) Roshan Wathore, Ankit Gupta, Hemant Bherwani and Nitin Labhasetwar, “Understanding Air and Water Borne Transmission and Survival of Coronavirus: Insights and Way Forward for SARS-CoV-2,” *Science of The Total Environment*, vol. 749 (2020), p. 3.
- 5) Maosheng Yao, Lu Zhang, Jianxin Ma and Lian Zhou, “On Airborne Transmission and Control of SARS-Cov-2,” *Science of The Total Environment*, vol. 731 (2020), p. 2.
- 6) Wathore *et al.*, (2020), p. 4.
- 7) Pei-Shih Chen *et al.*, “Ambient Influenza and Avian Influenza Virus during Dust Storm Days and Background Days,” *Environmental Health Perspectives*, vol. 118, no. 9 (2010), pp. 1211~1216.

Based on these discussions, it is difficult to brush aside as unscientific the possibility of the COVID-19 virus being transmitted across the border through yellow sand from China to North Korea, either travelling a shorter distance across the border areas surrounding the Amnok/Yalu and Duman/Tumen rivers or longer distances of more than 200km over the West Sea from the Shandong Peninsula to Pyongyang. While it is difficult to confirm whether North Korean health officials referred to the studies introduced above, North Korea has recognized the danger posed by air pollutants spreading to North Korea from China before the beginning of the pandemic. For example, North Korea forecasted that, as seen in Figure 1, the density of fine dust will increase across the western coastal areas due to fine dust blowing from China with westerly winds from February 27 to March 5 in 2019 just before the beginning of the pandemic and consequently advised people against going outside due to health concerns. North Korea may have inferred the possibility of the COVID-19 virus spreading to the country based on such perceptions of threat of the spread of fine dust from China.

### ■ Possibility of the Spread of COVID-19 Due to Fine Dust Produced in North Korea

The reason why the scientific community has paid attention to the relationship between COVID-19 and fine dust is because in addition to long-distance transmission of the virus, it has also been discovered that individuals exposed to fine dust are more vulnerable to COVID-19 infection.<sup>8)</sup> Considering the probability that the COVID-19 virus exists within North Korea even despite its comprehensive border closures, it can be anticipated that the likelihood of the COVID-19 virus spreading will increase in correlation to the increase of fine dust production as a result of greater use of fossil fuels for heating and cooking during the winter as well as more

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8) For example, see, Yongjian Zhu, Jingui Xie, Fengming Huang and Liqing Cao, "Association between Short-Term Exposure to Air Pollution and COVID-19 Infection: Evidence from China," *Science of The Total Environment*, vol. 727 (2020); Silvia Comunian, Dario Dongo, Chiara Milani and Paola Palestini, "Air Pollution and COVID-19: The Role of Particulate Matter in the Spread and Increase of COVID-19's Morbidity and Mortality," *International Journal of Environmental Research and Public Health*, vol. 17, no. 12 (2020), etc.

time being spent indoors.

In particular, there is a need to highlight the fact that North Korea's dependence on coal and biological fuels such as firewood and charcoal is greater than other countries due to its insufficient supply of energy. Coal, lignite, and other biofuels are the predominant fuels used for heating and cooking purposes in the cities and villages of North Korea. Such circumstances indicate that the people of North Korea are more likely to be exposed to fine dust when indoors and therefore more vulnerable to COVID-19 infection compared to other countries, which have electricity-based economies and societies.<sup>9)</sup>

Existing studies and reports on the COVID-19 situation in North Korea consider the capital city of Pyongyang to be a relatively safe area given that, compared to other regions, resources and personnel related to pandemic prevention have been concentrated as well. However, Pyongyang is also susceptible to the spread of COVID-19 through fine dust. As seen in Figure 2, recent satellite images showing smoke coming out of the chimneys at the Pyongyang thermal power plant confirm that it is being operated. It does not appear that the surrounding areas are being affected because the amount of smoke captured in the satellite image is small and because the image was taken on a sunny day during the summer. But pictures taken in areas near the power plant by foreigners visiting Pyongyang during the winter show large amounts of smoke that covered nearby areas. Moreover, the fact that the power plant is located in the middle of the city and not on its outskirts suggest that there are a large number of Pyongyang citizens who are regularly exposed to smoke.

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9) The issue of respiratory diseases and spread of infectious diseases caused by pollutants produced when cooking indoors is also a concern confronting slums in the cities of third-world countries struggling with the COVID-19 pandemic. See, Jason Corburn *et al.*, "Slum Health: Arresting COVID-19 and Improving Well-being in Urban Informal Settlements," *Journal of Urban Health*, vol. 97, no. 3 (2020), p. 353.

<Figure 2> The Pyongyang Thermal Power Plant in the Pyongchon District



Source: Google Earth (image taken on June 6, 2021, accessed September 15, 2021)

In addition to power plants or factories such as the Pyongyang thermal power plant that emit large amounts of smoke that are visible in satellite images, fine dust is also emitted with dust from a countless number of ‘smaller chimneys’ of ordinary houses that are difficult to see in satellite images. Therefore, Pyongyang is a city that emits a large amount of fine dust in North Korea. It is also possible to presume that the COVID-19 virus will be transmitted indoors during the winter in Pyongyang through fine dust. However, the possibility of the COVID-19 virus spreading is not the same in every area of Pyongyang.

<Figure 3> Tap-3-dong Area in the Taedonggang District



Source: Google Earth (image taken on March 10, 2021, accessed September 15, 2021)

Compared to cities in capitalist countries, the urban areas in the socialist city of Pyongyang promotes economic, social, and cultural equity. However, under the Kim Jong-un regime, large scale high-rise apartments have been constructed on Changjeon street, Yeomyeong street, and Mirae Scientists street. The media and researchers have subsequently interpreted the new city landscape in Pyongyang as signs of change in North Korea. However, such change has not occurred in every area of Pyongyang. Similar to capitalist cities, urban space has started to become differentiated in North Korea as well.

For example, the dependence on other sources of energy such as coal and biofuels will be relatively greater in areas to replace the insufficient supply of electric energy precipitated by varying lengths of time, during which the electric energy is provided



for each district in Pyongyang.<sup>10)</sup> Figure 3, a satellite image of Tap-3-dong area in the Taedonggang district, shows how one-story houses that provide a poor residential environment are concentrated in a disorderly manner. Compared to the Chung district, which is considered the ‘Gangnam area of Pyongyang,’ energy consumption in this area will largely be based on biofuels and, as a result, the probability of infection through fine dust will be relatively higher both indoors and outdoors. In addition, such areas are particularly vulnerable to the spread of infectious diseases because the clustered nature of these houses in terms of spacing makes social distancing difficult to sustain. These spatial characteristics have been witnessed in slums in the cities of third-world countries such as India and Brazil. Moreover, the space in these slums in addition to the preexisting economic and social vulnerabilities of these areas make responding to the COVID-19 pandemic much more difficult compared to wealthier areas in the same cities.<sup>11)</sup> Detached from the ideals of socialist city planning, the likelihood and speed of the spread of the virus can be expected to be higher compared to other wealthier areas in Pyongyang such as those seen in Figure 3 that have been, in reality, differentiated due to economic and social conditions.

The spacial disparity of the spread of the COVID-19 virus observed in Pyongyang can also be applied to other cities. The multiple indicator cluster survey (MICS) published relatively recently in 2017<sup>12)</sup> reports the proportion of energy sources for heating and cooking as well as the number of households per administrative region, and can be used to estimate the areas that are most vulnerable to the spread

10) According to interviews of North Korean defectors conducted by the author, electricity is supplied the longest in the Chung district and the length of time tends to decrease towards the outskirts. Jin-Tae Hwang, “Where is ‘Gangnam of Pyongyang?’” *Journal of The Korean Association of Regional Geographers*, vol. 26, no. 3 (2020), p. 249.

11) Jason Corburn *et al.*, (2020); Kishinchand Poornima Wasdani and Ajnesh Prasad, “The Impossibility of Social Distancing among the Urban Poor: The Case of An Indian Slum in the Times of COVID-19,” *Local Environment*, vol. 25, no. 5 (2020), pp. 414-418.

12) UNICEF, “Multiple Indicator Cluster Survey 2017 Survey Findings Report: DPRK,” pp. 80-83, [https://mics-surveys-prod.s3.amazonaws.com/MICS6/East%20Asia%20and%20the%20Pacific/Korea%2C%20Democratic%20People%27s%20Republic%20of/2017/Survey%20findings/Korea%20DPR%202017%20MICS\\_English.pdf](https://mics-surveys-prod.s3.amazonaws.com/MICS6/East%20Asia%20and%20the%20Pacific/Korea%2C%20Democratic%20People%27s%20Republic%20of/2017/Survey%20findings/Korea%20DPR%202017%20MICS_English.pdf) (accessed September 24, 2021).

of the virus in each area and region through cross-analysis with other data such as population density and satellite images.

### ■ Inter-Korean Joint Response to the COVID-19 Pandemic from the Perspective of a Community of Life on the Korean Peninsula

During his keynote speech at the Oslo Forum on June 12, 2019, President Moon Jae-in stressed that “two Koreas not only share a border, but constitute a community of life that must live together.” During his keynote speech at the UN General Assembly on September 21, he urged North Korea to “change in accordance with the global community era.” A joint response to the COVID-19 pandemic should also be based on the perspective of a community of life on the Korean Peninsula and the global community more broadly.

Joint responses to the pandemic can be divided by short- and long-term policies. As an immediate short-term response, South Korea needs to exert diplomatic efforts to secure a sufficient amount of vaccines that North Korea can trust. As noted above, there is a concern that the likelihood of exposure to the COVID-19 virus will increase in North Korea during the coming winter season due to the increase of fine dust not only travelling across its borders but also produced domestically. While indicators regarding North Korea’s economy suggest that the situation is not as bad as the levels witnessed during the Arduous March, the health situation worsened by the border closures that have been implemented for nearly 2 years is likely to have led to weaker immunity against the virus among the people of North Korea.

In the mid- to long-term, experts and researchers in South Korea should investigate foreign studies regarding the pathways of COVID-19 infection by considering not only South Korea but also including North Korea in their analyses. The verification of the possibility of the COVID-19 virus crossing the border through fine dust requires additional research. It is of course possible, in contrast to the concerns of the author, that the COVID-19 virus is not transmitted through fine dust. However, merely waiting for a future in which our desired outcomes are materialized

is a naive and unscientific response unsuited for the current moment amidst the COVID-19 crisis. Considering forecasts that pandemics similar to COVID-19 will occur frequently in the future, there is a need to establish a joint inter-Korean integrated research governance to combat crises, and this will prove to be the most effective measure to prevent later pandemics similar to COVID-19.

As noted above, the purpose of this study is not to verify the possibility of the COVID-19 virus crossing over the border into North Korea from China or the likelihood of COVID-19 spreading due to fine dust in North Korea, but rather to emphasize that the joint cooperation between the two Koreas is essential to address such concerns. Verification is impossible without basic data on a variety of factors such as fine dust per region, humidity, and the strength of wind. Sharing weather information with the scientific community in South Korea, which will involve less political pressure compared to security-related and politically sensitive information, is the starting point for integrated research conducted jointly by the two Koreas.

Lastly, a change in perception by the North Korean government is necessary. Until now, North Korea has considered proposals related to the area of health by South Korea to be an extension of ‘humanitarian assistance’ provided by ‘wealthy’ South Korea to ‘poor’ North Korea and has relegated the issue as secondary compared to issues related to the economy and the military. However, North Korea, which has been exposed to unpredictable natural disasters such as fine dust and floods over the past few years, appears to have reevaluated such disasters as security threats. North Korea should move past its passive approach, demonstrated by its submission of its Voluntary National Review (VNR) report with the expectation of receiving aid from the international community, and instead pursue a more varied and active response strategy as a member of the ‘global community.’ Within this context, North Korea should consider ways to strategically utilize South Korea, its ‘partner in the community of life on the Korean Peninsula,’ as one of options to its strategy.

Rather than the outcome of the regular cycle of standardized rhetoric intended to repackage inter-Korean cooperation whenever a power transition occurs in Seoul,

the community of life on the Korean Peninsula is a reflection of the new environment in which geographical and material connectivity between South and North Korea is increasing. Waiting for North Korea to announce its first confirmed case of COVID-19 might be too late. Now is a time when bold strategies and implementation for the two Koreas are necessary to transform the COVID-19 crisis into an opportunity to lay the foundation of a community of life on the Korean Peninsula. ©KINU 2021

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