



Vulnerability Assessment of the Potential Radiation Contamination Risk Associated with the Punggye-ri Nuclear Site in North Korea:

Human Rights Shortcomings and the Role of the United Nations

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Abstract

The human right to health of over 1,080,000 citizens living near Punggye-ri nuclear test site in North Korea is potentially at risk. In early 2024, the South Korean Ministry of Unification identified 17 among 80 North Korean defectors who suffered from chromosomal abnormalities, raising the possibility of severe impact from radiation exposure. The United Nations (UN) has played a pivotal role in promoting climate and human rights norms, intended to induce policymaking that is more supportive of both climate change and human rights. Furthermore, the UN and related agencies have perhaps been the only forces to provide humanitarian aid for the disaster-affected citizens in North Korea. The Kim Jong-un regime has been incapable of meeting the needs of its citizens and has systematically violated their human rights by prioritizing its nuclear program. This article analyzes the current human rights shortcomings of the Kim Jong-un regime, particularly the human right to health of its citizens, which it has put at risk in the region near the Punggye-ri nuclear test site. Further, this article analyzes past efforts at socialization in the context of intergovernmental organizations (IGOs) and how IGOs have contributed to promoting North Korean policymaking more supportive of climate and human rights norms by the Kim Jong-un regime. It argues that the application of socialization in the IGO context should also be undertaken to address the human rights situation of North Korean citizens living near the Punggye-ri nuclear test site to encourage greater adherence to climate and human rights norms by the Kim Jong-un regime.

Keywords: socialization in the IGO context, Punggye-ri nuclear test site, North Korea, human right to health, United Nations

Introduction

The Kim Jong-un regime's hostile behavior reached unprecedented levels during the period 2022 to 2023. During that period, it conducted at least 105 missile tests (HRW 2024, 10), including launching a spy satellite in late 2023. In response to security threats posed by the North Korean regime's bellicose actions, South Korea decided to suspend the military pact with North Korea formalized in 2018. In response, North Korea then fully suspended that pact (Mackenzie and Chatterjee 2023). As the trilateral alliance between the US, South Korea, and Japan strengthened to counter the security threats posed by North Korea, the Kim Jong-un regime has made further threats against South Korea, and indeed the entire international community, by maintaining close ties with Russian president Vladimir Putin. Additionally, the regime designated South Korea as its "principal enemy," effectively announcing that it had abandoned the goal of reunification with South Korea (Slow 2024).

Given such increased levels of hostility, there is a greater chance that the Kim Jong-un regime could conduct another round of nuclear tests at Punggye-ri in the near future. If the Kim Jong-un regime chooses to do so, it would exacerbate the existing climate crisis and further undermine ordinary North Korean citizens' human right to health as articulated by the International Covenant on Economic, Social, and Cultural Rights (ICESCR). Article 12 of the ICESCR recognizes the human right to health as "...the right of everyone to the enjoyment of the highest attainable standard of physical and mental health," and further stipulates that state parties take steps to fully realize "(a) The provision for the reduction of stillbirth-rate and of infant mortality and for the healthy development of the child; (b) The improvement of all aspects of environmental and industrial hygiene; (c) The prevention, treatment and control of epidemic, endemic, occupational, and other diseases; (d) The creation of conditions which would assure to all medical service and medical attention in the event of sickness" (UNGA 1966).

The current situation in the area near the Punggye-ri nuclear testing site is very worrisome. The South Korean Ministry of Unification recently found that 17 out of 80 North Korean defectors were suffering from chromosomal abnormalities, implying they had been severely impacted by radiation

exposure (Jung Eun Lee 2024).

Meanwhile, the United Nations (UN) has played a pivotal role in promoting climate and human rights norms to induce policymaking that is more supportive of both. Furthermore, the UN and related agencies have perhaps been the only forces to provide humanitarian assistance to the disaster-affected citizens of North Korea at a time when the Kim Jong-un regime has not only been incapable of meeting the needs of its citizens but has systematically violated their human rights by prioritizing its nuclear program over their welfare. This article posits that coercive approaches have failed to force the Kim Jong-un regime to make policy choices more supportive of denuclearization and climate and human rights norms. Thus, socialization approaches should be considered for engaging the Kim Jong-un regime to induce policymaking that is more supportive of these aforementioned norms. Given the lessons learned from past socialization efforts regarding climate change and human rights concerns, the potential impact of socialization approaches on denuclearization, particularly in the environmental and human rights contexts, should be seriously considered.

This article, therefore, addresses the North Korean regime's current human rights shortcomings, specifically the human right to health of its citizens living near the Punggye-ri nuclear test site. It also analyzes the role that past efforts at socialization within the intergovernmental organization (IGO) context have played in shaping North Korean policymaking that supports climate and human rights norms. The study argues that socialization should again be undertaken in connection with the current situation of North Koreans in the Punggye-ri nuclear test site region, with the hope that in doing so North Korea will exhibit greater adherence to climate and human rights norms.

Climate Change, Denuclearization, and Socialization in Theory and IGO Practice

Climate change, in addition to the risks posed by nuclear weapons, threatens the human rights of the citizens of North Korea and beyond. The crisis of

climate change and nuclear weapons has multiplied other, greater risks and vulnerabilities. North Korean citizens have suffered from the consequences of climate change, particularly in the form of natural disasters that include recurrent flooding and drought (J. H. Kim 2024). The droughts of 2014 and 2020, for example, were reported to have had a disastrous impact on North Korean citizens. According to North Korean media, the deadliest flooding occurred in the Amnok River regions during the summer of 2024, resulting in the death or displacement of more than 5,000 citizens, while about 15,400 citizens lost their homes (M. Kang 2024, 5). In one of his luxury cars, Kim Jong-un visited a less-affected area for a photo opportunity (Jae Hoon Lee 2024), while many old rescue helicopters crashed during subsequent rescue operations (Koh 2024a) and thousands of dead bodies and disaster-affected citizens were abandoned in Jagang-do Province (Koh 2024b). The Kim Jong-un regime was unable to respond to the disaster, and yet it refused to seek outside assistance (M. Kang 2024, 11).

The coercive approaches advocated by both the Kim Jong-un regime and the international community have been ill-suited to address climate change, denuclearization, and/or the human rights violations that amount to crimes against humanity. Indeed, the Kim Jong-un regime's use of coercion in dealing with the climate change crisis resulting from the pursuit of nuclear weapons has only significantly strained diplomatic relations with the international community, further deteriorating the human rights of its own citizens. On the other hand, the use of coercion by the international community has not been effective in dealing with North Korea's misgovernance of the climate crisis, its pursuit of nuclear weapons, nor the crimes against humanity that it has consistently committed against its own citizens.

Habib has argued that climate change should be addressed with a human rights approach rather than the realist concept of self-help of states (Habib 2011). Another conventional approach, incentivization, has been similarly unsuccessful in, *inter alia*, decreasing the Kim Jong-un regime's hostile behavior. Both coercion and incentivization have failed to lead to either the internalization of climate change norms or to denuclearization. Goodman and Jinks (2004) have argued that the shortcomings of coercion

and incentivization result from the failure to recognize the complexity of the socially constructed inter-state environment, including interactions between state actions and norm diffusion.

English School rationalism further recognizes that ongoing socialization by repeated interactions among states could result in a common set of norms and principles. As Hedley Bull wrote, “A society of states (or international society) exists when a group of states, conscious of certain common interests and common values, form a society in the sense that they conceive themselves to be bound by a common set of rules in their relations with one another, and share in the working of common institutions” (Bull 1977, 13). Socialization is “the process by which actors internalize the expectations of behavior imparted to them by the social environment” (Boekl et al. 1999, 7), and therefore can be viewed as the internalization of international rules and norms (Alderson 2001; Hooghe 2004). As Finnemore and Sikkink pointed out, socialization takes place as “...state leaders conform to norms to avoid the disapproval aroused by norm violation and thus to enhance national esteem” (1998, 904).

The level of a state’s socialization is often measured by its degree of compliance. There are two types of norm internalization. Domestic norm internalization occurs when norms are integrated into a state’s overall policymaking as to its social, political, and legal practices. International norm internalization occurs as a product of top-down socialization within international organizations and among state officials, including other political elites. Checkel argues that this latter form of norm internalization comprises the transition from the “logic of consequences to a logic of appropriateness; this adoption is sustained over time and is quite independent from a particular structure of material incentives or sanctions” (Checkel 2005, 804–805).

Intergovernmental organizations (IGOs) have played an important role in diffusing international norms and practices for both the environment and human rights. A state’s membership in relevant IGOs increases the chances of transforming its norm-violating behavior, primarily through top-down socialization (Greenhill 2015). Thus, IGOs play a crucial role as “sites and promoters of socialization” (Checkel 2005, 806–808) as well as the agents of

norm entrepreneurs (Finnemore and Sikkink 1998).

There are two types of socialization in the IGO context (Checkel 2005, 804). Type I socialization is when a norm-violating state makes a partial behavioral change but does not fully engage in norm internalization. Therefore, the targeted state's initial interests have not yet been changed (Bearce and Bondanella 2007, 706). Type II socialization, however, consists of much greater socialization processes so that a state fully internalizes new international norms by integrating them into its domestic legal system, which may, in turn, lead to changes to its initial interests (Bearce and Bondanella 2007, 706).

Greenhill's (2015) study indicated that socialization in the context of IGOs has influenced authoritarian states such as China and Bahrain. Membership in IGOs has improved human rights practices in Bahrain, while increased interactions between China and the United Nations Human Rights Council (UNHRC) and its related agencies have led to some degree of policy change regarding human rights in China (Greenhill 2015, 82–91).

Socialization in the IGO context has also contributed to the promotion of international human rights norms and practices in North Korea. Choi and Howe's findings indicated that the UN's attempts at socialization in 2014 led to the Kim Jong-un regime recognizing that its violation of human rights norms comprised "crimes against humanity" (Choi and Howe 2018, 118–119). Although the UN's 2014 attempts at socialization have been only partially successful, they notably induced the Kim Jong-un regime to sign and ratify the Convention on the Rights of Persons with Disabilities (CRPD) (Choi and Howe 2018, 129). Also of note, the Kim Jong-un regime submitted follow-up reports to the CRPD in 2019 and again in late 2023 in response to questions raised by the CRPD in connection with its initial report (Song et al. 2024, 22). Furthermore, as much as fifty percent of North Korean laws that had been in violation of human rights norms were either revised or replaced by newly enacted legislation (Song et al. 2024, 22).

Similarly, IGOs have been leading efforts to resolve climate change and address the human rights crisis in North Korea. For instance, the UN and its related agencies have been the only institutions to provide assistance to disaster-affected North Korean citizens. Regrettably, the Kim Jong-

un regime suspended UN operations in 2020 as part of its COVID-19 restrictions (UNGA 2023, 8); however, North Korea lacked the capacity to help its citizens. In response to this deficiency, North Korea has agreed to and signed the Paris Agreement (PA) under the UNFCCC (Ha 2021, 163), creating a global climate governing regime.

The Kim Jong-un regime has expressed the political will to adhere to the climate norms of the PA; however, the actual level of compliance to the PA remains highly questionable. As measured by the climate action tracker, North Korea's compliance level was "insufficient" due to the lack of internal capacity (Koons 2021). A capacity shortfall remains the most challenging area for PA implementation for the vast majority of developing nations (Popovski 2019). In a failed state such as North Korea, the problems related to inadequate capacity are even worse than those found in other developing nations.

In fact, North Korea has been identified as one of the most fragile states in the world (FSI 2024). The regime's COVID-19-related border restrictions added insurmountable burdens to the economic activities of its citizens, leading in turn to deteriorating human rights conditions among ordinary North Koreans. Not permitting UN operations within its territory has significantly hindered the PA's bottom-up implementation. More importantly, the Kim Jong-un regime has disregarded the apparent fact that the nuclear testing undertaken at Punggye-ri has created a major threat to the human right to health of its own citizens and the citizens of neighboring countries.

Meanwhile, the coercive measures undertaken by IGOs over the past two decades to pressure North Korea to denuclearize have failed. In retaliation against the coercive measures imposed by IGOs, North Korea withdrew from the Non-Proliferation Treaty (NPT) in 2003 (Winters 2005, 1499). Further, beginning in 2009, North Korea has prevented the International Atomic Energy Agency (IAEA) from inspecting its nuclear sites (Murphy and Smith 2021). In addition, the UN imposed sanctions against North Korea but they were largely ineffective as China and Russia circumvented the sanctions to aid the Kim regime (Choi et al. 2017; Zwirko 2024).

Unfortunately, the same sanctions adversely impacted the human rights

of ordinary North Korean citizens (Haggard and Noland 2023, 1–8). The UN Security Council (UNSC) introduced an updated version of Resolution 1718 Implementation Assistance Notice (IAN) No. 7, which allowed humanitarian assistance activities by IGOs and INGOs (international non-governmental organizations) while the sanctions imposed against North Korea remained intact (UNSC 2023). However, the effort has largely been undermined by the Kim Jong-un regime's decision in 2020 to suspend all UN humanitarian activities within their territory due to the border lockdown (UNGA 2023, 8). The most recent development indicates that North Korea resumed its nationwide vaccination campaign in 2024, allowing shipments into the country of six types of essential vaccines provided by United Nations International Children's Emergency Fund (UNICEF), Gavi, and the World Health Organization (WHO) (Igram and Frisone 2024). Also, the Kim Jong-un regime allowed UNICEF to assist with transporting and field monitoring to ensure safe access to the vaccines of nearly one million children and pregnant women (Frisone and Alhattab 2024). Although the Kim Jong-un regime has not yet fully reopened the border or allowed the return of all UN staff, the recent vaccination campaign efforts present an important opportunity for IGOs to engage with North Korea—both to socialize North Korea in an IGO context from the bottom-up (among ordinary citizens) and from the top-down (the Kim Jong-un regime).

More recently, Russia vetoed the UNSC's proposed extension of the mandate for an expert panel on sanctions against North Korea (UN 2024). Former US Ambassador to the United Nations Linda Thomas Greenfield said that “out of box” approaches were needed to address failed monitoring sanctions against North Korea (*Korea Times* 2024a), and further added, “...the imperative of DPRK human rights is at the forefront of the UNSC's agenda (*Korea Times* 2024b).

Since the failed summit between Kim Jong-un and US President Trump in 2019, the Kim Jong-un regime's hostile behaviors have increased (Song et al. 2024, 23). During that 2019 summit, human rights received little or no attention from the former South Korean administration despite the fact that addressing human rights might have furthered its primary objective of denuclearization (King and Shin 2021, 16–19). Cha has argued

that denuclearization efforts would be facilitated by a human rights agenda because “new US-DPRK relations or [a] stable peace regime on the Korean Peninsula...could be achieved without a fundamental transformation of political relations between the US and the DPRK, and that transformation is impossible without an improvement in the human condition” (Cha 2021, 171–172).

Given the lessons learned from past socialization efforts vis-à-vis climate change and human rights concerns, the potential impact of socialization approaches on denuclearization, particularly in the environmental and human rights contexts, should be seriously considered.

Vulnerability Assessment of Potential Radiation Contamination at the Punggye-ri Nuclear Test Site in the Context of Human Rights during the Kim Jong-un Era

There have been six nuclear tests conducted at the Punggye-ri nuclear test site between 2006 and 2017, and the resulting environmental problems have become increasingly serious human rights concerns for the population in the region and beyond it. Among those six nuclear tests conducted at Punggye-ri, the last test is considered the most powerful (H. Lee et al. 2023). In 2018, the collapse of the test tunnels followed by several earthquakes, along with the previous multiple nuclear tests taken in Punggye-ri, likely caused “tired mountain syndrome” (Pabian and Liu 2017), which resulted in the leakage of dangerous radioactive materials into the air, soil, and water (Brady 2019, 2). Experts like Dr. Kim Bok Chul claim that contamination of groundwater by harmful radioactive materials in North Korea is highly possible (South Korean National Assembly Secretariat 2019, 86), and a Dr. Lee expressed concerns as the situation of the groundwater is frightening and out of control (South Korean National Assembly Secretariat 2017b, 76).

The environmental and human rights situation caused by the Punggye-ri nuclear test site has been counterproductive to the already existing environmental and human rights crises in North Korea. Chun and Lee’s

research indicated that the country has already suffered from widespread groundwater and soil contaminations caused by illegal discharges of industrial and non-treated wastewater and excessive use of agricultural fertilizers and chemicals (Chun and Lee 2018, 447). The contaminations of groundwater and soil will likely increase as long as the Kim Jong-un regime fails to adequately invest in or manage the facilities regarding this issue (North Korean Ministry of Land and Environment Protection 2012). It is more problematic that the majority of North Korean citizens have no option but to use the contaminated groundwater and soil. Several spring water companies have been operating since the mid-1990s (Cho et al. 2013), and one of them provided exclusively to Kim's family (Chun and Lee 2018, 453–454). However, most of the North Korean citizens are unlikely to get access to these spring waters.

Furthermore, efforts to increase arable lands through severe deforestation has exacerbated the impacts of climate change, particularly in the regions near the Punggye-ri nuclear test sites (Chun and Lee 2018, 450–451) as well as the environmental pollution generated from those activities (Ki 2016, 133–146), while the North Korean regime has failed to secure food to its citizens since the North Korean famine of the 1990s (Lankov 2015, 81–82). The research by Ki et al. (2019, 563–573) concluded that major deforestation occurred from the first to the third nuclear tests in the regions near the Punggye-ri test sites. The research found cracks in some rocks following the second nuclear test that might have led to the release of harmful radioactive materials that could have contaminated the groundwater in the regions. Furthermore, major deforestation was also observed throughout much-expanded areas from the fourth to sixth nuclear tests. Large-scale earthquakes from the nuclear detonations likely resulted in possible radiation leaks into the soil and groundwater (Ki et al. 2019, 563–573). A study by Lewis (2017) also asserted that the sixth nuclear test caused major forest and environmental destruction that could lead to large-scale, secondary earthquakes at any moment in the future, which increases the chances of possible radiation leaks into the air, soil, and groundwater.

Another major concern is North Korea's high vulnerability to climate-related natural disasters. The contaminated areas could expand should

heavy rains carry the radioactive materials to other regions. Like many other regions in North Korea, the areas near the Punggye-ri nuclear test site have experienced natural disasters, such as recurrent flooding caused by heavy rains. For instance, just five days before the fifth nuclear test at Punggye-ri, hundreds of people died and about 68,000 were displaced by a massive flood in North Hamgyong Province (J. Y. Kim 2016). Another heavy rain in 2019 severely damaged roads and bridges around the Punggye-ri nuclear test site (Jung 2020). In 2022, the use of tunnel number four at the Punggye-ri nuclear site was suspended due to flooding (Bermudez et al. 2022).

The Kim Jong-un regime has also failed to deal adequately with the post-disaster situation. At the same time, the IFRC (International Federation of Red Cross and Red Crescent Societies), UN, and other humanitarian organizations have been the only forces providing immediate assistance to those disaster-affected citizens in an attempt to fill the vacuum of governance in areas abandoned by North Korea. Despite failing to provide post-disaster management, the Kim Jong-un regime has refused outside help since 2020. Since that date the Kim regime has not allowed the entry of UN staff members (UNGA 2023, 8), further exacerbating the humanitarian crisis in disaster-prone regions. Currently, the IFRC is the only humanitarian aid organization operating to save disaster-affected victims in North Korea. According to the IFRC's 2023 mid-year report, the North Korean regime "concentrates its consistent efforts on the agricultural development, land management, eco-environment protection, education, and health, etc." (IFRC 2024, 2). However, the regime's inability to deal with the situation is evident since the country's existing domestic laws and regulations regarding environmental protection from industrial wastewater, agricultural fertilizers, and chemicals are not detailed enough to be practical. The worst thing is that North Korea has no environmental regulations regarding potential radioactive contamination by its nuclear facilities (Chun and Lee 2018, 444–453).

The Kim Jong-un regime's efforts have been somewhat limited and remain largely rhetorical due to the prioritization of its military and nuclear programs. Amidst the country's many problems, to include its food crisis, the Kim Jong-un regime has been obsessed with the pursuit of nuclear weapons. In late 2022, Kim Jong-un remarked, "Our generation will not

pursue an immediately visible improved environment for the economic life at the cost of giving up the nuclear weapons...nor will we change our choice even if it would mean experiencing great difficulties” (UNGA2023, 6). The misgovernance of nuclear program prioritization and its consequences would prove unbearable for most citizens of North Korea. The widespread deforestation due to several nuclear tests at Punggye-ri will likely be another factor undermining overall agricultural activity in the region (Chemnick 2019). The regime has been unable to secure food for most of its citizens since the North Korean famine of the 1990s (Lankov 2015, 81–82). In 2019, over ten million people, about 40 percent of the population, were faced with food insecurity (UNFAO and UNWFP 2019). The food situation remains incredibly fragile as the country’s agricultural output in 2022 once again fell far below average (UNFAO 2022). UNSCR 2397 sanctions banning agricultural equipment, such as hand tools, irrigation equipment, and tractors, have negatively impacted overall agricultural production, which in turn adversely affects the human rights situation of North Korean citizens (Haggard and Noland 2023, 5). The most recent interviews conducted by the UNOHCHR (United Nations Office of the High Commissioner for Human Rights) indicated that starvation was occurring in North Korea due to the regime’s restrictions on various small economic activities in border areas among citizens (UNGA 2023, 7). The importation of 46,000 metric tons of rice from China in early 2023 (UNGA 2023, 7) and the deepening military cooperation with Russia in exchange for food in early 2024 (Herskovitz 2024) are not viable long-term solutions to the country’s chronic food shortages. Furthermore, the regime’s restriction on UN activities inside the country since 2020 (UNGA 2023, 8) has not helped procure citizens’ immediate needs. The Kim regime’s recent strategic failure to deepen military cooperation with Russia undermines denuclearization efforts on the Korean Peninsula, which will likely be counterproductive to efforts at environmental protection in areas near the Punggye-ri nuclear site, deteriorating citizens’ human right to health.

The Kim Jong-un regime’s response to the environmental damage at the Punggye-ri nuclear test site has always been inadequate. The government has claimed there was no leakage of radioactive materials after the fifth nuclear

test at Punggye-ri in 2016. In mid-2018, the North Korean deputy director of the Nuclear Weapons Research Institute once again asserted, “There is no leakage of radioactive materials and the surrounding ecological environment is very clean” (H. Lee et al. 2023, 25). However, it is difficult to believe such claims since the regime has never provided scientific evidence to back them (H. Lee et al. 2023, 25). In addition to the leakages of radioactive materials into groundwater and soil being made by nuclear tests at Punggye-ri, as analyzed in earlier sections, some Chinese scientists have warned of possible leakages of radioactive materials into the air after the collapse of the nuclear site in 2017 (Kang 2017). Indeed, atmospheric transport of radioactive xenon was observed in neighboring countries such as Japan, seemingly from the fourth nuclear test at Punggye-ri in early 2016 (De Meutter et al. 2017). Another concern is that local and international communities consume agricultural and marine products from the areas around the Punggye-ri nuclear test site. For instance, pine mushrooms, one of the local specialties at Punggye-ri, have been traded or smuggled to China, South Korea, and Japan for decades. The items are often difficult to track since North Korea has never disclosed relevant information about them (An 2017; H. Lee et al. 2023, 43). China remains North Korea’s number one trading partner (Choi et al. 2017), even though they temporarily banned the import of agricultural and marine products from North Korea after the first nuclear test in 2006 (H. Lee et al. 2023, 43). However, data from 2015 indicates that about 41 seafood processing companies in China were at that time importing seafood from North Korea, and half of these products were reexported to the US and European nations (Park 2015).

South Korea began to increase its imports of North Korean agricultural and marine products in the late 1990s. South Korea took no action after the first nuclear test by North Korea in 2006, while China and Japan banned imports of North Korean agricultural and marine products. As concerns intensified regarding North Korean marine products harvested in the seas off Kilju County (South Korean National Assembly Secretariat 2006, 6–9), the area closest to the Punggye-ri nuclear test site, the former North Korean minister of maritime affairs and fisheries said, “There have been no instances of radioactive substances being detected above the standard level” (H. Lee et

al. 2023, 46). Even after North Korea's second nuclear test in 2009, the then South Korean government continued to import agricultural and marine products without restrictions (H. Lee et al. 2023, 46). The South Korean government finally acted to ban all North Korean agricultural and marine products after North Korea viciously attacked the South Korean naval vessel, the Cheonan, in 2010 (Hong 2010). In 2015, the South Korean government announced for the first time that smuggled agricultural products from North Korea might have been radioactively contaminated. According to the South Korean government, radioactive cesium isotopes detected among smuggled pine mushrooms from North Korea were nine times the standard levels (Yoon 2015). Meanwhile, interviews in 2016 by private organizations revealed the health problems of North Korean defectors who escaped Kilju County. According to the findings, thirteen defectors from Kilju County had experienced such symptoms such as headaches, weight loss, and decreased sensory functions (H. Lee et al. 2023, 52).

Therefore, there was a growing need for further investigations. The South Korean Ministry of Unification, in cooperation with the Korea Institute of Radiological and Medical Sciences (KIRAMS), began to conduct radiation exposure tests for North Korean defectors from the areas near the Punggye-ri nuclear test site. However, only thirty North Korean defectors were tested in 2017, and ten in 2018 (H. Lee et al. 2023, 50). Among these, four of the North Korean defectors showed worrying levels of chromosomal abnormalities, as shown in Table 1 below (H. Lee et al. 2023, 62). The former South Korean Minister of Unification Cho Myung Gyon concluded, "...we plan to conduct health checkups, including for radiation exposure, on all the North Korean defectors from Kilju County who wish to have them" (South Korean National Assembly Secretariat 2017a, 70).

Table 1. Combined Table of the Four North Korean Escapees with Abnormalities in the 2017 Tests

Subject	Sex /Age	Stable chromosome				Unstable Chromo-some	Residence at the time of each nuclear test (year) /Occupation	Year of last escape from North Korea	History of medical radiation exposure (type/year)	Personal history
		Number of abnormal chromo-somes	Median (Gy)	95% confidence interval		Number of abnormal chromo-somes				
				Lowest (Gy)	Highest (Gy)					
1	M43	10	394	149	719	2	1st(2006) Punggye-ri /Farmer 2nd(2009) Punggye-ri /Farmer	2011	Chest X-ray every two years (every two years; 4 times in total)	Former smoker (4 pack-years; quit 4 years ago) No work experience in handling harmful chemicals (pesticides, etc.)
2	M74	8	320	53	645	4	1st(2009) Kilju County /Office worker 2nd(2009) Kilju County /Office worker	2010	1 head and neck CT in 2015 1 chest X-ray and 1 head X-ray in 2015	Current smoker (30 pack-years)
3	M53	8	320	0	1073	2	1st(2006) Kilju Town, Kilji County /Laborer 2nd(2009) Kilju Town, Kilju County /Laborer	2010	1 chest X-ray (2010)	Current smoker (30 pack-years)
4	F39	7	279	0	1037	1	1st(2006) Kilju County /Unemployed 2nd(2009) Kilju County /Unemployed	2012	1 chest X-ray (2017)	Non-smoker

Source: H. Lee et al. (2023, 62).

Nonetheless, after all of its findings, the former South Korean Ministry of Unification was reluctant to conduct any follow-up tests of the defectors and abruptly stopped testing in 2019 (Ng and Mackenzie 2023). The South Korean Ministry of Unification failed to resume the tests in 2021 and 2022. As of early 2023, data indicates that about 33,882 North Korean defectors had entered South Korea as of 2022, 881 of whom had lived in one of the eight cities of Kilju, Hwadae, Kimchaek, Myonggan, Myongchon, Orang, Tanchon, and Paegam, or counties in North and South Hamgyong and Ryanggang provinces, that is, in areas near the Punggye-ri nuclear test site (H. Lee et al. 2023, 50). In early 2024, the South Korean Ministry of Unification, with the help of KIRAMS and the Korea Hana Foundation, announced additional test results: seventeen defectors out of eighty who were tested exhibited higher than standard levels of chromosomal abnormalities which indicated that they had been exposed to harmful levels of radiation (Shin 2024). The South Korean government once again concluded that those seventeen defectors might have been “adversely impacted by the nuclear tests conducted at Punggye-ri nuclear site in the DPRK” (Shin 2024). However, they further added, “... Computed tomography (CT), smoking, and old age etc., could also be contributing factors to the test results therefore, a direct link to nuclear testing has not been proven” (Shin 2024). However, the latest radiation test was considered extremely limited because of the small sample size. The director of the Transnational Justice Working Group, Lee Young Hwan, argued that a much larger number of defectors should be tested for the test results to be considered more scientifically credible, and thus follow-up research is much needed (Shin 2024).

According to the international radiation dosage standards, there is a risk of cancer as well as death from levels above 1,000 mSv (H. Lee et al. 2023, 59). The test results were concerning because the North Korean defectors tested significantly higher. Indeed, Dr. Barretta noted that those test results levels “would cause serious radiation sickness” (Y. K. Kim 2019). Further, a Dr. Joo added, “The test results for the North Korean defectors showed staggering levels that are hundreds of times higher than that of the average person, numbers that could not show up unless exposed to radiation” (M. S. Kim and K. H. Kim 2019). Over twenty defectors among the people who

were tested in 2016 said that they suffered from leukopenia, headaches, and ailments in the bones and joints (H. E. Kim 2018).

Water use is a particular concern as many of North Hamgyong Province's citizens consume groundwater daily. As of 2008, according to data from North Korea, up to about 15 percent of citizens in North Hamgyong Province were using groundwater as drinking water (H. Lee et al. 2023, 32). In 2021, the Voluntary National Review (VNR) by North Korea indicated that only about 44.5 percent of the rural population had access to safe water (South Korean Ministry of Unification 2023, 277). One of the defectors from Kilju County in North Hamgyong Province also stated their family members and neighbors used to drink groundwater from the Punggye-ri nuclear test site (H. E. Kim 2018). They found out about the existence of the Punggye-ri nuclear test site and its potential risk of radiation exposure only after coming to South Korea. However, their neighbors and other citizens were not aware of the harm of radiation due to a lack of information (H. E. Kim 2018). Other defectors' testimonies indicated that the Kim Jong-un regime did not evacuate or warn citizens while conducting the six nuclear tests at Punggye-ri (Mun 2018).

North Korea's broken healthcare system under Kim Jong-un poses a further threat to the human right to health for the residents of regions near the Punggye-ri nuclear test site. The system under the Kim Jong-un regime is so broken that citizens cannot sustain themselves without outside help. However, the Kim regime aggressively imposed COVID-19-related policies as it sought to use the pandemic as an opportunity to increase control over its citizens. The regime rejected the COVID-19 vaccine aid offered by the international COVAX initiatives, claiming that there were no COVID-19 cases in the country (Choi 2022). In mid-2022, the regime announced the first outbreak of COVID-19 in the country (Chung and Kim 2022). At the same time, the regime introduced the first COVID-19 vaccination program with the help of China, but the specific details of the program were mainly unknown due to the lack of transparency by the Kim Jong-un regime (Song et al. 2024, 134). Furthermore, since 2020, when the regime suspended international humanitarian aid due to COVID-19-related border restrictions, many women and children have not been vaccinated against

vaccine-preventable diseases such as measles, rubella, polio, and tuberculosis (UNGA 2023, 8–9).

WHO data indicates that North Korea has about 133 centralized tertiary care hospitals, 1608 secondary care hospitals, and 6,263 clinics, with about 235 anti-epidemic related health facilities (WHO 2016), with about 215,727 health-related personnel working in these facilities (Grundy et al. 2015, 1–10). However, most facilities have been poorly managed and equipped, with severe shortages of the necessary medicine and equipment to treat patients. Many of these medical facilities lack even the most basic medicines and essential diagnostic tools such as disinfectants, antibiotics (Pollack and Dalnoki-Veress 2021), and even X-rays, blood testing kits, hematology, ultra-sound imaging tools, etc. (WHO 2016; Pollack and Dalnoki-Veress 2021). The Kim regime has acknowledged this failure, noting, “the need for pharmaceutical supplies, modern medical appliances, and the need for the construction of new hospitals in Pyongyang” (Explore, Democratic People’s Republic of Korea 2018; Hotham 2019). Since North Korea is “unable to produce all medical supplies by itself” medical supplies need to be provided, even if it means importing them (UNGA 2023, 8). Most of North Korea’s pharmaceutical factories have become inoperative due to a shortage of raw materials and electricity (S. Cho 2019). As the country’s pharmaceutical supply system is completely broken over 90 percent of medicine and medical supplies need to be imported (Song et al. 2024, 135). Since early 2020, the regime’s border restrictions have caused a significant decrease in international aid (UNGA 2023, 1–14) and even Chinese medical supplies (Kang and Ishimaru 2021).

According to the Database Center for North Korean Human Rights, about 95 percent of North Korean defectors have reported that the regime has not provided basic medicine and necessary medical supplies since 2019. About 85 percent have testified they had to buy medicine from unauthorized private pharmacies (Song et al. 2024, 129). Medicine would often be purchased on the black market without a doctor’s prescription, potentially putting patients in danger (S. Cho 2019). Most of the medicine and medical supplies sold by these unauthorized private pharmacies are extremely expensive; therefore, it is difficult for ordinary citizens to access them (Song

et al. 2024, 130). Furthermore, about 25 percent of defectors answered that they saw patients die due to a lack of necessary facilities, proper medical treatment, and adequately trained medical staff (Song et al. 2024, 130–136). According to the most recent VNR report by North Korea, the Breast Tumor Institute at Pyongyang Medical Hospital, Okryu Children's Hospital, and Ryukyong General Ophthalmic Hospital have been constructed since 2012 (DPRK VNR 2021). However, challenges in sustaining modernized medical supplies due to the country's severe economic crisis have persisted (Song et al. 2024, 131–136). It is reported from defectors' testimonies that injection needles for vaccinations are reused at least two or three times and electricity to most of the hospitals is provided for only two hours per day (South Korean Ministry of Unification 2023, 272). Furthermore, medical equipment, such as x-ray machines, sterilizers, ambulances, hospital beds, medical and surgical furniture, etc., has been banned by sanctions since 2016, which has had a direct and adverse impact on the most vulnerable citizens in North Korea (HRW 2024, 136; Haggard and Noland 2023, 5). North Korea's overall healthcare system has long been collapsed, and the situation has even worsened since early 2023 as city hospitals forcefully remove patients due to a lack of fuel (Song et al. 2024, 136).

According to WHO data, the healthcare worker-to-patient ratio in North Korea is relatively high, with about 36.7 doctors per 10,000 citizens (WHO 2019). However, most of these doctors are poorly trained and not well-positioned to provide high-quality medical services (Grundy et al. 2015, 1–10). Many of them have been unpaid by the regime as North Korea's economy has long collapsed; therefore, many doctors illegally practice medicine outside of hospitals, and patients are often forced to pay bribes to receive treatment (South Korean Ministry of Unification 2023, 273–276). Since the majority of doctors are incapable of providing even a minimal level of medical services, it is difficult to expect them to treat patients with severe diseases caused by radiation exposures from the Punggye-ri nuclear test site.

The Kim Jong-un regime has been widely known for its brutal human rights abuses and crimes against humanity committed against ordinary citizens as well as prisoners at political prison camps. Political prison camp number 16, Hwasong, is only about 1.5 kilometers from the Punggye-ri

nuclear testing site (Bogle et al. 2023, 2). Prison camp number 16 has been in operation since 1983 (Bermudez et al. 2015), and holds an estimated 20,000 prisoners (Bogle et al. 2023, 4). Most of the prisoners in this facility are being held for life simply for having done or said something against the Kim regime, and they are often subjected to forced labor under the most dangerous conditions (Hawk 2012).

The potential health risks for prisoners exposed to harmful radiation have grown significantly since prisoners have been subjected to forced labor at the Punggye-ri nuclear test site. A former guard at political prison camp number 22, Ahn Myeong Cheol, testified in 2009 that “from the early 1990s, young political prisoners from camps in Hoeyong, Jongsong, and Hwasong were taken to an underground construction site at Mt. Mantap... it was a source of fear among the political prisoners. Once taken there, no one came back alive” (Bogle et al. 2023, 6). Other defectors also testified in 2016, “...My understanding is that the state had mobilized prisoners from *gwalliso* [political prisoner camp] number 16 to the Punggye-ri site for digging purposes...before they carry out the test, everything needs to be done secretly, which is why they mobilized political prisoners, who are easy to control, rather than members of the general public (*Daily NK* 2016). However, the Kim regime has long denied the existence of these political prison camps. At the same time, North Korean citizens’ human right to health is at risk, exacerbating the existing human rights crisis in the country.

Conclusion

In the recent test results by the South Korean Ministry of Unification, with the help of KIRAMS and the Korea Hana Foundation, seventeen defectors among eighty showed higher than standard levels of chromosomal abnormalities, which likely indicates they had been exposed to significant and harmful levels of radiation (Shin 2024). The journey of those groups of defectors to be finally tested has not been easy. The initial test with a relatively small sample size was conducted before the last one in early 2024, and the results have largely been downplayed by the former South Korean

government (H. Lee et al. 2023, 58–60). At the past Trump-Kim summits, none of the parties were interested in including a human rights agenda at the denuclearization negotiating table (King and Shin 2021; Cha 2021). Despite the significance of the test results announced in early 2024, they were once again downplayed by the South Korean government, which adding qualifying statements such as, “Computed tomography (CT), smoking, and old age etc., could also be contributing factors to the test results therefore, a direct link to nuclear testing has not been proven” (Shin 2024). However, the latest radiation test was considered extremely limited due to the small sample size and failed to disclose all related information (Jung Eun Lee 2024).

Progress has been achieved in the IGO reinforcement of international human rights norms and practices in North Korea. Although these efforts are not quick fixes, all efforts, including those of the diplomatic and INGO community, should remain focused on positive outcomes. The inclusion of the human rights agenda in denuclearization efforts should be given further consideration since the Kim Jong-un regime’s prioritization of the nuclear program is inextricably linked to environmental and human rights crises in that country. Continued attention is needed to further enhance potential socializing effects in North Korea, thereby inducing greater adherence to international human rights norms and practices by that country.

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